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COMPARATIVE EFFECT OF LAND- AND AQUATIC-BASED PLYOMETRIC TRAINING ON JUMPING ABILITY AND AGILITY OF YOUNG BASKETBALL PLAYERS

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ABSTRACT

The effect of land- and aquatic-based plyometric training on jumping ability and agility of young basketball players was investigated. Eighteen young male, semi- professional basketball players (age: 18.81±1.46 years) were randomly assigned to aquatic plyometric training (AP), land plyometric training (LP) or a control group (CON). The plyometric training groups were subjected to an 8-week long plyometric training program that consisted of three plyometric training sessions per week of 40 minutes per session. The players performed jumping ability and agility tests before and after the training or non-training period. The 2×3 analysis of variance and Tukey post hoc test revealed no significant differences ($p>0.05$) between the AP and LP for any of the jumping ability and agility test values. A significant training effect ($p<0.05$) was seen in the experimental groups (AP and LP) for all the test variables from pre- to post-training. Significantly greater gains were observed with regard to all measurements in the AP compared to the CON. The LP only achieved significant greater gains in the Vertical Jump Test compared to the CON. The 8-week aquatic- based plyometric training program provided the same or more benefits for jumping and agility ability of young basketball players than the land-based plyometric training program of the same duration.

Key words: Power; Agility; Aquatic plyometrics; Land plyometrics; Basketball.

INTRODUCTION

Plyometrics as it is known and used today received a great deal of attention in the early 1970s when athletes from the Eastern European countries began to dominate power dependant events (Stemm & Jacobson, 2007). Plyometrics is a specialised, high-intensity training technique that enables an athlete's muscles to deliver as much strength as possible in the shortest period of time so that power development results (Radcliffe & Farentinos, 1999; Chimera *et al*., 2004). Plyometrics make use of the stretch-shortening cycle, which utilises the energy stored during the eccentric loading phase and stimulation of the muscle spindles to facilitate maximum power production during the concentric phase of movement (Potach, 2004; Potach & Chu, 2008). The afore-mentioned descriptions, together with several research findings, show that land-based plyometric programs can be used to significantly improve: explosive power (Fatouros *et al*.,

2000; Luebbers *et al*., 2003); flight time (Fatouros *et al*.,

2000); maximal isotonic (Fatouros *et al*., 2000; Toumi *et al*., 2004) and isometric leg muscle strength (Toumi *et al*., 2004); isokinetic peak torque of the legs (Miller *et al*., 2002) and shoulders (Schulte-Edelmann *et al*., 2005); range of ankle motion (Miller *et al*., 2002); speed (Rimmer & Sleivert, 2000); and the electrical muscle activity (Toumi *et al*., 2004) of males. Furthermore, land-based plyometric programs seem to significantly decrease ground contact time during sprinting activities (Rimmer & Sleivert, 2000) and the amortisation time during the execution of plyometric exercises (Toumi *et al*., 2004), which may have a positive effect on sport performance (Wilkerson *et al*., 2004).

Based on these benefits, it is apparent that land-based plyometric training is regarded as a useful training tool for athletes who participate in sport, which require dynamic, explosive types of movement such as basketball. In this regard, a period of 8 weeks of land-based plyometric training has been shown to be effective in eliciting significant positive changes with regard to maximum jump velocity, maximum force, absolute and relative power, as well as average power during 10 maximum counter-movement jumps among university-level male basketball players (Boraczyñski & Urniaz, 2008). Khlifa *et al*. (2010) reported similar significant positive results for squat jumps, counter-movement jumps and the 5-jump test among elite male basketball players after a 10-week plyometric program. The research findings of Santos and Janeira (2011) support the results of the latter studies. They concluded that a 10-week in-season land-based plyometric training program significantly improved squat jump, counter-movement jump, the Abalakov test, depth jump and the medicine ball throw test results for a group of male basketball players.

Despite the widespread acceptance, benefits and use of land-based plyometric training programs in the conditioning of basketball players, several researchers have questioned the efficacy and highlighted the potential risks of land-based plyometric training programs as a conditioning technique. Marginson *et al*. (2005), reported muscle soreness and a decrease in squat jump and counter-movement jump height in a group of men for 72 hours after a bout of plyometric jumps. According to Jamurtas *et al*. (2000), damage to muscle fibres or possible damage to musculotendinous junctions could be the sources of higher muscle soreness and the decrease in muscle function after the performance of land-based plyometric exercises. Moreover, the potential for injury exists, especially for athletes that are not used to land-based plyometric training. This is due to the high intensities and impacts or high volumes that are normally associated with plyometric training (Miller *et al*., 2002; Miyama & Nosaka, 2004; Ploeg *et al*., 2010).

In light of possible injury risk, the occurrence of muscle soreness and a possible decrease in muscle function due to land-based plyometric training programs, research findings suggest that aquatic-based plyometric training programs may provide a safer and more effective alternative for athletes, who need to develop their muscle power optimally (Miller *et al*., 2002; Miller *et al*., 2007; Stemm & Jacobson, 2007; Ploeg *et al*., 2010; Donoghue *et al*., 2011). Research offers several explanations for the preferred use of aquatic- above land-based plyometric training programs. The buoyancy provided by the water due to the increased density of water compared to air, reduces the impact forces and weight-bearing stress on the joints and limbs, thereby decreasing the risk of injuries (Miller *et al*., 2007; Ebben *et al*., 2010; Donoghue *et al*., 2011). Furthermore, the dynamic properties of water, such as surface, profile and wave drag, as well as

the high viscosity of this medium, increases the resistance to

movement (Miller *et al*., 2002; Robinson *et al*., 2004; Miller *et al*., 2007). Additional muscle activation is therefore required to overcome the water resistance and execute the same movement through water (Robinson *et al*., 2004).

Despite the possible benefits of aquatic-based plyometric training programs, to date only one study (Martel *et al*., 2005) has explored the relevance of these programs for team sport participants and no studies compared the benefits of these types of programs to those of land-based plyometric training programs for basketball players. The majority of studies that exist focused on sedentary and recreationally active participants of both genders. Studies by Miller *et al*. (2002), Robinson *et al*. (2004), Stemm and Jacobson (2007) and Ploeg *et al*. (2010) collectively reported that aquatic- and land-based plyometric training programs of between six and eight weeks had similar effects with regard to changes in jumping height (Vertical Jump Test), muscle power (Vertical Jump and Margaria-Kalamen Test), speed (40-m Sprint Test), isokinetic peak torque (knee-flexion and-extension, as well as ankle dorsi- and plantar- flexion) and active range of motion (dorsi- and plantar-flexion and knee-flexion) among groups of sedentary and recreationally active men and women. Only Robinson *et al*. (2004) found a significantly greater perception of muscle soreness at 48 and 96 hours after the plyometric exercise bout for the land-based plyometrics group when compared to the aquatic- based plyometrics group.

Merely one study could be found that compared the effects of aquatic- and land-based plyometric training programs on the performance and muscular injury of sport participants (club wrestlers) (Shiran *et al*., 2008). Consistent with the results of these studies, no significant differences were found pertaining to the changes in strength, speed, agility, fatigue index, peak and mean power or the risk of muscle injury between the aquatic- and land-based plyometric training programs. The wrestlers who participated in the aquatic-based plyometric training program did, however, experience less muscle soreness than the group that participated in the land-based plyometric training program.

It is clear from the findings of these studies that aquatic-based plyometric training programs could reduce the impact forces and the potential trauma to joints while providing resistance to movement well beyond that of land-based plyometric training programs. Unfortunately, studies to date have not addressed the effectiveness and benefits of aquatic-based plyometric training on team sport participants, such as basketball players. Therefore, the purpose of this study was to compare the effects of an 8-week land- and aquatic-based plyometric training program on the jumping ability and agility of young male basketball players. The findings of this study may possibly provide coaches and other sport professionals, who are involved with team sport participants, with information and guidelines that would enable them to plan and set-up safer and more effective plyometric training programs.

METHODS

Experimental design

A quasi-experimental pre-post-test design with convenient sampling was used for this study and participants were subjected to a series of jumping ability and agility tests after which the

experimental groups completed an 8-week plyometric training program in addition to their regular basketball conditioning program. The control group continued with their regular conditioning program for basketball and did not participate in a plyometric program. After completion of the 8-week plyometric or non-plyometric training programs, the jumping ability and agility tests were repeated.

Participants

Eighteen (n=18) young, semi-professional male basketball players participated in this study. Participants volunteered for the study and were healthy and free of lower extremity injuries during the time of testing. Participants were informed of the aims, nature, benefits and potential risks of the study, after which they all completed an informed consent form. The Ethics Committee of the institution where the study was conducted approved the study. Participants were matched and randomly assigned to three equal groups: an aquatic-based plyometric training group (AP: n=6); a land-based plyometric training group (LP: n=6); and a control group (CON: n=6). The descriptive statistics of the different groups of basketball players are presented in Table 1.

TABLE 1: **BIOGRAPHIC STATISTICS OF THE DIFFERENT GROUPS OF BASKETBALL PLAYERS**

	AP (n=6)		LP (n=6)		CON (n=6)	
Variables	Mean	SD	Mean	SD	Mean	SD
Age (years)	18.00	0.60	18.03	1.38	20.40	0.64
Body mass (kg)	75.66	3.93	67.50	1.00	60.25	7.03
Stature (cm)	180.28	4.58	182.41	7.24	175.33	4.67
Sport experience (yrs)	4.75	2.23	4.00	2.70	5.66	2.58

AP = Aquatic plyometric group; LP = Land plyometric group; CON = Control group
SD = Standard deviation

Testing procedures

The players underwent two days of testing, namely one pre- and one post-test day respectively. A week before the official testing week, each player was familiarised with the testing procedures and plyometric training programs, and the demographic data were gathered and anthropometric measurements (body mass & stature) taken. The baseline testing of agility (t-test and Illinois Agility Run Test) and jumping ability (Vertical Jump Test and Standing Long Jump Test) was completed one week before the onset of the different plyometric training protocols. Post-testing was performed a week after the training period. For the post-test, players were tested at the exact same time of day and same day of the week as the pre-test day to minimise the effect of circadian variations on the test results. All participants had to continue with the normal basketball, conditioning program through the duration of the study. Participants had not participated in any type of plyometric training programs for at least six months prior to the start of the study and were not permitted to participate in any resistance training programs during the time period of the study.

The following laboratory tests were conducted:

Vertical Jump Test [VJT] (Explosive leg power)

The VJT is regarded as an objective (r=0.90) and valid (r=0.93) test to determine the peak anaerobic power output of participants (Safrit, 1990; Maud *et al*., 2006). The VJT was executed according to the method of Harman and Garhammer (2008). The VJT was performed using the Vertec device (Power Systems, Knoxville, Tennessee). The participants performed a minimum of three trials with a 30-second rest period between each trial. The best of the three trials was recorded.

Standing Broad Jump [SLJT] (Explosive leg power)

The SLJT is considered a reliable (r=0.89-0.90) and valid test to determine the peak anaerobic power output of participants (Maulder & Cronin, 2005). The test was performed on a flat even mat that was fixed to the floor. A measuring tape was laid out on this surface. The participants stood with both feet so that the toes were behind the zero line. When the subject was ready, he would take off from both feet and jump forward as far as possible from a still- standing position. The jumping distance was recorded as the distance from the heel closest to the zero line. The participants performed a minimum of three trials with a 30-second rest period between each trial. The best of the three trials was recorded.

Agility T-Test [ATT] and Illinois Agility Run Test [IART] (Agility tests)
The ATT and the IART were conducted according to the method of Bloomfield *et al*. (1994) and Van Heest *et al*. (2002), respectively. Both tests were performed on the basketball court. A hand-held stopwatch was used to take the participants' time to the nearest 0.01seconds. The fastest time of the three trials was noted as the final agility time. A 5-minute rest period was allowed between each trial. According to Gabbett (2002), the intraclass correlation coefficient for the test-retest reliability and technical error of measurement for the IART are
0.86 and 2.02% respectively.

Training

The 8-week training regimen was adopted from a previous study by Robinson *et al*. (2004). Both the LP and AP trained three times per week (Saturdays, Mondays and Wednesdays) with a 48 hour recovery period between each training session. Each training session lasted for approximately 40 minutes and consisted of a warm-up, main set and cool-down. The aquatic-based plyometric training program was performed in a swimming pool with a depth of 130 cm (chest-deep). The participants were submerged during the performance of the aquatic- based plyometric training program. The warm-up of 10 minutes consisted of jogging for five minutes after which static stretches and a specific warm-up period of shorter, high intensity, dynamic stretches for more or less 5 minutes followed.

The plyometric exercises consisted of ankle jumps, speed marching, squat jumps and skipping drills. The participants were encouraged to perform all exercises in an explosive manner by performing each movement at a maximal effort. Each subject was allowed a 1- minute rest between sets and 3 minutes rest between exercises. The cool-down period consisted of static stretches of the major leg muscle groups for a period of 5 minutes. The swimming pool was regulated at a temperature of 27±1°C, according to the guidelines set by Martel *et al*. (2005).

The LP performed the plyometric exercises on a mat with a thickness of 3cm. The training procedures were similar to those of the AP. The training program was based on the recommendations of intensity and volume from Chu (1998) and Milic *et al*. (2008). The list of plyometric exercises as well as the progression that was followed over the 8-week period is presented in Table 2. All CON participants were requested to refrain from any plyometric training.

TABLE 2: **PLYOMETRIC EXERCISE PROGRESSION FOR 8-WEEK PERIOD**

Training week	**Plyometric training exercises and repetitions**				
	Ankle jump	Speed marching	Squat jump	Skipping drill	Sets
1	15	8	8	8	3
2	17	9	9	9	3
3	19	10	10	10	3
4	22	11	11	11	3
5	17	9	9	9	3
6	19	10	10	10	3
7	22	11	11	11	3
8	25	12	12	12	3

Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows (SPSS version 16.0, SPSS Inc., Chicago, IL). The descriptive statistics of each test variable for each group were calculated first. A 2×3 analysis of variance (ANOVA) followed by a Tukey post-hoc test was used to examine the significance between independent variables of groups (AP, LP and CON) on the dependent variables of jumping ability and agility. Dependent paired *t*-tests were done to reveal the significant changes between the pre- and post-training results. In all analyses the level of significance was set at $p<0.05$.

RESULTS

The results for the jumping ability and agility measurements of each of the groups are presented in Figure 1. Table 3 presents the percentage differences between all of the pre- and post-training values for the ATT, IART, VJT and SLJT, as well as the significance of these differences. None of the last-mentioned measurements displayed any significant differences in terms of the pre-training values between the different groups. There were no significant differences between the post-training values of the AP and LP. A significant training effect ($p<0.05$) was found in the experimental groups (AP and LP) for all the test variables from pre- to post-training. The post-hoc analysis revealed significantly greater gains with regard to all measurements in the AP compared to the CON. However, the LP only succeeded in achieving significant greater gains (pre- to post-training) in the VJT compared to the CON (Figure 1A).

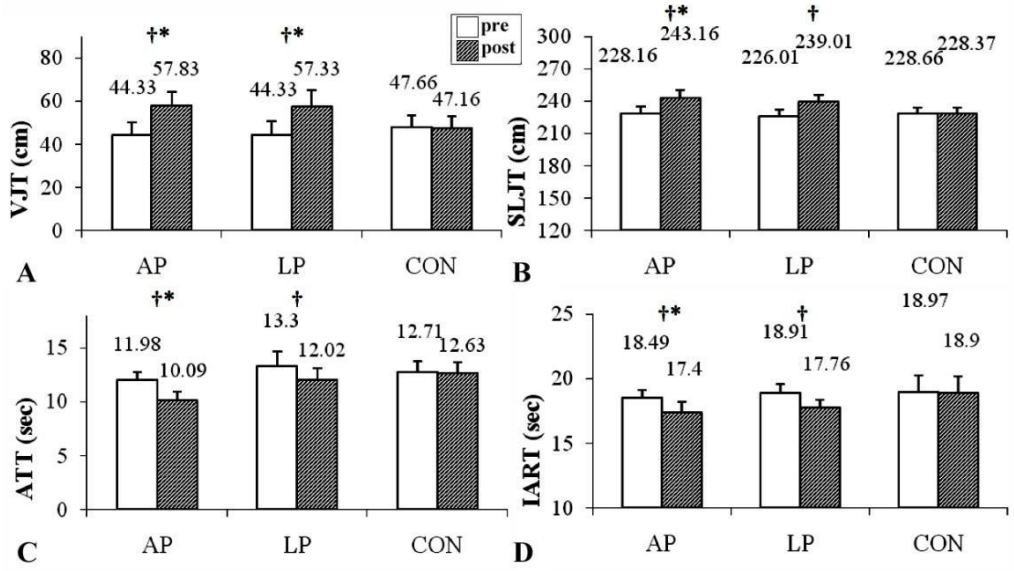

FIGURE 1: **MEANS, RANGE AND WITHIN GROUP CHANGES AND BETWEEN GROUP DIFFERENCES**

TABLE 3: **PERCENTAGE DIFFERENCE BASED ON PRE- AND POST- TEST VALUES OF GROUPS FOR EACH TEST**

Test values	AP (n=6)	LP (n=6)	CON (n=6)
VJT (cm)	30.45*	29.33*	-1.05
SLJT (cm)	6.57*	5.75	0.13
ATT (secs)	-15.78*	-9.62	-0.63
IART (secs)	- 5.90*	-6.08	-0.37

* Changes in pre- to post-training values are significantly different ($p<0.05$)

DISCUSSION

The study succeeded in showing that aquatic- and land-based plyometric training programs of an eight-week duration had a significant training effect with regard to all the measured jumping ability and agility values from pre- to post-training in a group of young, male basketball players. The control group's jumping ability and agility values showed no significant improvements from the pre- to post-training period. In spite of the favourable results with regard to the training affect that each of the experimental groups (AP and LP) experienced, the AP was the only group that had achieved significantly better pre- and post- training differences in all the measured variables compared to the CON. VJT was the only test in which the LP displayed significantly better pre- and post-training improvements compared to the CON.

No other studies have been conducted to compare the effects of an aquatic- and land-based plyometric training program on jumping ability and agility test scores of young, male basketball players, which made it difficult to compare the results of this study to similar studies. However, several studies have compared the benefits of aquatic-based programs to those of

land-based plyometric training programs in sedentary and recreationally active men and women. Overall, these studies seem to suggest that aquatic- and land-based plyometric training programs of between six and eight weeks have similar effects with regard to changes in jumping height and muscle power in the VJT (Miller *et al*., 2002; Robinson *et al*., 2004; Stemm & Jacobson, 2007; Ploeg *et al*., 2010), which is consistent with the findings of this study.

Similar to the results of this study, the majority of research reported a significant training effect for VJT height from pre- to post-training in AP (Miller *et al*., 2002; Robinson *et al*., 2004; Stemm & Jacobson, 2007), whereas only two of the identified studies found a significant pre- to post-training effect in the LP for VJT height (Robinson *et al*., 2004; Stemm & Jacobson, 2007). In contrast to the results of the present study that the AP achieved significantly better pre- and post-training differences in VJT height when compared to the CON, the majority of research in this area that included a CON in the study design, reported no significant differences between AP and CON (Miller *et al*., 2002; Ploeg *et al*., 2010). Stemm and Jacobson (2007) are the only researchers to find that AP and LP significantly outperformed the CON in the VJT height after a period of training.

Although no studies could be found that have simultaneously investigated the possible effects of aquatic- and land-based plyometric training programs on the agility of participants, the results of this study suggest that participants' agility values could be significantly improved by making use of a period of aquatic-based plyometric training when compared to non- plyometric training. However, the land-based plyometric training program failed to produce significant improvements in the agility of participants when compared to the non-plyometric program. Dissimilarly, one research study in which the efficacy of a 6-week land-based plyometric training program on athletes' agility was investigated, provided proof that the mentioned program may lead to significant decreases in agility times for the ATT and IART compared to a non-plyometric program (Miller *et al*., 2006).

Although the design of this study did not allow the researchers to determine the reasons underlying the improvements in jumping ability and agility from pre- to post-training due to the plyometric training programs, several authors have proposed some credible explanations. Plyometric-related programs may promote changes within the neuromuscular system that enhances neuromuscular efficiency. In this regard research evidence suggests that more motor units are stimulated and activated or the neural firing frequency is enhanced due to plyometric training (McLaughlin, 2001). The activation of more motor units would enable the muscle to generate more power, compared to what was previously possible.

Furthermore, Swanik *et al*. (2002) concluded that the sensitivity of the muscle spindle system may increase because of a plyometric training program and that this adaptation may lead to the enhancement of participants' joint proprioception. Plyometric training appears to enhance kinaesthesia, which together with an enhanced joint proprioception may increase functional stability (Swanik *et al*., 2002). Kubo *et al*. (2007) demonstrated that jump performance gains after plyometric training can be attributed to changes in the mechanical properties of the muscle-tendon complex. Notably, the authors observed that plyometric training significantly

increased the maximal Achilles tendon elongation and the amount of stored elastic energy together with an increase in the stretch-shortening cycle jumping performance. It can be postulated that a more compliant muscle-tendon unit would improve the stretch-shortening cycle

jumping performance by allowing the muscle fibres to operate at a more optimal length over the first part of the shortening phase (Markovic & Mikulic, 2010).

Despite inconsistent findings, researchers are of the opinion that plyometric training may possibly lead to significant increases in the proportion of type IIa fibres and the peak force of these muscle fibres (Malisoux *et al*., 2006). A transition in the muscle fibre type, as well as an increase in the contractile ability of the changed muscle fibres, would allow the exercising muscles as a whole to produce more power and higher jumping heights. Another possible neuromuscular adaptation that plyometric training appears to induce is the reduction in the time required for voluntary muscle activation, which may facilitate faster changes in movement direction and an accompanied decrease in the IART and ATT times (Wilkerson *et al*., 2004). According to Hutchinson *et al*. (1998), it is also possible that a cognitive, learned effect, rather than a purely motor strengthening effort, is the reason for an increase in the selected jumping ability and agility components due to plyometric training programs.

An unexpected result of the study was that the aquatic- and land-based plyometric training programs led to more-or-less similar gains in jumping ability and agility for the study participants. It is, therefore, conceivable that both training regimens led to the same physical and physiological adaptations over the period of eight weeks. According to Miller *et al*. (2002), the landing force during aquatic-based plyometric exercises is decreased because of the buoyant force of water, which facilitates a more rapid transition from eccentric to concentric muscle contractions (amortisation phase) and ultimately an increased power output. On the other hand, during land-based plyometric exercises, participants experience a higher amount of force during the landing phase (no buoyancy effect), which facilitates a longer amortisation phase and ultimately an increase in muscle strength (Miller *et al*., 2002). Both these adaptations could ultimately be transferred to the tests of jumping ability and agility, which would improve the scores of these tests.

A somewhat unexpected outcome of the study was that AP achieved significantly better pre- and post-training differences in all the measured variables compared to the CON, whereas VJT was the only test in which the LP displayed significantly better pre- and post-training improvements compared to the CON. This can possibly be attributed to the fact that participants in this study have been participating in basketball in which land-based plyometric type explosive movements (mimicking the VJT) are constantly being performed during practices, training and matches. Research also suggests that jump performance is a major factor of success in basketball, and a key fitness component for development during training sessions (Delextrat & Cohen, 2008). Activities such as blocking and scoring need a large amount of explosive power to be performed successfully.

Furthermore, research indicates that players move at an average velocity of 1.86 m/sec during the active phase of a game (Erčulj *et al*., 2008). For players to be able to maintain high velocities during the game, leg power (jumping performance measures) must be developed as these values act as predictors of sprint performance (Cronin & Hansen, 2005). Players' muscles were therefore already accustomed to land-based plyometric type, explosive

movements before the start of the intervention period. As a result, they would probably not be so sensitive and reactive to land-based compared to aquatic-based plyometric conditioning programs. This statement is confirmed by the findings of Turner *et al*. (2003), who attributed the

positive results due to a land-based plyometric training period to the fact that the participants were untrained and not accustomed to this type of training. In view of this, it is important to consider participants' experience in plyometric type of movements and training when planning a study of this kind. Participants, who are not accustomed to land- and aquatic-based plyometric type explosive movements, would probably be more sensitive and reactive to these plyometric conditioning programs than participants who are accustomed to these types of movements.

The finding that the AP was the only group that achieved significantly better pre- and post-training differences in the agility values compared to the CON, could be attributed to the fact that the AP trained with lower loads (buoyancy effect), which facilitated a faster transition time from eccentric to concentric muscle contractions (amortisation phase), whereas the LP trained with heavier loads (no buoyancy effect) and experienced a longer amortisation phase (Miller *et al*., 2002). These statements suggest that aquatic-based plyometric training programs may reduce ground contact times when players are changing direction during agility tests and drills, which is a major component of agility (Miller *et al*., 2006). However, agility can be described as a relatively complex task, which makes power transfer from plyometric exercises to the agility tests very difficult (Tricoli *et al*., 2005). This notion is highlighted by the non-significant pre- and post-training differences in the agility values of the LP when compared to the CON. Tricoli *et al*. (2005) failed to demonstrate that land-based plyometric training programs would lead to improved agility performances when compared to a group that underwent Olympic weightlifting training. It is, therefore, possible that agility tasks are more influenced by motor control factors than by muscle strength or power capacity (Young *et al*., 2002).

CONCLUSION

A comparison between the effects of an 8-week land- and aquatic-based plyometric training program on the jumping ability and agility of young, male basketball players revealed that both plyometric training programs had a significant training effect whereas the control group's values showed no significant improvements from pre- to post-training. However, the AP was the only group that achieved significantly better pre- and post-training differences in all the measured variables compared to the CON. Overall, the results of the study suggest that an 8-week aquatic-based plyometric training program provides the same or even more benefits with regard to the jumping ability and agility of young team sport participants than a land-based plyometric training program of the same duration. The fact that literature shows that aquatic-based plyometric training programs are associated with less muscle soreness and a lower risk of injury compared to land-based plyometric training programs, make it a viable alternative for athletes who participate in explosive-types of sports, such as basketball. A reduction in training-related injuries while attaining the highest possible level of adaptation remains a priority for athletes who wish to perform consistently for long periods of time.

However, the results of the present study must be interpreted with caution since the participants were a selected group of young, male basketball players from one geographic

area in Iran. Hence generalisation of the results to other basketball players would not be accurate. Another possible limiting factor is the small number of participants available for each of the subgroups tested. Small group sizes in this study could have caused outliers to influence the mean values of the respective jumping ability and agility test scores more than would have been the case with larger group sizes. Finally, the study design did not allow the researchers to

explain the reasons underlying the improvements in the different jumping ability and agility test scores.

Further studies in the area of aquatic-based plyometric training programs are needed to test the benefits of these types of programs with a much larger sample size of athletes from different sport disciplines and from various geographic areas in the world. These studies also need to conduct biochemical and biomechanical analyses to identify the precise neural and musculoskeletal mechanisms that underlie the changes in the various physical and motor performance components after a period of plyometric training.

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EFFECTS OF DYNAMIC STRETCHES ON ISOKINETIC HAMSTRING AND QUADRICEPS FEMORIS MUSCLE STRENGTH IN ELITE FEMALE SOCCER PLAYERS

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ABSTRACT

This study investigated the effects of dynamic stretches on isokinetic hamstring (H) strength, quadriceps femoris (Q) strength, and the H/Q ratio in elite female soccer players. Fifteen elite female soccer players (age: 22.13±2.69; height: 164.53±7.57; weight: 57.8±7.86) participated in the study. The length of the lower extremity and the

circumference of the thigh were measured for each subject. On different days, isokinetic muscle strength of the participants was measured twice using a Biodex dynamometer and concentric/concentric 60˚/s, 180˚/s and 300˚/s test protocols. Knee flexion-extension range of motion (ROM) was measured using goniometry at two different times. After a non-stretching warm-up, the peak torque (PT) of the H and Q muscles at 60˚/s, 180˚/s and 300˚/s were measured. The H/Q ratios were calculated for 60˚/s, 180˚/s and 300˚/s. In addition, the PT values for the latter were calculated after dynamic stretches for H and for Q. Comparisons between the H and Q measurements showed a significant difference between peak torques, H/Q ratios, and ROM (p<0.01). In conclusion, dynamic stretches have positive effects on muscle strength, H/Q ratios and ROM. Therefore, dynamic stretches may increase performance and reduce the risk of injury to athletes.

Key words: Quadriceps; Hamstrings; Muscles Isokinetic; Dynamic stretches.

INTRODUCTION

Hamstring injuries are common in many sports, including running, soccer, football and basketball (Zakas *et al*., 1995; Orchard & Seward, 2002; Arnason *et al*., 2004; Woods *et al*., 2004; Bamac *et al*., 2008; Silder *et al*., 2010). Playing soccer requires high speed and strength of the lower extremities. Thus, a reduced range of motion due to weakness or shortness in the muscles of the lower extremities increases the risk of injury (Yamamoto, 1993; Worrell, 1994; Alter, 1997). In previous studies, 80% of injuries in soccer players were found to affect the lower extremities, and of these, 47% were in the hamstring muscles (Ekstrand & Gillquist, 1983). In a more extended study, 10% of the injuries in one season of soccer were found to be injuries in the hamstring muscle (Morgan & Oberlander, 2001).

Awareness of the morphology, flexibility and strength of the hamstring muscles will reduce the risk of injury (Silder *et al*., 2010). Stretching is typically believed to increase joint range of motion or flexibility, which promotes greater sporting ability by improving muscular

performance and reducing the risk of musculoskeletal injury (Shellock & Prentice, 1985; Alter, 1997; Sekir *et al*., 2010).

To prevent injury, muscles should be subjected to stretching and strengthening exercises. Athletes and coaches use many different types of stretching. The type of stretching performed is usually based on personal preference only. No optimal type or amount of stretching has been identified. There are various techniques of stretching, including ballistic, proprioceptive neuromuscular facilitation (PNF), static and dynamic stretches (Sekir *et al*., 2010). Stretching exercises are known to have immediate and late effects depending on the subjected muscle group. Stretching has been found to increase flexibility and thereby increase muscle performance (Shellock & Prentice, 1985; Alter, 1997; Gleim & Mchugh, 1997; Gallon *et al*., 2011).

However, some authors have argued that stretching exercises have only a limited effect on muscle strength and resistance (Fowles *et al*., 2000; Behm *et al*., 2001; Church *et al*., 2001; Young & Behm, 2003). Dynamic stretches (DS) involve using the weight of the body to increase the flexibility of muscle fibres. DS involve contraction of the muscle fibres while they are being stretched. No study to date has directly investigated the effect of dynamic stretches on

musculoskeletal injury risk characteristics. Therefore, the role of dynamic stretching remains unknown (Sekir *et al*., 2010).

Muscular imbalances between agonist and antagonistic muscles have been suggested as a possible cause of sport-related injuries (Grace, 1985; Aagaard *et al*., 1997; Soderman *et al*., 2001; Devan *et al*., 2004; Bamac *et al*., 2008). The most common method used to assess muscular imbalance is the ratio of isokinetic agonist to antagonist muscle strength. Isokinetic testing can be used to evaluate quadriceps and hamstring muscle strength, allowing the determination of the magnitude of the torque generated and subsequently the hamstring to quadriceps (H/Q) muscle strength ratio (Bamac *et al*., 2008). The H/Q isokinetic peak torque ratio has been used to assess muscle balance and the functional ability of the knee (Holmes & Alderink, 1984; Aagaard *et al*., 1995; Bamac *et al*., 2008). An abnormal H/Q muscle ratio may reflect a predisposition to injury (Knapik *et al*., 1991; Aagaard *et al*., 1997; Devan *et al*., 2004; Bamac *et al*., 2008). Dauty *et al*. (2003) have shown that an H/Q ratio of less than 0.6 at 60˚/s represents a 77.5% probability of injury to the hamstring muscle in elite soccer players.

The quadriceps femoris and the hamstring muscle groups are involved in several important motor abilities such as running and jumping in soccer. This study aimed to investigate the effects of DS on isokinetic hamstring (H) strength, quadriceps femoris (Q) strength and the H/Q ratio in elite female soccer players. Imbalance in the H/Q ratio is known to increase the risk of injury. To eliminate the imbalance and prevent injury, athletes can practise stretching and strengthening of the muscles.

MATERIALS AND METHODS

Subjects

Fifteen (N=15) elite female soccer players (age: 22.13±2.69; height: 164.53±7.57; weight: 57.8±7.86) participated in this study. They had been active in high-level soccer competitions

(they were members of the team that won the 2010 Turkish inter-university soccer tournament and was placed 4th in the 1st European Universities Football Championship in Futsal) for 4.6 (range: 3 to 8) years and practised 8 hours/week. Before the initiation of the study, the subjects were asked to complete a questionnaire to determine whether they had any musculoskeletal pain, discomfort or known injury in a lower extremity. Soccer players were excluded from the study if they had a current or recent lower extremity injury, if they had complaints of pain, swelling, or functional limitations in these joints, or if they had apparent limitations in their knee range of motion.

Each soccer player was informed of the testing procedures, and their written informed consent was obtained. This study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the ethics committee of Kocaeli University.

All the measurements were obtained before the soccer season. First, anthropometric dimensions of the players were measured, such as the height, weight, body mass index (BMI), the length of the dominant lower extremity, thigh circumference and knee ROM at flexion and extension. This was followed by measuring hamstring strength using an isokinetic dynamometer (Biodex Multi-Joint System 3, Biodex Medical Systems, Inc., Shirley, NY, USA). These measurements were acquired on different days after two different warm-up exercises were performed by the same

players. For the first measurement, the players were asked to refrain from stretching before the test (non-stretching) and then to do mild warm-up exercises immediately before the test. For the second measurement, isokinetic muscle strength measurements were taken immediately after the subjects did warm-up exercises mostly consisting of DS.

Anthropometric measurements

The measurements were conducted at the Physical Education and Sport Department laboratory of Kocaeli University. All the measurements were taken in a ventilated area at 22- 25˚C. The measurement times were between 10h00 and 16h00 during 4 days of the week.

The height (cm) and weight (kg) of the players were measured with Tanita, and their BMIs were calculated. The length (cm) of the dominant lower extremity and the thigh circumference (cm) of the players were measured using a measuring tape. The length of the lower extremity was defined as the distance between the anterior superior iliac spine and the medial malleolus. The thigh circumference was measured at midway between the anterior superior iliac spine and the lateral condyle of the femur (Otman *et al*., 1995).

Knee flexion-extension ROM was measured with a goniometer. The measurements were conducted with players in a prone position. The pivot point was the lateral condyle of the femur. The fixed handle of the goniometer was placed on the lateral midpoint of the hamstring, and the mobile handle was placed on the fibula during the measurements (Otman *et al*., 1995).

Dynamic stretches

Isokinetic muscle strength measurements were performed on different days. For the first measurement, isokinetic muscle strength of the hamstring and quadriceps were measured

after non-stretching (NS) mild warm-up exercises. For the second measurement, a DS protocol was used to warm-up the hamstring and quadriceps prior to isokinetic muscle strength assessment. The DS protocol consisted of 2 stages (the 5 repetitions of slow stretching the first stage and 10 repetitions of quick stretching in the second stage). The DS procedure was applied to both the hamstring and quadriceps muscle groups. Stretching was performed 5 times slowly and then 10 times as quickly and powerfully as possible without bouncing. Between each stretching repetition, the players stood upright for a 15 second rest period. The DS procedure lasted for 7±1 minutes for each player.

Three DS exercises for the quadriceps femoris muscle were performed. First, in an upright standing position, the subject touched her heel to her buttock (*stork stand*) so that the knee was fully flexed and stretched. In the upright standing position, the player leaned forward and raised her foot from the floor with her hip and knees slightly flexed. Finally, the player contracted her hip extensors and hamstring muscles so that her leg was extended towards the posterior aspect of the body while the hips nearly came to full extension and the knee to full flexion (Sekir *et al*., 2010).

Three DS exercises for the hamstring muscles were performed. First, in the upright standing position, the knee was fully extended, and the hips were flexed to achieve a stretch. In the upright standing position, the player contracted her hip flexors and flexed her hip joint, raising her thigh parallel to the ground with her knee joint flexed at approximately 90°. Finally, the

player contracted her quadriceps while maintaining the height of her thigh and extended her knee joint so that her leg extended toward the anterior aspect of her body (Sekir *et al*., 2010).

Isokinetic strength testing

The researcher conducted all isokinetic strength measurements. The dominant lower extremity was used for each test. Three trial repetitions were allowed for the isokinetic testing. The first measurement was made without the players' doing any stretching exercises (non-stretching) and the second measurement was made after the players' performed DS. The second test was conducted on the same players on different days. The soccer players were informed of the content of the isokinetic test before the test was initiated.

The female soccer players were positioned on an isokinetic dynamometer (Biodex Multi-Joint System 3, Biodex Medical Systems, Inc., Shirley, NY, USA) with the hip flexed to 90° and the dynamometer and knee joint axes were aligned (Silder *et al*., 2010). To restrict the motion of joints other than the knee, the body and the thigh were fastened to the dynamometer chair using crossties. The leg was then tied to the axis of the dynamometer using a special apparatus for the knee joint.

The maximal gravity corrected concentric peak torque was obtained for the knee extensors (quadriceps femoris) and flexors (hamstring) during isokinetic knee joint movement at angular velocities of 60°/s, 180°/s and 300°/s. The four parameters studied in this investigation were the peak torque (PT) (deg/second), peak torques per kg of weight (PT/Kg BW), total work (TW), and H to Q muscle ratio (Bamac *et al*., 2008). For the dominant lower extremities of the players, the range of motion of the knee joint was set at 0-90˚. Leg

isokinetic concentric/concentric (Con/Con) knee flexion and extension was performed at 60˚/s (5 repetitions), 180˚/s (10 repetitions), and 300˚/s (15 repetitions). The highest PTs were obtained from the Biodex computer after the measurements. Between velocity tests, the soccer players were allowed to rest for 1 minute. The most frequently reported strength ratio of the muscles of the knee has been the concentric hamstring-quadriceps muscle ratio (Hcon/Qcon) (Coombs & Garbutt, 2002). The H/Q muscle strength ratio was calculated by dividing the maximal knee flexor (H) moment by the maximal knee extensor (Q) moment measured at identical angular velocities in concentric mode. Peak concentric torque (Nm) values of the Q and H, as well as their ratios were used in the statistical analyses (Bamac *et al*., 2008).

Statistical analyses

The data were analysed using the Statistical Package for Social Sciences (SPSS) (SPSS for Windows v 15.0, SPSS, Chicago, IL, USA). The means and standard deviations of all the measurements were calculated. The differences between group means were determined using a non-parametric test for independent samples (Mann-Whitney U test). A p-value of 0.05 was considered statistically significant.

RESULTS

The mean anthropometric data of the soccer players (age, height, weight, BMI, length of the dominant lower extremity, and thigh circumference) are presented in Table 1.

TABLE 1: **BIOMETRIC DATA OF THE SOCCER PLAYERS (N=15)**

Variables	**Mean±SD**
Age (years)	22.13±2.69
Height (cm)	164.53±7.57
Weight (kg)	57.80±7.86
BMI (Body Mass Index)	21.19±1.32
Circumference of dominant thigh (cm)	49.06±3.08
Length of dominant lower extremity (cm)	85.93±5.92

The isokinetic muscle strength measurements of the dominant lower extremity are summarised in Table 2. In all the test velocities, both quadriceps and hamstring muscles concentric PT, PT/kg BW and TW were higher in the second (DS) than first (NS) measurements. A high level of concentric knee flexion strength was observed for the DS compared to the NS at 60˚/s, 180˚/s and 300˚/s ($p<0.05$).

In the 60˚/s test, there were significant differences between NS and DS with respect to the hamstrings and quadriceps (PT ($p=0.027$ and 0.039, respectively). There were significant differences between NS and DS with respect to the hamstrings (PT/kg BW and TW ($p=0.020$

and 0.048, respectively). However, no significant differences were found between NS and DS for the quadriceps (PT/kg BW and TW ($p=0.081$ and 0.462, respectively).

TABLE 2: **MEAN±SD VALUES FOR DOMINANT QUADRICEPS AND HAMSTRING CONCENTRIC PEAK TORQUE PER KG OF WEIGHT AND TOTAL WORK (N=15)**

Variables	**Test 1 (Non-stretching/NS) Mean±SD**		**Test 2 (Dynamic Stretches/DS) Mean±SD**		**p-Value**	
	Hamstring (H)	Quadriceps (Q)	Hamstring (H)	Quadriceps (Q)	H	Q
PT (60˚/s)	62.95±17.27*	138.30±24.34*	78.94±15.35*	162.32±22.95*	**0.027**	**0.039**
PT/kg BW (60˚/s)	110.45±20.35*	248.69±43.14	127.07±17.15*	273.35±36.88	**0.020**	0.081
Total Work (60˚/s)	320.11±114.29*	642.62±193.16	391.87±95.22*	683.95±184.62	**0.048**	0.462
PT (180˚/s)	47.33±11.20*	94.77±20.25*	58.66±9.13*	110.67±14.48*	**0.009**	**0.027**
PT/kg BW (180˚/s)	85.84±11.20*	170.57±27.09	97.56±11.64*	190.69±22.98	**0.012**	0.054
Total Work (180˚/s)	446.92±118.37*	877.00±200,57*	562.08±117.83*	1001.89±108.50*	**0.015**	**0.048**

PT (300˚/s)	39.71±7,48*	73.52±15,14	46.08±7,12*	75.40±12,48	**0.039**	0.696
PT/kg BW (300˚/s)	70.34±10.78*	130.07±19.46	78.54±9.65*	133.67±17.09	**0.039**	0.566
Total Work (300˚/s)	551.40±128.46	1127.17±251,97	599.30±125.91	1164.10±178.34	0.352	0.462

*Significant differences between Test 1 and Test 2 ($p<0.05$).

In the 180˚/s test, the hamstring and quadriceps muscles PT revealed significant differences between NS and DS (p=0.009 and 0.027, respectively). The TW of the hamstring and quadriceps revealed significant differences between NS and DS (p=0.015 and 0.048, respectively). The data concerning PT/kg BW between NS and DS showed significant differences with respect to the hamstring muscles at 180˚/s (p=0.012). However, no significant differences were found for the quadriceps muscle (p=0.054). In the 300˚/s test, the hamstring muscles PT and PT/kg BW revealed significant differences between NS and DS (p=0.039 and 0.039, respectively). No significant differences were found for TW (p=0.352). There were no statistical differences PT, PT/kg BW and TW of NS and DS (p=0.696, 0.566 and 0.0462, respectively). These results showed that the stretches caused lengthening of the muscle tendon unit and increasing muscle visco-elasticity and joint range of motion.

The first measurement presented lower H/Q muscles ratio at the speed of 60˚/s, 180˚/s and 300˚/s (Table 3). The data concerning H/Q muscles ratio between the NS and DS measurements showed significant differences at 60˚/s. The results of the NS and DS of knee flexion-extension ROM indicated that dynamic exercises increase knee joint range of motion (p=0.001) (Table 3).

TABLE 3: **MEAN±SD FOR H/Q MUSCLES RATIOS AND RANGE OF MOTION (N=15)**

Variables	**Test 1 (Non-stretching) (NS)**	**Test 2 (Dynamic Stretches) (DS)**	**p-Value**
Muscle ratio			
60˚/s	0.46±0.05*	0.51±0.05*	**0.021**
180˚/s	0.51±0.05	0.54±0.06	0.197
300˚/s	0.54±0.07	0.57±0.06	0.357
ROM			
Knee flexion-extension	134˚±12˚	135˚±11˚	**0.001**

*Significant differences between Test 1 and Test 2 ($p<0.05$). ROM = Range of motion

DISCUSSION

Stretching exercises are traditionally recommended before most physical activities; therefore, it is important to determine the extent to which a stretching routine influences the performance of the activity and the injury risk to the related joints or muscles (Sekir *et al*., 2010). Stretching exercises have immediate and late effects (Rejeski *et al*., 1995; Gleim & Mchugh, 1997). These

exercises (stretching) facilitate improvement of muscle flexibility and joint motion with prolonged beneficial effects. The immediate effects, which last for approximately one hour, can be explained by the visco-elastic response of the muscle (Gleim & Mchugh, 1997). A 6-week stretching exercise program results in more permanent changes in muscle visco-elasticity and joint range of motion (Magnusson *et al*., 1996; Gleim & Mchugh, 1997). DS may improve muscle performance and possibly reduce the risk of injury. Therefore, according to the results of this study it is recommended that dynamic stretching should be performed before every activity.

In the study by Renström (1993), 60 to 80% of injuries were found to be associated with extrinsic factors, such as training errors and changes in running activities. Intrinsic factors were also common, especially misalignments, including excessive pronation and cavus foot. These changes are associated with common over-use injuries, but specific anatomic abnormalities and abnormal biomechanics of the lower extremity are not correlated with specific injuries on a predictable basis. Factors such as leg-length discrepancy, poor flexibility, muscle weakness and imbalance, deficits in neuromuscular coordination and ligamentous laxity can cause running injuries. Acquired or secondary factors, such as kinetic chain dysfunctions, are more common than previously acknowledged.

A concentric hamstring-to-quadriceps ratio that is lower than 0.6 and a hamstring asymmetry of more than 10% do not help identify previous hamstring injuries. A mixed eccentric- hamstring-to-concentric-quadriceps ratio that is lower than 0.6 is the best indicator (probability: 77.5%). The rate of recurrence is 30% (3 out of 10 cases) and the rate of new hamstring muscle injuries is 31% (5 out of 16 cases) (Dauty *et al*., 2003). Soderman *et al*. (2001) demonstrated the relationship between a lower H/Q muscle ratio and knee injury risk in studies involving soccer players.

In a previous study, it was reported that regarding isokinetic strength, volleyball players had lower H/Q muscle ratios than soccer players (Magalhaes *et al*., 2004). The authors suggested that this low H/Q muscle ratio found in volleyball players could contribute to enhanced knee injury susceptibility, with a particular emphasis on the tensional stress on the anterior cruciate ligament (ACL) due to decreased joint stabilising strength (Bamac *et al*., 2008).

The hamstring muscles play a key function in maintaining knee joint stability (Coombs & Garbutt, 2002). The role of the hamstring muscles during leg extension is to assist the anterior cruciate ligament in preventing anterior tibial drawer forces. Tensile stress on the ACL is significantly reduced when the hamstring and quadriceps muscles are co-active during extension compared to when the quadriceps are active alone (More *et al*., 1993). A 'normal' H/Q strength ratio of 0.6 is frequently used as an injury prevention and rehabilitation goal (Sekir *et al*., 2010). In the present study, DS applied on certain muscle groups increased isokinetic muscle strength and improved muscle performance. Moreover, DS exercises positively affected the H/Q ratio, which reflects a muscle imbalance. This may reduce the risk of injury in these muscles.

Bamac *et al*. (2008) found that a highly developed quadriceps muscle contributes to decreased antagonist hamstring muscle co-activation in volleyball players. The mean quadriceps peak torque was found to be significantly higher in volleyball players than in basketball players and control subjects. The volleyball players had a lower H/Q muscle ratio than the basketball players and the controls at 300°/s due to exacerbated quadriceps strength related to hamstring muscle strength. This functional imbalance could be a specific volleyball adaptation or/and could reflect

insufficient hamstring compensatory strength training. Although the sport represented in the current study (soccer) requires similar movements (running, jumping, acceleration and deceleration), different training skills may be responsible for the differences in the H/Q muscle ratios among the sports examined.

Some researchers have reported that landing technique has significant implications on the kinematics and muscle activation patterns of the lower extremity. To decrease the risk of injury as a result of muscular imbalance, attention must be given to proper muscle balance between the hamstring and quadriceps muscles (De Vita & Skelly, 1992).

Previous studies have shown that elite athletes in various sports have different isokinetic muscle strengths. In the present study, athletes of the same sport were evaluated because their motion and muscle biomechanics would be similar. Knapik *et al*. (1991) demonstrated that female collegiate athletes with low H/Q strength ratios based on high-speed isokinetic measurements had a higher incidence of ACL injury. In the current study the elite female soccer players performed routine dynamic stretching exercises for their knee flexor

(hamstring) and extensor (quadriceps) muscles. DS may reduce the risk of injury and improve performance due to their positive effect on the H/Q ratios, muscle strength of the knee extensors and flexors, as well as knee ROM.

CONCLUSIONS

Hamstring/Quadriceps muscle imbalances can be seen as an injury risk for elite athletes. They could benefit from specific strength training of hamstring muscles. In the current study the elite female soccer players performed routine dynamic stretching exercises for their knee flexor (hamstring) and extensor (quadriceps) muscles. DS may reduce the risk of injury and improve performance due to their positive effect on the H/Q ratios, muscle strength of the knee extensors and flexors, as well as knee range of motion.

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SELF-EFFICACY AND SOCIAL SUPPORT OF ACADEMY CRICKETERS

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ABSTRACT

This article aims to provide an initial insight into the role that South African provincial cricket academies play in talent development of cricketers by reflecting on possible changes in academy cricketers' self-efficacy and perceived social support over an academy season, as well as indicating the relationship between self- efficacy and social support. A purposive sample of 65 male, university-age (18-25 years) provincial academy cricketers completed a self-efficacy questionnaire and a social support questionnaire, designed specifically for the purposes of the current study, at the culmination of their academy programme. A pre-experimental post-test- pre-test design was used. The results indicated significant positive changes in self- efficacy, esteem social support, informational social support and tangible social support over a cricket academy season. A significant correlation between self- efficacy and informational social support was found. Although this preliminary study provided evidence of increases in self-efficacy and perceived social support of South African provincial academy cricketers over an academy season, psychometrically tested scales need to be developed to measure these constructs, whilst larger, randomised sample sizes would make the results more generalisable.

Key words: Self-efficacy; Social Support; Informational social support; Sport academy; Cricket.

INTRODUCTION

Self-confidence is one of the most frequently cited psychological factors considered to influence

athletic performance and the most critical cognitive factor in sport (Feltz, 1984; Gill & Williams, 2008). Self-confidence is one‟s belief that one can successfully perform a desired behaviour (Weinberg & Gould, 2011). Self-efficacy is a situation-specific form of self-confidence and refers to one‟s conviction that one can be successful at specific tasks and skills under specific conditions (Hall *et al.,* 1996).

Appropriate support and training are essential if talented individuals are to fulfil their potential (Abbott & Collins, 2004). Self-efficacy and social support are two of the strongest and most consistent correlates of physical activity participation across populations (Peterson *et al*., 2008). The distinct social nature of sport suggests that social support may be an important source of confidence (Wilson *et al*., 2004). In Rees and Freeman‟s (2009) study, participants improved levels of self-efficacy and performance when they perceived that someone was available to provide the relevant support when necessary. High achievement is

increasingly attributed to the interaction between unusual talent combined with high motivation (Heller & Viek, 2000; Ziegler & Raul, 2000). The goals of research in sport talent development are to understand the development of talent, to shorten the journey on the path to expertise and to extend the athlete‟s ability to perform at a peak level repeatedly (Starkes *et al*., 2001).

The purpose of provincial cricket academies in South Africa is to develop skills, mental toughness, cricket knowledge and etiquette of talented male school leaver cricketers (The Academy, n.d.). Provincial cricket academies select players when they achieve a certain level of cricket excellence and show potential in the sport. They also consider the commitment of a cricket player to the learning process. Academies typically provide a cricketer with a social support structure within a cricketing context by providing coaching staff, cricket administrative staff and teammates. This unique context further provides an aspiring cricketer with opportunities to boost his self-efficacy and improve his cricketing skill levels.

An important aspect of Bandura‟s (1977) self-efficacy theory is the differentiation between self-efficacy and outcome expectancy. Bandura describes self-efficacy as a person‟s belief in his or her ability to execute a particular behaviour successfully. He describes outcome expectancy as a person‟s expectation that a specific behaviour (e.g. selection for and attendance of a provincial cricket academy) will lead to a specific outcome (e.g. improved cricket performance). Efficacy expectations determine how much effort people expend on a task and how long they will persist in the face of adversity or setbacks (Bandura, 1977). One of the strategies for improving self-efficacy is verbal persuasion (Bandura, 1994). People are more likely to increase and sustain efforts when verbally persuaded that they have the potential to succeed in a given task. However, disappointing results following one‟s efforts quickly disconfirm unrealistic boosts in self-efficacy.

Bandura‟s (1977) self-efficacy theory and Vealey‟s (2001) model of sport confidence have provided the foundation for most of the self-confidence studies in sport psychology literature (Hays *et al.,* 2009). Bandura‟s (1986) theory of self-efficacy states that self-efficacy is enhanced by performance accomplishments, vicarious experiences (modelling), verbal persuasion, imaginal experiences, physiological states and emotional states. According to Bandura (1994), the most influential of these six principle sources of information is performance accomplishments (successful performance). Vealey‟s (2001) model of sport confidence categorised three main sources of sport self-confidence, namely achievement, self-regulation

and social climate. Within this model, social support is regarded as a source of sport confidence within the social climate domain (Vealey, 2001).

There appears to be a lack of research evidence on the relationship between social support and success in sport, although social support is generally considered to be an influencing factor (Rees & Freeman, 2009). Druckman (2004) reports that a number of research studies undertaken regard self-efficacy as a key variable for enhancing all aspects of human performance. However, South African and international research on self-efficacy and social support in the sports context is lacking. To the best of our knowledge, no research has been conducted on the value of South African cricket academies in developing talent or on developing self-efficacy and perceived social support of cricketers.

This article aims to provide an initial insight into the role that South African provincial cricket academies play in talent development of cricketers by reflecting on possible changes in self-efficacy and perceived social support over a six-month academy season, as well as by indicating the relationship between self-efficacy and social support of academy cricketers.

METHODOLOGY

Research design

A quantitative methodology, namely a pre-experimental design was used. According to Bless and Higson-Smith (1995), the purpose of this type of study is to gain insight into a situation, phenomenon, community or person. The specific design used was that of a one-group retrospective post-test-pre-test design. It is a variation of the one-group pre-test-post-test design in that the measures were administered post-intervention and the dependent variables were measured at one point in time. Self-efficacy and social support were the dependent variables and the cricket academy programme was the independent variable. In a one-group retrospective post-test-pre-test design, response shift bias is reduced and perceived changes made in knowledge, skills, attitudes or behaviours is more accurately assessed compared to the one-group pre-test-post-test design (Colosi & Dunifon, 2006).

This study varied from the traditional pre-test-post-test design in that the questionnaire was administered after the intervention. This type of design has become popular because it is applied at only one point in time, often on a single instrument that measures a variable „then‟ (pre-test) and „now‟ (post-test) (Colosi & Dunifon, 2006). By testing what participants believe about programme content once the programme has been completed, their frame of reference for assessing the changes in knowledge, skills, attitudes or behaviours is consistent. This reduces response shift bias (Davis, 2003), which was identified as the biggest weakness of the one-group pre-test-post-test design (Howard, 1980).

At the completion of the six-month academy programme, participants completed a self- efficacy questionnaire and a social support questionnaire developed specifically for this study. Participants provided two responses to each item according to how strongly they agreed or disagreed with each of the statements (e.g. “I have someone who listens to my concerns”). One response reflected their perception at the present time (present) and the other response reflected their perception at the start of the academy programme (before). Raidl *et al.* (2004) assert that this design reduces incomplete data sets because the data are collected on one occasion only. In

addition to this, this design was convenient for both the administration and completion of the measures because of the economising of time. An added advantage of this design is the built-in strategy for simultaneously comparing pre-tests with post-tests (De Vos, 2002).

Participants

The participants were selected using non-probability purposive convenient sampling. The total sample consisted of 65 male university-age (18-25 years) cricketers who participated in a South African Inter-provincial Cricket Academy Week. The mean age of the participants was 20.58 years, with a standard deviation of 1.95 years. The majority of the participants

(71%) fell within the age range of 18-21 years. The sample reflected the diversity of ethnicity in South Africa with 23 (36%) Black participants, 21 (32%) White participants, 17 (26%) Ccoloured participants and four (6%) Indian participants. With regard to specialised roles within their cricket teams, 18 (30%) were specialist batsmen, 18 (30%) were specialist bowlers, 21 (34%) were all-rounders (batsmen and bowlers) and 4 (6%) indicated that they were specialist wicket keepers.

Measures

The measures used for data collection for this study were an expanded version of Cox *et al.*"s (2003) Competitive State Anxiety Inventory-2R (CSAI-2R) and an adapted version of Rees and colleagues" (Rees & Hardy, 2000; Rees & Freeman, 2007) social support measure. As a result of a lack of valid measures in sport psychology, researchers have tended to write their own items (Rees, personal communication, 30 June 2008).

Self-efficacy measure

The Competitive State Anxiety Inventory-2 (CSAI-2) (Martens *et al*., 1990) has been used extensively in research and is possibly one of the most well-known anxiety instruments used in sport psychology research. However, studies examining the psychometric properties of the CSAI-2 raised questions about its factor structure (Cox *et al.*, 2003). As a result, Cox *et al.* (2003) revised the Competitive State Anxiety Inventory – 2 and concluded that the CSAI-2R has stronger psychometric properties in terms of its factor structure than the original CSAI-2 (Martens *et al*., 1990). The CSAI-2R has an internal reliability of 0.81 (Cox *et al.*, 2003). Self-efficacy was measured by expanding on the self-confidence scale of the revised Competitive State Anxiety Inventory-2 (CSAI-2R: Cox *et al*., 2003).

The items used in this study were the 5 items of the self-confidence scale of the CSAI-2R combined with 5 items that were adapted from the Sport Self-Efficacy Scale (Ryckman *et al.*, 1982). A 5-point Likert scale anchored each item with descriptors ranging from „Strongly disagree" [1] to „Strongly agree" [5]. Bandura (1986) and Hu *et al.* (2005) made suggestions and recommendations with regard to making measures situation-specific, and when developing the self-efficacy measure used in this study, these were considered. Adaptations were made by creating items that were specific to cricket, as well as changing the subject of each item, e.g. "I find that I am not accident prone" was changed to "I am confident that I can cope with injury" in order for it to measure self-efficacy rather than self-esteem (Hu *et al*., 2005). By making these changes, the measure identified the extent to which the cricket player believed that he could accomplish the task at hand, based on Bandura"s (1977) definition of self-efficacy.

The average inter-item correlation of the 10 items on the adapted self-efficacy measure was 0.33 for the „present" (post-academy) items and 0.32 for the „before" (pre-academy) items. Cronbach"s alpha internal reliability coefficients were measured at 0.82 („present") and 0.80 („before"). The relatively low inter-item correlations indicate that the measure needs to undergo standardisation, specifically for the diverse South African population.

Social support measure

Rees and Freeman (2007) created a measure for their study, involving perceived and received social support and self-confidence in university-age athletes. Their 2007 study made use of 2 of the 4 social support dimensions, that is emotional support and esteem support. Correlations between their two subscales of perceived support were strong ($r=0.76$, $p<0.05$). Cronbach"s alpha internal reliability coefficients were 0.78 and 0.81 for the emotional and esteem subscales respectively, with the total for both scales being 0.88. In the received support scale, Cronbach"s alpha internal reliability coefficients were 0.72 and 0.84 respectively, with the total for both scales being 0.87.

The items used for the measure created for this study were selected from the 37 items derived by Rees and colleagues (Rees & Hardy, 2000; Rees & Freeman, 2007) in their research on social support experiences of high-level sportspeople. The items were chosen according to their suitability to the study sample. In line with recommendations made by Rees and Hardy (2000), 4 dimensions of sport-relevant social support were assessed, namely emotional social support (items 1, 5, 9, 13), esteem social support (items 2, 6, 10, 14), informational social support (items 3, 7, 11, 15) and tangible social support (items 4, 8, 12, 16). With regard to the tangible social support items, the items suggested by Rees (personal communication, 30 June 2008) relating to transport and accommodation, were included. This was done to make the measure more relevant to a South African context, as also recommended by Rees. A 5-point Likert scale anchored each item with descriptors ranging from „Strongly disagree" [1] to „Strongly agree" [5].

Statistical reliability for the summated scores of each of the 4 domains was determined by using Cronbach"s alpha. The reliability coefficient and the inter-item correlation values of each item are presented in Table 1.

TABLE 1: **INTERNAL RELIABILITY AND INTER-ITEM CORRELATION OF SOCIAL SUPPORT QUESTIONNAIRE**

FACTOR	Number of items	Alpha ('after')	Alpha ('before')	Mean inter-item correlation ('after')	Mean inter-item correlation ('before')
Emotional	4	0.74	0.70	0.42	0.38
Esteem	4	0.69	0.77	0.36	0.45
Informational	4	0.66	0.75	0.33	0.43
Tangible	4	0.61	0.66	0.28	0.33

Procedures

Potential participants, namely members of the 5 South African provincial cricket academies, were identified and approached via the manager of each of the academies. Testing sessions were scheduled prior to the start of the South African Interprovincial Academy Cricket Week. Informed consent was obtained from all participants prior to the completion of the questionnaires. The measures were group-administered at a time convenient for each team.

The first author was present during all of the testing sessions to assist where necessary.

Data analysis

Statistical techniques employed to investigate the relationship between self-efficacy and the various types of social support were a one sample post- and pre-test t-test, the Pearson product-moment correlation coefficient and an analysis of variance (ANOVA). Cronbach"s alpha was used to assess the internal reliability of the questionnaires used. Cronbach"s alpha internal reliability coefficients for the adapted self-efficacy measure were measured at 0.82 („after") and 0.80 („before"). Cronbach"s alpha internal reliability coefficients for the 4 factors of the adapted social support measure ranged from 0.61 to 0.74 (post-academy) and 0.66 to 0.77 (pre-academy). The alpha coefficients for both of the adapted measures used in this study were acceptable. Nunnaly (1978) indicated 0.7 to be an acceptable reliability coefficient and 0.6 to be acceptable for an exploratory study.

A between-subjects t-test was used to determine whether there were any differences in social support data between participants who attended their current 6-month academy programme for the first time and those who attended for the second time. No significant differences were found, and as a result, data from first-year and second-year participants were combined in subsequent data analyses.

RESULTS AND DISCUSSION

The results reflecting possible changes in self-efficacy and perceived social support over a 6-month academy season, as well as the relationship between self-efficacy and social support of academy cricketers are presented and discussed in this section.

Change in self-efficacy over duration of academy attendance

A within-subjects t-test was done to determine the differences between the mean performance scores on the pre- (before) and post- (after) items on the self-efficacy measure. The pre-academy (before) items referred to self-efficacy at the start of the academy. The post- academy (after) items referred to self-efficacy after completing their current 6-month academy season. Considering that the self-efficacy measure"s Likert scale ranged from „Strongly disagree" [1] to „Strongly agree" [5], the mean scores reported on both the pre- and post-items on the self-efficacy measure were relatively high. The mean scores reported ranged from 3.74 to 4.31 (pre) and 4.06 to 4.59 (post). All of the items, except for item 9, reflected significant ($p \leq 0.05$) changes over the duration of the academy. Item 9 was "I am confident that I can bounce back from disappointment". Although changes on item 9 were not significant, the mean scores were high. Figure 1 depicts the significant and non-significant differences for each item.

Bandura (1997) stated that the most effective manner in which to strengthen self-efficacy is to

provide opportunities for people to have mastery experiences by succeeding at a task. A cricket academy programme grants an individual cricketer numerous opportunities for success and improvement throughout the academy season, thereby providing information about past performances, which is a primary source of self-efficacy information.

The mean scores of the self-efficacy items were relatively high before the start of the provincial cricket academy programmes (pre-academy), which supports the notion that individuals who are high in self-efficacy are likely to progress to a higher level in sport. Individuals high in self-efficacy believe in their abilities and have positive thoughts surrounding what they do. They have a greater pro-social orientation and may, therefore, be predisposed to view any social support they receive positively (Bandura *et al*., 1996; Bandura *et al*., 1999).

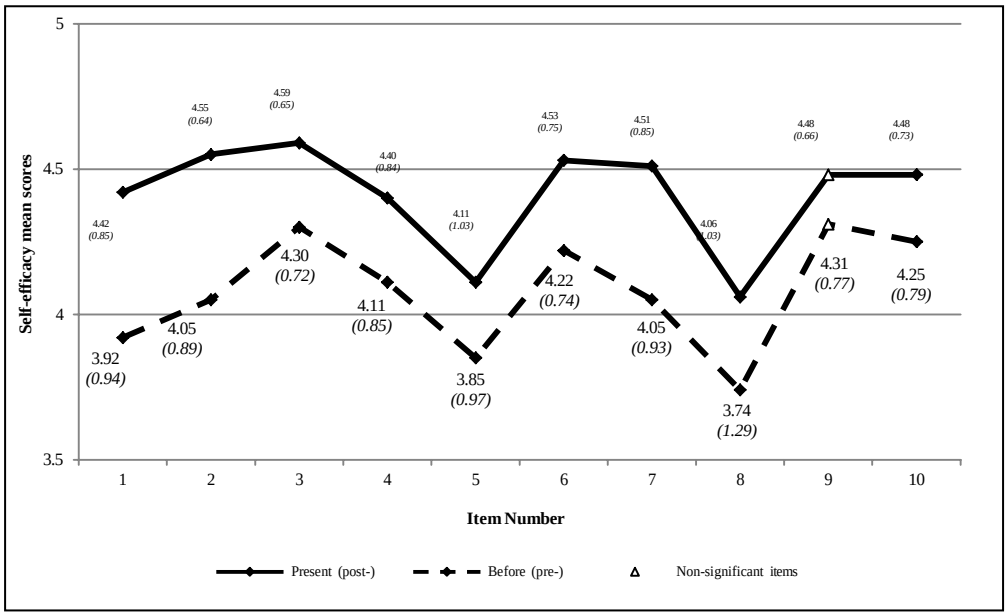

FIGURE 1: **MEAN AND STANDARD DEVIATION SCORES OF SELF-EFFICACY FACTORS (pre- and post-test)**

Change in social support factors over duration of academy attendance

A within-subjects t-test was used to determine the difference in the pre-test and post-test mean scores of social support. The social support measure"s Likert scale ranged from „Strongly disagree" [1] to „Strongly agree" [5]. The mean scores ranged from 3.70 to 4.09 (pre) and 3.96 to 4.37 (post), which are relatively high mean scores. Significant ($p \leq 0.05$) changes were reflected in emotional social support (item 13), esteem social support (items 6, 10, 14), informational social support (items 3, 7, 11, 15) and tangible social support (item 12).

When the relevant items were combined so that each social support factor could be compared (post-test-pre-test), a significant ($p \leq 0.05$) change over the duration of the academy occurred in the esteem social support, informational social support and tangible social support factors. The

only factor in which a significant change did not occur was emotional social support. Figure 2 shows the pre-test and post-test mean scores and standard deviation scores (in brackets) of the social support factors reported by the participants.

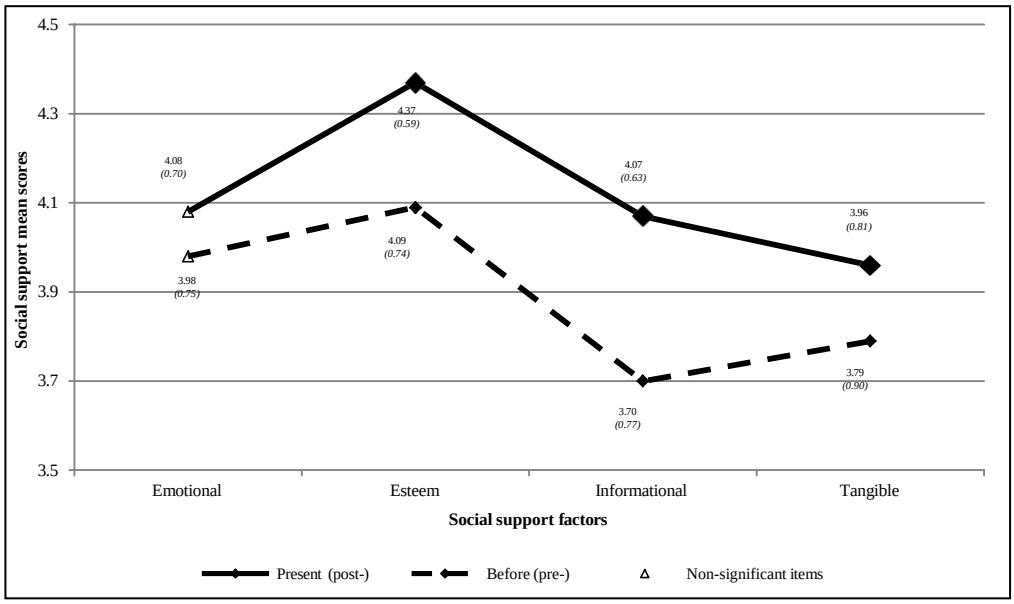

FIGURE 2: **MEAN AND STANDARD DEVIATION SCORES OF SOCIAL SUPPORT FACTORS (pre- and post-test)**

Of the 4 social support factors, only the change in emotional social support (e.g. having someone there for them) was not significant. There was a significant change in the esteem social support (e.g. having someone who could encourage them and boost their confidence), informational social support (e.g. having someone to give constructive criticism and technical advice) and tangible support (e.g. having someone to set up sessions in practice) over their current 6-month academy period. The services provided at a provincial cricket academy, as mentioned above, lend themselves to an improvement in esteem social support, informational social support and tangible social support. The non-significant change in emotional social support may have been the result of an academy cricketer relying on previous providers of social support, such as parents or a former coach, throughout the duration of the provincial cricket academy. The non-significant change in emotional social support may also indicate the lack of and the need for sport psychology consultants as part of an academy programme.

Correlations between self-efficacy and the four social support factors

The Pearson product-moment correlation coefficient was calculated in order to determine the strength and direction of the correlation between the dependent and independent variables (Coolican, 1999). The level of significance was set at a 5% level ($p \leq 0.05$) as convention dictates (Coolican, 1999).

Table 2 shows the correlations between the reported change in the pre- and post-academy mean scores on self-efficacy and the reported change in the pre-test and post-test mean scores on the 4

social support factors. The only significant correlation was that of the change in self- efficacy and the change in informational social support. The correlation was of moderate

strength and positive in direction.

Individuals possess a self-system that enables them to exercise a measure of control over their thoughts, feelings, motivations and actions (Bandura, 1986). This is done by perceiving, regulating and evaluating behaviour, which results from the interplay between the self and the environmental sources of influence. If an academy cricket player believes that he is in control and that he has the power to produce specific results, he will be motivated to compete successfully (Cox, 2007). The process of creating and using these self-beliefs is an intuitive one: cricket players engage in a particular behaviour, interpret the results of their actions, use these interpretations to create and develop beliefs to engage in subsequent behaviours in similar domains and behave in accordance with the beliefs created (Bandura, 1986). The social nature of sport suggests that social support may be an important source of confidence (Babkes & Partridge, 2004).

TABLE 2: **CORRELATIONS BETWEEN CHANGE IN PRE- AND POST-TEST ACADEMY MEAN SCORES ON SELF- EFFICACY AND FOUR SOCIAL SUPPORT FACTORS**

Variable	**Self-Efficacy Difference**
Emotional Social Support difference	0.05
Esteem Social Support difference	0.11
Informational Social Support difference	0.38*
Tangible Social Support difference	-0.08

Note. Diff = Difference over duration of academy. * $p \leq 0.05$

Sport confidence is a construct measuring self-efficacy in sport-specific situations (Callow *et al*., 2001). Vealey *et al*. (1998) identified and discriminated between different sources of confidence underlying and affecting the level of sport confidence. Nine sources of sport confidence were established, which were categorised into domains of achievement (mastery, demonstration of ability), self-regulation (physical and mental preparation, physical presentation) and social climate (social support, coaches‟ leadership, vicarious experience, environmental comfort, situational favourableness). Social support is a source of sport confidence contributing to the domain of social climate and therefore contributes to sport confidence.

There is evidence that social support links to elements of motivation (Reinboth *et al*., 2004). Motivation regulates the expectation that a given course of behaviour will produce certain outcomes. Self-efficacy thus governs the motivating influence of outcome expectancy. Bandura (1977) defines outcome expectancy as a person‟s expectations that a specific behaviour will lead to a certain outcome. The difference between outcome expectancy and self-efficacy is explained by the fact that a cricket player can believe that what he does will lead to specific outcomes (outcome expectancy), but he may doubt his ability to execute a particular behaviour (self-efficacy). Unless people believe that their actions can produce the desired outcomes, there will

be little incentive to act or persevere when faced with difficulties

(Bandura, 1997). By providing informational support (e.g. advice and role clarification), cricket players‟ belief in their ability to execute a particular behaviour may improve because their outcome expectancies have become more realistic.

Only 1 of the 4 types of social support, namely informational social support, showed a correlation with self-efficacy over the duration of the academy season. This supports research using Chellandurai‟s (1993) model and Smith and Smoll‟s (1997) work on coaching success, which showed that athletes seem to be satisfied with coaches who emphasise training and instruction and provide positive feedback based on good performance. Thus, academies may improve cricket players‟ self-efficacy by providing information about aspects such as goal setting, technique and match situations. Additionally, those participants who were higher in self-efficacy may have been more receptive to informational support due to having a higher performance orientation (Vealey, 1988).

CONCLUSION

This article has provided an initial insight into self-efficacy and perceived social support in talented provincial academy cricketers by reflecting on changes in self-efficacy and perceived social support over a six-month academy season, specifically within a South African context. It has also indicated possible relationships between self-efficacy and social support of academy cricketers during an academy season.

Significant changes in self-efficacy, esteem social support, informational social support and tangible social support over the duration of an academy season were found. The results revealed that the provincial academy cricketers began their current six-month academy season with a relatively high level of self-efficacy and that this level of self-efficacy improved during the academy programme. Additionally, a significant correlation was found between self-efficacy and informational social support during their current academy season. This result confirms the notion that social support may influence self-efficacy through the channel of honest feedback on performance accomplishments.

Informational social support may influence self-efficacy by providing the cricket player with information that allows him to form more realistic and achievable outcome expectancies, thus influencing self-efficacy. Results support the value of informational support in influencing self-efficacy. It may be important then to encourage and re-iterate the value of past performances, both positive and negative, in integrating positive reinforcement and lessons learnt from these experiences.

As mentioned previously, South African provincial cricket academies aim to develop natural talent, skill, mental attitude, general cricket knowledge, as well as cricket etiquette of players. This research provides support for the value of such academies in their quest to develop talent, build self-efficacy and provide social support through the services provided as part of the programme of academies.

The questionnaires used in this study were not standardised measures. As is the case with most sport psychology measures, further validation work needs to be conducted on both

questionnaires before the results can be viewed with greater confidence. The cultural diversity within South African needs to be considered in future studies when standardising the questionnaires for use with South African cricketers. Although the sample was relatively small, it was unique and representative of South African provincial academy cricketers. In future studies, the classical pre-test-post-test design is preferred. The use of a control group would offset the response-shift bias concerns of the one-group pre-test-post-test design and the risk of inaccurate recall of the one-group retrospective pre-test-post-test design. A control group could consist of cricketers who are on the waiting lists to attend the provincial cricket academies.

Future studies should consider prospective longitudinal studies in order to clarify the causal chain linking social support and self-efficacy and ultimately performance more clearly. Although self-efficacy and social support were assessed in relation to the academy season, performance was not assessed. In social psychology, self-efficacy mediates the relationship between social support and adaptive outcomes such as performance. Future research could therefore examine whether self-confidence or other psychological states mediate the social support–performance relationship.

This is the first South African study of its kind, and it extends the limited national and international research, particularly on the combination of self-efficacy and social support in a sport-performance context.

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PREVALENCE OF OVERWEIGHT AND UNDERWEIGHT AMONG BLACK SOUTH AFRICAN CHILDREN FROM RURAL AREAS IN THE

NORTH-WEST PROVINCE

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ABSTRACT

The aim of this study was to determine the prevalence of overweight and underweight according to body mass index (BMI) and percentage body fat, among Black South African children in rural areas from the North-West Province. The sample (N=168) consisted of 47 eleven-year-olds, 58 twelve-year-olds and 63 thirteen-year-old children of which 79 were boys, and 89 were girls. Anthropometric measurements (BMI and percentage body fat) were taken according to the standard ISAK methods. Descriptive statistics and the Independent t-tests were used. The majority of the boys were of normal weight (80%), with 19% underweight and 1% at risk of overweight. The majority girls were also of normal weight (78%), with 11% underweight, 4% at risk of overweight and 7% overweight and obese. Regarding percentage body fat, 47% of the boys were classified as optimal, 44% as low, 5% moderate high and 4% high. In girls, 58% were rated as optimal, 18% as low, 10% as moderate high, 7% as very high and 3% in the high and very low categories each. There were no significant differences in BMI and percentage body fat among the different age groups ($p<0.05$). It appears that teachers and school-based health professionals should promote changes in school education and screening programmes by designing health programmes that are sensitive to race and individual needs.

Key words: BMI; Percentage body fat; Body composition; Black South African children.

INTRODUCTION

The environment of children has drastically changed worldwide during the last decades as reflected in unhealthy dietary habits and sedentary behaviours (Ahrens *et al*., 2006). There is a growing concern that a lack of time and space, safety considerations, and competition with television, video games and computers are resulting in sedentary lifestyles (Pica, 1999; Tremblay & Willms, 2000; Salmon *et al*., 2005).

Numerous studies have reported that children are becoming more overweight and physically inactive (Cole *et al*., 2000; Sallis, 2000; Tremblay & Willms, 2000; WHO, 2000; WHO, 2003; Evers *et al*., 2007). The prevalence and aetiology of childhood obesity may vary

according to lifestyle and socio-economic status. Most of the reports with regard to childhood obesity are from studies conducted in urban areas (Abdenur *et al*., 1994; Taylor *et al*., 1997; Saraswathi *et al*., 2011). Black South African children in rural areas have different lifestyles when looking at the availability of televisions and computers (Stroebel *et al*., 2007). Also, Black

children in rural areas generally live far from school and transportation is mainly on foot. The food intake for these children is usually unbalanced or inadequate and may lead to nutritional stunting or malnutrition (Monyeki *et al*., 2008; Kimani-Murage *et al*., 2010). Childhood nutritional stunting has been suggested as a possible factor contributing to the high prevalence of overweight in developing countries because of the observed association between stunting in childhood and obesity in adults (Popkin *et al*., 1996; Sawaya *et al*., 1998; Hoffman *et al*., 2000; Mantsena *et al*., 2004).

Over the past century, most nutrition research and policy concerning the developing world focused on poverty and under nutrition (Sawaya *et al*., 1998; Hoffman *et al*., 2000; Mantsena *et al*., 2004). Currently, there is growing evidence of a major shift toward overweight and obesity in these societies (Wang *et al*., 2002). A study by Marks *et al*. (2009) reported higher prevalence rates of obesity among children residing in rural areas compared to the general paediatric population.

In South Africa, a number of researchers have shifted their focus towards African children (Underhay *et al*., 2002; Monyeki *et al*., 2005; Armstrong *et al*; 2006; Stroebel *et al*., 2007; Jacobs *et al*., 2010). A few studies (Underhay *et al*., 2002; Monyeki *et al*., 2005; Armstrong *et al*., 2006) conducted in the North-West Province collected valuable data on the prevalence of overweight and stunting in 10- to 15-year-old rural children. According to Monyeki *et al*. (2005), body composition is an important indicator of the health status in children and adolescents. The aim of this study was to determine the prevalence of overweight and underweight according to body mass index (BMI) and percentage body fat, among Black South African children in rural areas of the North-West Province.

METHODOLOGY

Participants

The study made use of a convenient sample with a quantitative research design. Black South African children aged 11 to 13 years from three rural primary schools in the Potchefstroom area in the North-West Province participated in this study. The sample (N=168) consisted of 47 eleven-year-old, 58 twelve-year-old and 63 thirteen-year-old children. Of the total number examined, 79 were boys and 89 were girls. Parental consent was obtained from all subjects before participating in the study. Ethical approval was obtained from the Ethics Committee of the North-West University. In addition, permission from the Department of Education was acquired to conduct the tests at the schools.

Measurement procedure

The first stage of the measurement procedure was conducted with the children separated into groups according to school grade and gender. The measurements and examinations were completed over a one-month period during scheduled appointment hours within a private

class setting. Measurement procedure was explained to children in detail to reduce any uncertainties and anxiety. With help from assistants, the participants completed a personal detail information sheet that included: age, gender, language and contact numbers. Thereafter, the anthropometric measurements were assessed. To ensure reliability of the study the researcher

did all the anthropometric measurements.

Anthropometric Measurements

Measurements were taken according to the standard procedures of the International Society for the Advancement of Kinanthropometry (ISAK) methods (ISAK, 2001). The following measurements were taken:

Stature: Maximum stature was measured to the nearest 0.1cm with a stadiometer with the child standing upright and the head in the Frankfort plane.

Body mass: The children wore hospital gowns and underwear while their body mass was measured to the nearest 0.1kg on an electronic scale (Krupps). The scale was calibrated at the beginning of the study with a 20kg standard calibration weight. Using stature and body mass measurements, the BMI was calculated using the following equation (ACSM, 2006):

$$BMI = \frac{weight\,(kg)}{height\,(m)^2}$$

Skinfolds: The triceps and subscapular skinfolds were measured in duplicate to the nearest 0.2mm with a Harpenden® skinfold caliper with a constant pressure of 10g/mm^2 (Cambridge Scientific Intruments, Cambridge, MA) and the two values averaged. Sites on the right side of the body were measured and percentage body fat was determined using a 2-site skinfold measurement (triceps and subscapular) (Slaughter *et al*., 1988).

$$\Sigma SKF > 35mm{:}\%BF = 0.783(\Sigma SKF) + 1.6$$

$$\Sigma SKF < 35mm{:}\%BF = 1.21(\Sigma SKF) - 0.008(\Sigma SKF)^2 + I*$$

For Africans: $I*$ = -5.2

ΣSKF = Sum of skinfolds $\quad$ $\%BF$ = Percentage body fat

STATISTICAL ANALYSIS

Microsoft Excel Version 7.0 Analysis Tool and Statistica (Statsoft, 2006) were used for all quantitative data analyses. Descriptive statistics were used to report on means and standard deviations. Participants' weight status was classified by BMI percentile into underweight, normal weight, at risk of overweight, overweight and obese (Kuczmarski *et al*., 2000). Participants' percentage body fat was classified into very low, low, optimal range, moderate high, high and very high (Lohman, 1987). Independent t-tests were used to determine differences among age groups. Significance was accepted at $p<0.05$.

RESULTS

Table 1 shows descriptive information for the anthropometric characteristics, namely body mass index (BMI) and percentage body fat. The average BMI and percentage body fat for

boys were 16.5kg/m^2 and 10.5% respectively, whereas the averages for girls were 18.3kg/m^2 and 20% respectively. There were no significant differences in BMI and percentage body fat among the different age groups ($p<0.05$).

TABLE 1: **MEAN AND STANDARD DEVIATIONS OF ANTHROPOMETRIC**

CHARACTERISTICS (N=168)

Age (yrs)	BMI (kg/m^2)		Percentage Body Fat (%)	
	Boys Mean±SD (n)	Girls Mean±SD (n)	Boys Mean±SD (n)	Girls Mean±SD (n)
11	15.7±1.64 (19)	17.8±3.85 (28)	10.1±5.16 (19)	19.3±7.93 (28)
12	16.8±1.60 (29)	18.8±4.76 (29)	10.3±2.98 (29)	20.9±9.29 (29)
13	16.6±2.29 (31)	18.3±3.10 (32)	10.9±5.33 (31)	19.6±6.27 (32)
Tot. Gr.	16.5±1.94 (79)	18.3±3.92 (89)	10.5±4.52 (79)	20.0±7.82 (89)

Figure 1 reports the prevalence of underweight, normal weight, at risk of overweight and overweight and obesity among boys and girls as defined by CDC BMI cut-off points (Kuczmarski *et al*., 2000). Healthy children have a BMI percentile ranging from between the 5th percentile to the 85th percentile. The children whose weight was more than the 85th percentile to less than the 95th percentile were considered as overweight and those who were equal to or greater than the 95th percentile as obese. The children, whose weight was equal to or lower than the 5th percentile, were considered underweight. In the case of the boys, the majority (80%) were of normal weight, with 19% underweight and 1% at risk of overweight. None of the boys (0%) were classified as overweight and obese. For the girls, the majority (78%) were also of normal weight, with 11% in the underweight category, 4% at risk of overweight and 7% overweight and obese.

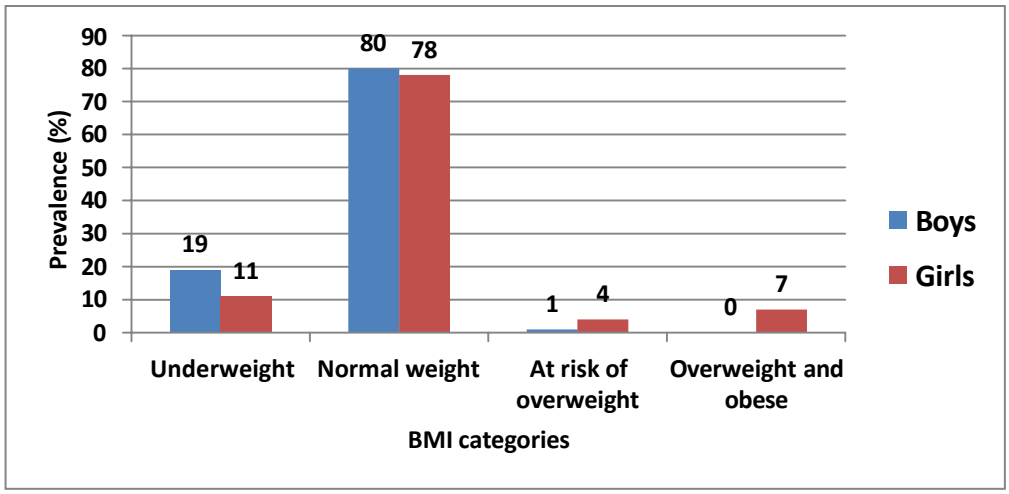

FIGURE 1: **PREVALENCE WITHIN WEIGHT CATEGORIES FOR BOYS AND GIRLS (N=168)** (Kuczmarski *et al*., 2000)

Figure 2 illustrates the percentage body fat ranges for boys and girls respectively, as classified according to percent-fat charts by Lohman (1987). Body fat is regarded as being too high when it exceeds 25% for boys and 35% for girls and is considered low in children when it ranges between 6 and 10% in boys and 12 and 15% in girls (Lohman, 1999).

Regarding percentage body fat, 47% of the boys were classified as optimal, 44% as low, 5% as moderate high and 4% as high. Of the girls, 58% had an optimal range percentage body fat, followed by 18% classified as low, 10% as moderate high, 7% as very high and 3% each in the high and very low category.

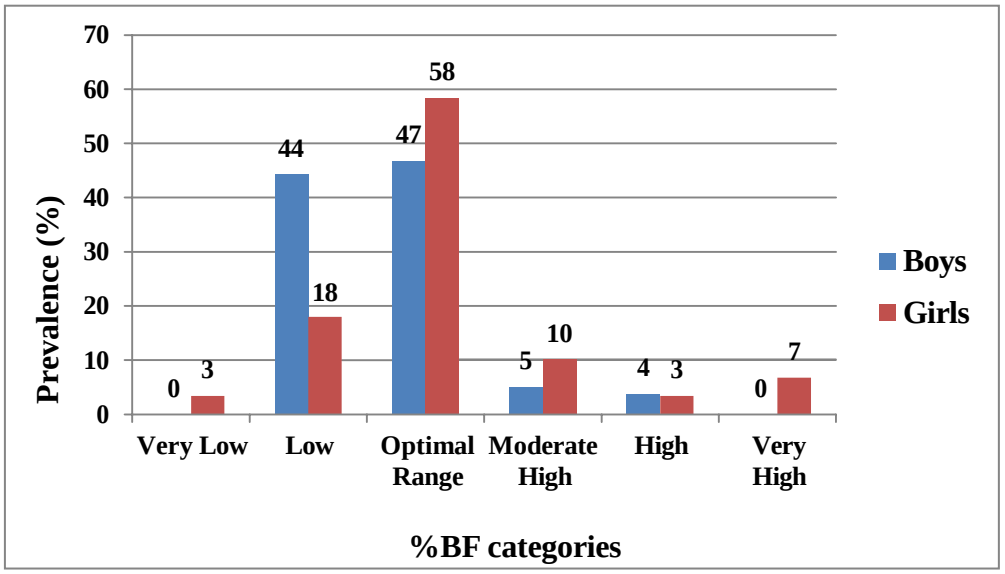

FIGURE 2: **PERCENTAGE BODY FAT RANGES FOR BOYS AND GIRLS (N = 168) (Lohman, 1987)**

DISCUSSION

The concern for the health of South African children has arisen from an awareness of international trends in paediatric overweight and obesity coupled with the results of the National Food Consumption Survey and some factors identified by the Birth to Twenty Study (Armstrong *et al*., 2006).

The mean BMI for both boys and girls reported similar results than those measured in rural children from KwaZulu-Natal (Jinabhai *et al*., 2001) and the greater Johannesburg area (McVeigh *et al*., 2004). However, the THUSA BANA study on 10- to 15-year-old children from five different regions in the North-West Province found the BMI and percentage body fat to be higher than the results reported in this study (Underhay *et al*., 2002). In contrast, a study conducted on rural primary school children in the Ellisras region, found lower BMI values (Monyeki *et al*., 2005). Moreover, Monyeki *et al*. (2005) reported lower percentage body fat measurements in girls, but higher percentage body fat measurements in boys.

In comparison with other countries, the BMI for boys in the present study showed significantly lower values than those reported in countries such as Australia, Canada, Mexico, Portugal and the Midwestern part of the United States of America (Pitetti *et al*., 2002; Pena Reyes *et al*., 2003; Olds & Dollman, 2004; Tremblay *et al*., 2005; Ribeiro *et al*., 2006). In contrast, the girls' BMI in the present study reported similar results to these countries.

Taylor *et al.* (1997) reported higher percentage body fat than that found in the present study. In accordance with this finding, the children in this study had a percentage body fat lower than the values reported in the study by Abdenur *et al*. (1994). Furthermore, the percentage body fat for boys in the present study was significantly lower than values reported for Australia, China and the United Kingdom (Rowlands *et al*., 2002; Murdey *et al*., 2005; Wickramasinghe *et al*., 2005). However, the girls from the present study reported similar results to studies in the United Kingdom and United States of America (Philadelphia), whereas Australia, Denmark and France reported significantly higher percentage body fat values (Ekelund *et al*., 2001; Gavarry *et al*., 2003; Murdey *et al*., 2005; Wickramasinghe *et al*., 2005; Ittenbach *et al*., 2006).

Compared to the findings reported by Monyeki *et al.* (1999), Monyeki *et al*. (2005) and Goon *et al*. (2006), none of the boys were overweight and obese. Furthermore, girls demonstrated a prevalence rate for overweight of 7%, which is higher than that reported by Monyeki *et al*. (1999). The prevalence rate of this study is lower than those reported by Armstrong *et al.* (2006) who reported overweight rates of 8.3 to 11.4% for boys and 12.6 to 14.2% for girls. The weights of most children were within the normal range (80% and 78% for boys and girls respectively), which is in accordance with Kruger *et al*. (2006) who investigated 10- to 15- year-old children from the North-West Province.

Body fat measurements revealed that 47% of boys and 58% of girls were in the optimal range category, which is in agreement with Kruger *et al*. (2006). However, it should be noted that a large percentage (44%) of boys were in the low percentage body fat category, which can explain the significantly higher prevalence rate for underweight (19%) compared to 11% for girls. According to a report by the United Nations Children's Emergency Fund (UNICEF, 2011), the prevalence rate for underweight children in developing countries measured in 2006 was 32%. In comparison, the present study reported a much lower rate for underweight children. The UNICEF reported that children in rural areas were twice as likely to be underweight than children in urban areas. In contrast, a study by Hanson and Chen (2007) reported that children from lower socio-economic backgrounds and rural areas had a significantly higher BMI. According to Rebato *et al*. (1998), this trend also appeared in samples in Guatemala and India.

The study suggests that although the majority of children were classified as normal weight, a high prevalence rate for boys was found in the underweight category with a mean percentage body fat below the prescribed limit. This suggests that the children in rural areas are undernourished and might be more prone to several deficiencies and disorders. Therefore, the nutritional status of the children should be investigated to ascertain whether this phenomenon is linked to malnutrition. Future studies examining the maturational status, as well as the environmental conditions that affect the health of children are needed.

There are several limitations of the current study that should be taken into account. Since, the present study did not reveal strong evidence of overweight and obesity among the Black South African children who participated, the prevalence estimates of overweight and obesity in the present study are not comparable to many other global studies, because of variation in the criteria used (BMI cut-off points), age and socio-economic status. The children selected were limited to a small geographic location, and as a result of time constraints, children were selected purposely and not randomly, which could have influenced the outcomes of the study. In addition, future studies should endeavour to include children from urban schools.

CONCLUSION

The prevalence of overweight among Black South African rural children was low, and this may reflect the fact that the children came from low socio-economic backgrounds. The relatively high prevalence of underweight found in this study has implications for the children's growth and development. It is suggested that the nutritional status of the children should be investigated to ascertain whether this phenomenon is linked to malnutrition. In developing countries, environmental constraints such as malnutrition or under nutrition, infectious diseases, poor living conditions and lack of educational facilities must be taken into consideration when discussing growth and development in children (Parizkova & Hills, 1998).

In conclusion, the majority of children were classified as normal weight. However, a high prevalence rate for boys was found in the underweight category with a mean percentage body fat below the prescribed limit. In the light of these findings, teachers and school-based health professionals should promote changes in school education and screening programmes by designing health programmes that are sensitive to race and individual needs.

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STRESSORS AMONG SOUTH AFRICAN SOCCER OFFICIALS: A PROFILE ANALYSIS

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ABSTRACT

The purpose of this study was to determine the contribution of selected stressors to the level of stress experienced by South African soccer officials. Forty-two South African Football Association (SAFA) accredited officials, attending a training camp in Potchefstroom, participated in this study. The group comprised of 40 male and two female officials. The average age of the officials was 37.52 (±6.09) years, and the period for which they were accredited as a SAFA official ranged from 2 to 27 years.

The Ontario Soccer Officials' Survey (OSOS) was used to determine the perceived levels of stress. The results indicated that fitness concerns were rated as the highest contributor to the stress experienced followed by role-culture conflicts, fear of failure, peer conflicts, interpersonal conflict, time pressures and lastly, fear of physical harm. The Spearman Rank Order Correlation showed a high correlation between the number of years the officials were accredited with SAFA and the total level of stress they experienced. Furthermore, the results indicated that 60% of the officials, who served as an accredited official for longer than 12 years, experienced five to seven stressors, which contributed to the total level of perceived stress.

Key words: Soccer; Officials; Acute stress; Certification; Sport; South Africa.

INTRODUCTION

Stress and anxiety among athletes have been the interest of various researchers in the field of sport and exercise psychology. However, little attention has been given to officials, judges, referees or umpires (Burke & Miller, 1990). Sport officiating can be a very stressful experience, characterised by stress and anxiety, consequently leading to various stress-related illnesses (Constable, 1996; Voight, 2008). Stress can be defined as "an imbalance in physiological and psychological systems that activate physiological and behavioural responses to restore balance" (Buckworth & Dishman, 2002:75).

Stress that is often experienced by officials includes, making mental, physical or performance related errors, as well as environmental conditions (crowd behaviour, noise, coaches and managers) (Anshel & Weinberg, 1999). The stress experienced by sport officials could have a significant impact on the officials‟ mental health, attention focus, concentration, effort, arousal, performance, satisfaction with their profession and intention to quit officiating (Taylor *et al*., 1990; Goldsmith & Williams, 1992; Gencay, 2009). Due to the negative consequences of stress, some researchers have investigated the stressors among sport officials (Balch & Scott, 2007). Findings from the preceding studies indicated that sport officials often experience various forms of acute (short-term, time-limited) stress during games. The intensity of the acute stress might vary as a function of age and culture. The inability to effectively deal with acute stress can be detrimental to both the performance and personal satisfaction of sport participants (Kaissidis-Rodafinos & Anshel, 2000). Although the abovementioned research was conducted on sport participants, the same negative consequences of acute stress are expected from soccer officials.

A few studies utilising similar questionnaires on soccer, volleyball and basketball officials, identified verbal abuse, fear of failure and mistakes, time pressures, fear of physical abuse, intrapersonal and peer conflicts, role conflicts and game pressure as potential stressors (Taylor & Daniel, 1987; Goldsmith & Williams, 1992; Rainey, 1995). In their study of basketball officials, Anshel and Weinberg (1995) found that making wrong calls, verbal abuse by coaches, threats of physical abuse and being in the wrong position on the court were the top four stressors. A study on Turkish basketball referees identified problems working with a partner, making a wrong call, threats of physical abuse, experiencing pain or injury and verbal abuse as the top five stressors (Ekmekci, 2008). These stressors were divided into two categories, namely „stressors relevant to performance‟ and „stressors related to the presence of others‟. Interviews and document analysis were also used to determine existing stress, which revealed a lack of motivation, lack of experience, personal insufficiency, level of personal improvement and fear

of making a wrong call, as the five top sources of existing stress (Ekmekci, 2008). No study could be traced regarding the stressors experienced by South African soccer officials.

The purpose of this study, therefore, was to determine the acute stressors experienced by South African soccer officials. The results of this study would alert mental skills trainers to the perceived sources of acute stress by soccer officials, which could lead to the development and application of appropriate stress management intervention programmes or techniques. In addition, assessing these stressors could be an important aspect in identifying and treating officials, who might be at the risk of negative consequences of excessive stress (Goldsmith & Williams, 1992).

METHODS

Participants

Forty-two (42) South African Football Association (SAFA) accredited officials, attending a training camp at the High Performance Institute in Potchefstroom, South Africa, participated in this study. The group comprised of 40 male and 2 female officials. The average age of the officials was 37.52 (±6.09) years, and the period of being a SAFA accredited official, ranged from 2 to 27 (M=10.55±5.54) years.

Procedure

A mental skills trainer administered a single questionnaire to the officials attending a mental skills training workshop. This was done in a classroom setting, before the start of the workshop. Detailed instructions appeared on the front cover of the questionnaire, which required their demographic information (name, surname, age, gender, referee or assistant referee, years of service as soccer official, and accredited years as a SAFA official). The officials were ensured about the confidentiality of the results. They provided permission that their responses may be used for research purposes. The officials were free to discontinue their participation at any stage of the study.

Questionnaire

The Ontario Soccer Officials" Survey (OSOS) of Taylor *et al*. (1990) was used to determine the perceived levels of stress by the officials. The questionnaire consisted of 30 items, which contribute to one of the following seven subscales: role-culture conflict, fear of failure, interpersonal conflict, time pressures, fitness concerns, peer conflicts and fear of physical harm. The questions were ordered randomly.

The subjects were requested to indicate how much each situation would contribute to their stress levels on a 4-point Likert scale ranging from 0 to 3. A score of 0 indicates no contribution to the stress experienced, while a score of 1, 2 or 3 respectively indicates mild, moderate and strong contribution to the level of stress experienced by the official. Cronbach alpha reliability coefficients ranged from 0.65 to 0.88 for the seven subscales (Taylor, 1989; Taylor *et al*., 1990). Construct validity has been supported and significant relationships between scores on the OSOS and the hypothesized outcomes of burnout, satisfaction, intentions to quit, and actual turnover have been reported. The low to moderate correlations between stressor scales suggest independent constructs (Taylor, 1989; Taylor *et al*., 1990).

Statistical analysis

The Statistical Consultation Services of the North-West University determined the statistical methods and procedures for the analysis of the research data. All of the Cronbach alpha coefficients were approximately 0.7 or higher, except for role-culture conflict, which obtained a value of 0.55. Although Schmitt (1996:350) indicated that "even relatively low (e.g. 0.50) level of criterion reliability does not seriously attenuate validity coefficients", interpretation of this score should be done with caution. Item number 14 ("Players of coaches who protest decisions when they do not understand the laws of the game") was removed from the factor scale role-culture conflict. With item 14 included in the factor scale the Cronbach alpha coefficient was 0.49. After removing item 14, the Cronbach alpha coefficient increased to 0.55. Due to the few items per scale (less than 10 items) the mean inter-item correlation was also reported as a measure of internal reliability. Clark and Watson (1995) recommend an optimal range for the inter-item correlation of 0.15 to 0.55.

Descriptive statistics (mean, SD, minimum, maximum) for the factor scales were calculated using the Statistical Package for Social Sciences (SPSS) for Windows (Version 15.1). The

contribution of the stressors to the level of stress experienced by the official was determined by means of the mean value; the higher the mean, the stronger the contribution of the stressors to the level of stress experienced by the official. The relationship between the demographic information and the amount of stressors an official had experienced was investigated using Spearman Rank Order Correlation Coefficients. Thereafter frequencies were used to determine how many of the officials exhibited 0, 1 to 2, 3 to 4 or 5 to 7 of the stressors. Lastly, cross tabulation was used to determine the relationship between the risk categories and the years as a SAFA accredited official. Cut-off points were set at 25 and 75% respectively, which resulted in 3 groups, namely the low experience group (<7 years), average experience group (7 to 12 years) and the high experience group (>12 years).

RESULTS

The results of this study are presented in Tables 1-4.

TABLE 1: **DESCRIPTIVE STATISTICS AND INTERNAL CONSISTENCY FOR DEMOGRAPHIC VARIABLES AND SELECTED STRESSOR SCALES**

Variables	Rating	Min	Max	Mean	SD	Cronbach alpha's coeff.	Mean Inter-Item correlation
Age		23	46	37.52	6.09	N/A	N/A
Years as official		6	31	16.10	6.88	N/A	N/A
Years SAFA accredited official		2	27	10.55	5.54	N/A	N/A
Fitness concerns	1	0	3	2.02	0.76	0.67	0.41
Role-culture conflict	2	0	3	1.82	0.86	0.55	0.24
Fear of failure	3	0	3	1.73	0.72	0.85	0.48
Peer conflicts	4	0	3	1.57	0.88	0.81	0.52
Interpersonal conflict	5	0	3	1.37	0.75	0.74	0.48
Time pressures	6	0	3	1.28	0.85	0.79	0.49

Fear of physical harm	7	0	3	1.23	0.91	0.83	0.50

TABLE 2: **SPEARMAN RANK ORDER CORRELATION BETWEEN AMOUNT OF STRESSORS AND DEMOGRAPHIC INFORMATION**

Demographic information	Risks	
	Correlation coefficient	p-Value
Age	0.03	0.85
Years as official	0.19	0.23
Years as SAFA accredited official	0.37	0.02*

* $p \leq 0.05$ (2-tailed)

TABLE 3: **FREQUENCY OF STRESSORS EXPERIENCED BY SOCCER OFFICIALS**

Stressors	Frequency	Percentage
0	12	28.6
1-2	15	35.7
3-4	10	23.8
5-7	5	11.9
Total	42	100.0

TABLE 4: **RISK CATEGORIES AND YEARS AS A SAFA ACCREDITED OFFICIAL**

		Years as a SAFA accredited official							
Risk categories	Stressors	Low (<7)		Average (7-12)		High (>12)		Total	
		Count	%*	Count	%*	Count	%*	Count	%*
0	0	3	25.0	7	58.3	2	16.7	12	100.0
1	1-2	4	26.7	11	73.3	0	0	15	100.0
2	3-4	1	10.0	5	50.0	4	40.0	10	100.0
3	5-7	0	0	2	40.0	3	60.0	5	100.0
	Total	8	19.0	25	59.5	9	21.4	42	100.0

Based on the results in Table 1, it is clear that the internal reliability of all the subscales were acceptable. Fitness concerns (M=2.02) were rated as the highest contributor to the stress experienced by officials, followed by role-culture conflicts (M=1.82), fear of failure (M=1.73), peer conflicts (M=1.57), interpersonal conflict (M=1.37), time pressures (M=1.28) and lastly, fear of physical harm (M=1.23). From Table 2 it seems that the longer an official was officiating

as a SAFA accredited official, the higher the perceived level of stress. In Table 3 the majority (35.7%) of officials indicated that 1 or 2 stressors had a great contribution to the total level of the stress, which they experienced. Table 4 indicates that 60% of the officials, who served as an accredited official for longer than 12 years, fell in the third risk category, that, is they experienced 5 to 7 stressors that contributed to the total perceived level of stress.

DISCUSSION

Soccer is the most popular sport worldwide and attracts both the greatest number of participants, as well as spectators. In South Africa, soccer is also one of the most popular sports together with rugby and cricket. Soccer matches are intensely followed, as is demonstrated by the 3.18 million fans, who attended the 64 matches during the 2010 Soccer World Cup held in South Africa (FIFA, 2010). In addition to the worldwide popularity of soccer, another phenomenon, called „football hooliganism" added to the rationale for this study. Football hooliganism includes forms of verbal and physical violence against players, match officials, as well as spectators. It also includes vandalising club and private property (Dunning, 2000). Despite the popularity of soccer and a large amount of research conducted on soccer, only two studies could be traced reporting stress experienced by soccer officials.

The purpose of this study was to examine the levels of stress experienced by South African soccer officials regarding some selected stressors as suggested by the OSOS (Taylor *et al*., 1990). In contrast to previous studies, this study revealed that fitness concerns contribute most to the total level of stress experienced by these officials. During a soccer match, it is the responsibility of the official to implement the rules of the game and to ascertain that players abide by these rules. This implies that the officials have to keep up with the play and be in a good position to judge any offence on the field (Reilly & Gregson, 2006). Therefore, inadequate fitness will prohibit officials from keeping up with the play and will consequently cause stress.

Various studies have identified role conflict as a source of stress amongst officials (Taylor & Daniel, 1987; Goldsmith & Williams, 1992; Rainey, 1995). Taylor (1989) points out that in a „win-at-all-cost" oriented society, the official may be constantly involved in a role-culture conflict, especially since an official"s integrity is often questioned by players, coaches and the crowd, usually in an attempt to have decisions changed in their favour. Officials experience immediate, unrestrained negative feedback throughout and after a match (Wolfson & Neave, 2007) and are often targets of unruly crowds, agitated coaches and aggressive players (Weinberg & Richardson, 1990). Winning teams rarely mention the quality of officiating, while losing teams or players often blame at least part of the loss on the referee (Constable, 1996). The findings of the current research support those of these previous studies. Role- culture conflict was found to be a source of stress among the South African officials.

Weinberg and Richardson (1990) stated that fear of failure is at the core of most officials" anxiety. In the context of this study, fear of failure includes refereeing an aggressive game, having a „bad" game, handling a critical game for one or either team(s), facing critical decisions during a game, maintaining concentration during a strenuous game and fear of making „bad" calls. In support of the findings of this study, various other studies on soccer, volleyball and basketball also identified fear of failure as a source of stress among the officials (Taylor & Daniel, 1987; Goldsmith & Williams, 1992; Rainey, 1995).

Peer conflict can be a major source of stress for people who are regarded as authority figures

(Constable, 1996). According to Constable (1996), officials have very few people that they

trust and the idea of having unpleasant relationships with one‟s peers must be extremely stressful for individuals who find themselves in such a situation. The results of this study support previous research findings (Taylor & Daniel, 1987; Goldsmith & Williams, 1992; Rainey, 1995), keeping in mind that officials identified peer conflicts as the fourth most important source of stress.

Intrapersonal conflicts such as dealing with over excited or hostile coaches, personality clashes with players or coaches, as well as personality clashes with club officials or spectators were identified as the fifth most important source of stress among the soccer officials. Previous studies on officials from different sport codes found intrapersonal conflict to be a source of stress (Taylor & Daniel, 1987; Goldsmith & Williams, 1992; Rainey, 1995; Haralambos *et al*., 2005), which substantiates the results of the present study.

Time pressures are stressors that evolve over a period of time as officials attempt to cope with refereeing, which takes them away from their families, friends and jobs (Constable, 1996). As in previous studies (Taylor & Daniel, 1987; Goldsmith & Williams, 1992; Rainey, 1995; Constable, 1996), time pressures were found to be a source of stress among the soccer officials.

Soccer officials identified spectators, players, coaches, trainers and other administrators as sources of aggression (Folkesson *et al*., 2002). There are recorded cases of players and coaches physically assaulting officials, throwing equipment at officials and yelling and screaming at them (Balch & Scott, 2007). In April 2002, two referees were attacked by players in separate incidents in Africa, when a team mate was sent off and a goal disallowed (Wolfson & Neave, 2007). It is interesting to note that the South African soccer officials identified fear of physical harm as the least important source of stress.

From the above-mentioned discussion, it is clear that South African soccer officials experience similar stressors as officials mentioned in previous studies, although the order prevalence differs. Fitness concerns were rated as the highest contributor to the stress experienced by South African officials, followed by role-culture conflicts, fear of failure, peer conflicts, interpersonal conflict, time pressures and lastly, fear of physical harm. In a study of Taylor *et al*. (1990) on Canadian soccer officials, fear of failure was rated as the highest contributor to the stress they experienced followed by role-culture conflicts, time pressures, interpersonal conflict, peer conflicts, fitness concerns and lastly, fear of physical harm.

It is clear that the major differences in the two country‟s ranked order of the stressors were regarding fitness concerns and time pressure. The reason for South African officials rating fitness concerns as the highest contributor to the stress they experience might by attributed to the emphasis FIFA places on the importance of a referees‟ physical fitness. Three top South African referees failed a Confederation of African Football fitness test and were consequently suspended from officiating locally, as well as internationally (Kwenaite, 2011). It is, therefore, clear that not being physically fit might have severe consequences for a referee‟s officiating career, an issue that is regarded as very serious by South African officials.

Concerning time pressures, the Canadian officials ranked the stressor third while the South African officials ranked the same stressor sixth. Taylor and Daniel (1987) found that 44.9% of the 215 officials in their study spent between 13 to 18 hours a week officiating. According to Adeel Carelse, match commissioner for the South African Football Association (SAFA), South African officials called to officiate one or two matches a week, for which they need at least three hours per game (Jackson, 2011). It is clear that Canadian officials spend significantly more time officiating in comparison with their South African counterparts, which might take them away from their jobs, families and friends more frequently.

Sport officials are responsible for ensuring that the efforts of participants during a match, takes place within the rules of the game (Mathers & Brodie, 2011). During high-profile events, the responsibility of officiating has been associated with elevated levels of stress due to the large number of spectators (Petterson-Lidbom & Priks, 2010), physiological demands (Catterall *et al*., 1993), the importance of certain games (Folkesson *et al*., 2002) and hooliganism (Dunning, 2000). Table 2 indicates a correlation between the years accredited as a SAFA official and the level of stress experienced by the officials. To further support the above results, Table 4 indicates that 60% of the officials, who served as an accredited SAFA official for longer than 12 years, experienced 5 to 7 stressors that contribute to the total level of stress they perceived, while only 16.7% of the officials, who served less than 7 years experienced 5 to 7 stressors. This may be attributed to the fact that more experienced officials will be used to referee high-profile games and thus may lead to elevated levels of stress among the more experienced officials.

CONCLUSION

Based on the results of this study, it is evident that South African soccer officials experience similar stressors as officials mentioned in previous studies, although the order may differ. The majority of officials indicated that 1 or 2 stressors had a great contribution to the total level of stress they experienced. An interesting finding was that 60% of the officials who served as an accredited official for longer than 12 years, experienced 5 to 7 stressors that contribute to the total level of stress they experienced placing them in the high risk. The results of this study could be used to alert management about the perceived stress experienced by the officials while doing their job.

Coaches and players need to be informed of the results of such studies in order to dispel ignorance and improve understanding with regard to the various stressors experienced by officials. The ongoing provision of education, continuous evaluation and follow-up, is needed to improve officials‟ quality of officiating and quality of life, as well as to reduce their stress. This would lead to greater enjoyment in being a referee. Early identification of officials who might be at risk to the negative consequences of high stress is important in order to ensure effective interventions to reduce stress factors and increase coping skills. Future research is needed to investigate the coping styles used by South African soccer officials, as well as to apply and evaluate preventive mental skills training programmes to assist officials in dealing more effectively with the stressors experienced before, during and after matches.

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WHY DO FANS ATTEND WORLD WRESTLING ENTERTAINMENT?

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ABSTRACT

This research examined the travel motives of South African World Wrestling Entertainment (WWE) fans at a live Smackdown event in July 2011, which was part of the WWE's world tour. Based on these motives, different market segments at the events were identified and profiled. This was the first time that the motives of WWE fans in

this country were identified and compared to previous research. A total of 450 questionnaires were distributed, of which 414 were completed and included in the analysis. The results showed that WWE fans in South Africa are motivated by four reasons: Unique experience and entertainment, Socialisation, Wrestling enjoyment and Known-group affiliation and novelty. Based on these motives, three distinct clusters of fans were identified: Recreational fans, Avid fans and Aficionados. The travel motives and behavioural characteristics of these fans differ significantly and results showed that WWE fans are a heterogeneous market. Therefore, marketing campaigns directed at these fans should be designed according to their individual needs and preferences in order to sustain the WWE's success and popularity in South Africa.

Key words: World Wrestling Entertainment; Fans; Motives; Sport entertainment; South Africa.

INTRODUCTION AND LITERATURE REVIEW

Amateur wrestling, as a sport, is probably one of the oldest athletic competitions in history and has a very rich heritage dating back to before Ancient Rome (Ashley *et al*., 2000; Waxmonksy & Beresin, 2001). Amateur wrestling was an honoured sport during the Greek and Roman periods, while in the early 19th century different European countries developed wrestling styles unique to their region (Ashley *et al*., 2000). In later years, wrestlers who participated in amateur competitions would often take part in paid matches, as part of wrestling shows, which led to professional wrestling becoming a distinct and separate entity from amateur wrestling (McQuarrie, 2006). Professional wrestling dates back to the carnival circuits of the 1920s, where wrestlers would perform in front of local audiences (Waxmonsky & Beresin, 2001). According to Smith (2008), professional wrestling is a passionate re- enactment of a violent fight between good and evil. The performers‟ objective is not to win the match but rather to attain a strong emotional connection with the audience. Although largely discounted as a legitimate sport (Jones, 2001; Atkinson, 2002), professional wrestling is a form of popular culture entertainment that is at least conceptually comparable to professional sport, such as football, hockey and soccer (Atkinson, 2002).

The World Wrestling Entertainment (WWE), formerly the World Wrestling Federation (WWF), is an integrated media and entertainment company based in Stamford, Connecticut (McQuarrie, 2006). The WWE is often referred to as "fake", "a sports opera", "a soap opera for men", "a melodrama where story twists and turns occur abundantly" and "a live action movie with wrestlers playing dual roles as leads and stuntmen" (Jenkins, 1997:65; Mazer, 1998:3; Ebinger, 1999; Sehmby, 2002:6). However, whether „sport‟ or „entertainment‟, this debate is irrelevant for many wrestling fans (Jones, 2001). The WWE is a multi-million dollar enterprise (Ashley *et al*., 2000), has an international fan base (Rosellini, 1999; Atkinson, 2002; Deeter-Schmeltz & Sojka, 2004; McQuarrie, 2006), is broadcast in over 162 countries, is translated into 11 different languages and draws more than 500 million regular viewers (Campbell, 1996; Rosellini, 1999; Media and Entertainment Industry WWE, 2002). The WWE‟s flagship showing Raw and Smackdown are extremely popular television shows that consistently rank among the most popular weekly television ratings (Ashley *et al*., 2000; Burke, 2001). Smackdown was the second-highest rated network television show, while Raw is ranked as the most watched cable television programme in the United States, viewed by five million households weekly (DeVine, 2000; Burke, 2001; McQuarrie, 2006). Spin-off products, which include t-shirts, video games,

books, toys and CDs, all attest to fan loyalty (Deeter-Schmeltz & Sojka, 2004).

However, what makes WWE of interest to consumer researchers is not its size and popularity, but rather the cohesive nature of its fan base (Deeter-Schmeltz & Sojka, 2004). WWE fans appear to be avid, involved and loyal even though „pure" sports fans denounce wrestling, claiming it is entertainment and not a „real" sport (Ashley *et al*., 2000). Nobody is really fooled into being a WWE fan; "most fans, from grade school up, know that the winner is predetermined and that the physical combat is at least partially embellished" (Waxmonsky & Beresin, 2001:127). WWE"s appeal comes from its stories rather than its pseudo athletes (Waxmonsky & Beresin, 2001). Fans consider the tension between the forces of good and evil, explore various interpretations for concepts, such as justice, fairness and patriotism, and create their own endings for mythic struggles (Burke, 2001).

The WWE is popular as both a television programme and a live event to which fans go to participate as both spectators and performers (Pratten, 2003; Ford, 2007). Wrestling demands viewers situate themselves as legitimate sport spectators (Sehmby, 2002). As Ford (2007:30) explains, "the pro-wrestling is unique as a massively popular live fictional performance that invites the audience to participate directly with the text; in fact, without audience participation, the text of pro-wrestling performance cannot be completed". At live events, fans have an active and vocal role in the show, and their behaviours include chanting along the name of favoured wrestlers, booing the antagonists and bringing the shows alive with
„audience heat", which is a term used by people in the wrestling industry to describe the fact that the most vocal audiences lead to the most impressive shows (Ford, 2007). Due to the unique nature of these live events, WWE events consistently rank among the top-grossing, pay-per-view events and sell out on almost every world tour (Pratten, 2003).

Burke (2001) suggests that a deeper understanding of spectator motives is required in order to begin to understand the popularity of televised and live professional wrestling events.

Therefore, what is it that makes WWE so popular among the public, or in other words what motivates fans to attend these live events? Are WWE fans in, for example, Indonesia, India, Australia and South Africa motivated by similar values? Research is needed to determine if motives to watch and support the WWE transcend national boundaries, and if so how they are affected by different core cultural values (Burke, 2001; Deeter-Schmeltz & Sojka, 2004). Ashley *et al*. (2000) add that given the amount of money spent in the sport industry each year and the popularity of televised sport, it has become common to characterise sport as entertainment. Mullin *et al*. (2000:378) agree and find that all of those involved in the sport industry could claim that they "are providing entertainment and escape for the everyday people of the world". However, professional wrestling is able to heighten this entertainment by manipulating some of its components, such as the format and the players, to add a greater appeal to the audiences (Pratten, 2003). Public reactions to events can be judged very quickly as events modified to please the viewers and as characters changed to suit the story lines. All this contributes to the success of what is now openly described as sport entertainment. It is the result of recognising the key components that attract the fans and developing each facet of a particular sport to its fullest level (Pratten, 2003). Professional wrestling is a commercially successful business and industry that has marketed itself most effectively and its success is the result of careful analysis of what the public enjoys, and more specifically, what motivates them to watch and attend wrestling matches (Pratten, 2003).

A motivation is often viewed as an internal factor that directs and integrates an individual‟s behaviour (Park *et al*., 2008). In other words, a motive is a need that is sufficiently stimulated to move an individual to pursue satisfaction, since an unsatisfied need might cause disappointment, dissatisfaction and feelings of disequilibrium (Park *et al*., 2008). Wrestling fans, therefore, choose an event to satisfy their internal needs (Crompton & McKay, 1997). Motivation is a dynamic concept that may vary from one person (fan) to another, from one market segment to another, from one event to another, as well as from one decision-making process to the next (Uysal *et al*., 1993). Marketers should therefore have knowledge of the needs that visitors (fans) are seeking to satisfy (Park *et al*., 2008). Furthermore, as Fodness (1994) warns, effective marketing is impossible without identifying, understanding and prioritising visitors‟ (fans‟) motivations.

In marketing sport or entertainment, the fans‟ perception of the event is very important (Ashley *et al*., 2000; Ford, 2007). Understanding different spectator motives can be of significant benefit to the sport marketer and organiser looking to increase revenue and ticket sales (Wann *et al*., 2008). Of particular interest, for both the marketing manager and event organiser, is to understand the specific motives that drive a spectator or fan to consume sport (Bernthal & Graham, 2003) and the subsequent development of marketing communications based on these motives (McDonald *et al*., 2002). These effective marketing communication plans can often help build groups of „die-hard‟ fans, thus expanding the customer base for a sport (Pease & Zhang, 2001). Spectator and fan motivation could be used as an effective psychographic segmentation method that can result in more effective marketing campaigns (Wann *et al.*, 2008). Furthermore, a comprehensive marketing model that includes motivation and other important spectator and fan variables, such as identification or loyalty, can be very useful in marketing a team or sport (Trail & James, 2001; Trail *et al*., 2003).

Specifically with regard to the WWE, identifying the motives of fans can play a crucial role in the success and popularity of the show. Although already successful in marketing WWE- related products, information on the motives and values of its fans would allow marketers to effectively target a large market via promotions that illustrate how products coordinate with these values (Deeter-Schmeltz & Sojka, 2004). The size and accessibility through its media outlets (magazines, pay-per-view television and regular television shows) of WWE fans make them an attractive target market (Deeter-Schmeltz & Sojka, 2004).

Previous research has focused on the demographic composition of wrestling audiences (Griffin, 1937; Bogardus, 1952; Ball, 1990); the effects of watching wrestling matches on the aggression levels of viewers (Kingsmore, 1970; Arms *et al*., 1979, Russel *et al*., 1988; Williams, 2002; Tamborini *et al*., 2005); the views of children when watching and discussing wrestling (Lemish, 1999; Nichols, 2001; Durant *et al*., 2001; Strand, 2002; Bernthal, 2003; Oppliger, 2003); and the observations of wrestlers at wrestling matches (Winningham, 1972; Freedman, 1988; Williams, 1989; Berger, 1990; Turko, 1991).

Various studies have been conducted into the motives of WWE fans, but they have focused mainly on fans in the United States (US). Saunders (1998) identified several types of wrestling fans in the US: nostalgic fans who watch wrestling because of their love of it as children; fans who attend events as an activity the whole family enjoys; fans who enjoy observing violence; fans who enjoy wrestling for the spectacle/fantasy; and fans who enjoy wrestling for athletic

exhibition. Feigenbaum (2000), on the other hand, identified US wrestling fans on a spectrum running from those who believe the event is real to those long- time fans who have extensive knowledge of the wrestling production and its history.

Ashley *et al.* (2000) found that wrestling fans at the World Championship Wrestling (WCW) event held in Texas, were serious about their sport and motivated to watch because it is fun and entertaining. Most fans were introduced to wrestling by their families and consider wrestling as fun for the whole family. They are loyal to professional wrestling and support it financially and emotionally. They consume wrestling by attending matches, watching it on television, ordering pay-per-views and buying videos and other wrestling-related products. The findings by Ashley *et al.* (2000) refute the argument that the majority of wrestling fans are uneducated and mostly low income with little disposable income.

Burke (2001) found that television viewers of the WWE in the US truly enjoy wrestling and their motivation for watching is group affiliation. These fans also suggested that professional wrestling narratives are unlike other television fare offered. Deeter-Schmeltz and Sojka (2004) found that WWE fans in mid-Western cities in the US are motivated to watch the WWE because they experience the values of belonging, self-respect and fun/enjoyment/ excitement, while James and Ross (2004) concluded that wrestling fans were mainly motivated by eustress (drama), self-esteem (achievement) and family togetherness. Ford (2007) identified the following motives of wrestling fans at wrestling events in Kentucky, Indiana, Tennessee, Georgia, Massachusetts and Toronto, US: they enjoy the athletic abilities, love the characters, a loved one asked them to come along, they wanted to be pro- wrestlers themselves, and the wrestling arena was a place to meet up with other fans they

knew. When asked to describe their experience at wrestling shows, fans identified the shows as „entertaining" and „unpredictable", relating specifically to the plot of the particular matches. Furthermore, fans engage in the text as a spectator because they want to be told a story, to be entertained and surprised. Investigating the motives of college students located in the Mid-South and South, Wann *et al.* (2008) found that wrestling fans were motivated by escape, eustress, group affiliation, entertainment and aesthetics.

The afore-mentioned studies collectively show that WWE fans in the US are mainly motivated by eustress, entertainment, group affiliation and family togetherness. However, no studies have attempted to identify the motives of WWE fans outside the US. This research would thus contribute to the literature about the motives of WWE fans from different countries, and the similarity between South African and US fans" motives. The research could provide WWE organisers and marketers with valuable information that could be used to market their live events to different markets in different countries, according to their distinctive needs and preferences. This will ultimately lead to a greater fan base, sold-out shows and increased fan loyalty.

The purpose of this research was to attempt to provide possible answers to the above- mentioned questions by analysing the travel motives of South African WWE fans at a live Smackdown event during the WWE tour to the country in July 2011, as part of a world tour. Based on these motives, it would be possible to identify and profile different market segments at the event. This is the first time that motives of WWE fans in this country will be identified and compared to previous research.

RESEARCH METHOD

As this was a quantitative research study, a structured questionnaire was used to collect the data. This section describes the questionnaire, the sampling method and survey, and the statistical analysis conducted.

Questionnaire

The questionnaire was divided into three sections. Section A, captured demographic details (gender, home language, age, occupation, home province, country of origin, level of education, marital status and when the decision was made to attend the event) and spending behaviour (number of persons paid for, length of stay and expenditure). Section B, captured motivational factors, measuring 26 items on a 5-point Likert scale, from 1= „not important at all" to 5= „extremely important". The motivational statements included in this section were based on the work of Ashley *et al.* (2000), Burke (2001), Deeter-Schmeltz and Sojka (2004), James and Ross (2004) and Wann *et al*. (2008). In this section, information was also requested specific to visitors" behaviour during the event (preferred accommodation, initiator of attendance, times attended, mode of transport, media sources), as well as their wrestling show preferences. Section C, captured respondents" preferred leisure activities, sport participation and personality type. For the purpose of this research, information from all three sections was used.

Sampling method and survey

To undertake this destination-based survey, questionnaires were distributed at the WWE"s Smackdown World Tour event held at the Coca Cola Dome in Johannesburg on 9 July 2011. The venue is divided into blocks, which determine the value of the different tickets purchased. For example, seats near the ring are more expensive than those further from the ring. Therefore, a stratified sampling method was used, within which a simple random sampling method was used in order to limit bias: the trained fieldworkers followed specific guidelines, handing out questionnaires to different non-homogeneous age groups, gender groups and ticket holders. Questionnaires were distributed to all visitors who were willing to participate before the event, while they were sitting and waiting in and outside the venue. Fieldworkers approached the respondents and explained the goal of the survey and the questionnaire to ensure that visitors participated willingly and responded openly and honestly. A total of 450 questionnaires were distributed and 414 completed questionnaires were administered. In a population of 25 000 (N), 394 respondents (n) would be seen as representative and result in a 95% level of confidence with a ±5% sampling error (Israel, 2009). Therefore, since approximately 20 000 visitors attended the event in Johannesburg, the number of completed questionnaires (n = 414) was more than adequate.

Statistical analysis

The data was captured using Microsoft© Excel© and analysed using Statistical Package for Social Sciences (SPSS) (SPSS, 2011). The analysis was done in three stages: a factor analysis; a cluster analysis; and an analysis of significant differences between motivational clusters of fans at the WWE event.

Firstly, a principal axis factor analysis, using an Oblimin rotation with Kaiser normalisation, was

performed on the 26 motivation items, to explain the variance-covariance structure of a set of variables through a few linear combinations of these variables. The Kaiser-Meyer- Olkin measure of sampling adequacy was used to determine whether the covariance matrix was suitable for factor analysis. Kaiser‟s criteria for the extraction of all factors with eigenvalues larger than one were used because they were considered to explain a significant amount of variation in the data. All items with a factor loading greater than 0.3 were considered as contributing to a factor, and all items with loadings less than 0.3 as not correlating significantly with this factor (Steyn, 2000). Any item that cross-loaded on 2 factors both with factor loadings greater than 0.3, was categorised in the factor where interpretability was best. A reliability coefficient (Cronbach‟s alpha) was computed for each factor to estimate its internal consistency. All factors with a reliability coefficient above 0.6 were considered as acceptable in this study. The average inter-item correlations were also computed as another measure of reliability. According to Clark and Watson (1995), these should lie between 0.15 and 0.55.

Secondly, a cluster analysis, using Ward‟s method with Euclidean distances, was performed on the scores of the motives to attend the event. A cluster analysis is a multivariate interdependence technique, whose primary objective is to classify objects into relatively homogeneous groups based on the set of variables considered, and is mostly an exploratory

technique (Hair *et al*., 2000). Hierarchical clustering makes no assumptions concerning the number of groups or group structure. Instead, the members are grouped together based on their natural similarity (Johnson & Wichern, 2007). This research did not take an *a priori* view of which data points should fall into which segment, rather, a hierarchical cluster analysis was used to explore the natural structure of the data, by means of Ward‟s method with Euclidean distances.

Thirdly, ANOVAs and Tukey‟s multiple comparisons, as well as two-way frequency tables and chi-square tests, were used to investigate any significant differences between the motivational clusters. The study used demographic variables (gender, home language, country of origin, age, occupation, and province of origin) and behavioural variables (length of stay, type of accommodation, transport, preferred type of music, expenditure, other events attended, initiator of attendance and when the decision to visit was made) to examine whether there were statistically significant differences between the groups.

RESULTS

This section discusses the results of the factor analysis (travel motives) and presents the results of the t-tests and cross-tabulations with chi-square tests to investigate significant differences.

Factor analysis

The pattern matrix of the principal axis factor analysis using an Oblimin rotation with Kaiser normalisation, identified four factors, which were labeled according to similar characteristics (Table 1). These factors account for 63% of the total variance. All factors had relatively high reliability coefficients, ranging from 0.77 (the lowest) to 0.94 (the highest). The average inter-item correlation coefficients of between 0.41 and 0.62 also imply internal consistency for all factors. Moreover, all items loaded on a factor had a loading greater than 0.3, and the relatively high factor loadings indicate a reasonably high correlation between the factors and their

component items. The Kaiser-Meyer-Olkin measure of sampling adequacy (0.94) indicates that patterns of correlation are relatively compact and yield distinct and reliable factors (Field, 2005). Barlett‟s test of sphericity reached statistical significance ($p<0.001$), supporting the factorability of the correlation matrix (Pallant, 2007).

Factor scores were calculated as the average of all items contributing to a specific factor in order to interpret them on the original 5-point Likert scale of measurement. As Table 1 shows, the following motives were identified: *Unique experience and entertainment* (Factor 1); *Socialisation* (Factor 2); *Wrestling enjoyment* (Factor 3); and *Known-group affiliation and novelty* (Factor 4). *Unique experience and entertainment* (Factor 1) obtained the highest mean value (4.36), was considered the most important motive for attending the event, had a reliability coefficient of 0.94 and an average inter-item correlation of 0.58. *Known-group affiliation and novelty* (Factor 4) had the second highest mean value (4.01), followed by *Wrestling enjoyment* (3.90). *Socialisation* (Factor 2) had the lowest mean value (3.06) and was rated as the least important motive for attending the WWE.

TABLE 1: **VISITORS' MOTIVES: FACTOR ANALYSIS OF WWE SHOW**

Motivation factors and questionnaire items	**Factor loading**	**Mean value**	**Reliability coefficient**	**Mean inter-item corr.**
Factor 1: Unique experience and entertainment		**4.36**	**0.94**	**0.58**
To be part of this unique and exciting event	0.81			
The event is a unique experience	0.77			
It is a once-in-a-lifetime experience	0.75			
Because I enjoy these type of events	0.75			
It is an exciting thing to do	0.75			
WWE Smackdown is a well-known international brand	0.74			
I always wanted to see WWE Smackdown wrestlers perform live	0.71			
These events are entertainment at its best	0.70			
Watching them on television made me want to see them perform live	0.64			
To have fun	0.62			
This is value for money entertainment	0.60			
To see my favourite Smackdown wrestler(s)	0.56			
Factor 2: Socialisation		**3.06**	**0.75**	**0.43**
To meet new people	0.71			
It is a sociable event	0.63			
Because I got tickets for free or as a present	0.52			
I try to attend as many of these events as possible	0.46			
Factor 3: Wrestling enjoyment		**3.90**	**0.89**	**0.62**
I enjoy the aggressiveness of the wrestlers	0.81			
I enjoy watching women wrestle	0.72			
I enjoy watching men wrestle	0.69			
I enjoy the rivalry and interaction between the wrestlers	0.67			
I enjoy watching their skills and abilities	0.42			
Factor 4: Known-group affiliation and novelty		**4.01**	**0.77**	**0.41**

For a chance to be with people who are enjoying themselves	0.58	
Because of curiosity	0.49	
To share the event with someone special	0.47	
To experience new things	0.42	
To spend time with family and friends	0.40	
Total Variance	**63%**	

Compared to previous research, as discussed in the literature review, Ashley *et al*. (2000), Ford (2007) and Wann *et al*. (2008) also identified *Entertainment* as a motive of WWE fans. Ford (2007) was the only author to identify a similar motive to *Socialisation*, finding that US fans attend a wrestling event since it is a place where they can meet up with other fans. The motive *Wrestling enjoyment* corresponds with results obtained by Saunders (1998), Ashley *et*

al. (2000), Burke (2001), Deeter-Schmeltz and Soijka (2004) and Ford (2007), while Saunders (1998), Ashley *et al*. (2000), Burke (2001), James and Ross (2004) and Wann *et al*. (2008) identified known-group affiliation or family togetherness as a motive in their respective research. *Unique experience* and *novelty* have not previously been identified as motives of WWE fans.

Results from the cluster analysis

An exploratory cluster analysis based on all cases in the data was performed on the motivational factors. A hierarchical cluster analysis, using Ward‟s method of Euclidean distances, was used to determine the clusters‟ structures. Two- and 3-cluster solutions were investigated, and the three-cluster solution was selected as the most discriminatory (Figure 1). The results of the multivariate analyses were used to identify the three clusters and to indicate that significant differences existed between them ($p<0.05$).

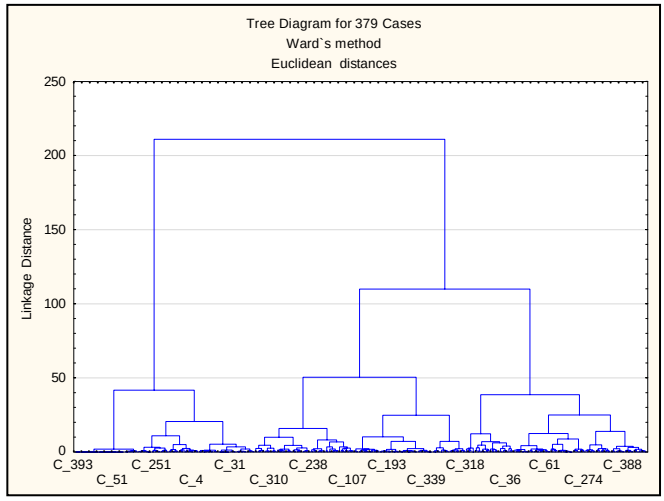

FIGURE 1: **THREE CLUSTER SOLUTION: WARD'S METHOD WITH SQUARED EUCLIDEAN DISTANCE MEASURES**

Identification of segmented clusters

As shown in Table 2, ANOVAs indicate that all 4 motivational factors contributed to differentiating between the three motivational clusters ($p<0.05$).

Cluster 1 contained 120 respondents and had the lowest mean scores across the 4 motivation factors. It was thus labelled the *Recreational fans*. The large number of respondents in this cluster could be explained by the fact that these visitors accompanied members of either Cluster 2 or Cluster 3 to the event. Cluster 2 was labelled the *Avid fans*, contained 119 respondents and had the highest means scores across all four motivational factors, implying that these fans want the complete package when they attend these types of live events. Surprisingly this cluster had the fewest respondents. Cluster 3 contained the most respondents

(140) and was especially motivated by *Unique experience and entertainment* and *Wrestling enjoyment*. This cluster was labelled the *Aficionados* since they place a higher importance on the wrestling entertainment and skills than on socialisation and novelty.

TABLE 2: **ANOVA AND TUKEY'S POST HOC MULTIPLE COMPARISONS FOR MOTIVATIONAL FACTORS IN THREE SUPPORTER CLUSTERS**

Motives to attend	Cluster 1 Recr. Fans (n=120)	Cluster 2 Avid fans (n=119)	Cluster 3 Aficionados (n=140)	F-ratio	p-Value
Unique experience and entertainment	3.58[a]	4.78[b]	4.64[b]	168.123	<0.05
Socialisation	2.37[a]	4.45[b]	3.39[a]	328.090	<0.05
Wrestling enjoyment	2.65[a]	4.59[b]	4.38[c]	336.378	<0.05
Known-group affiliation and novelty	3.43[a]	4.63[b]	3.91[c]	72.640	<0.05

* Statistically significant difference: $p \leq 0.05$
[a] Group differs significantly from type (in row) where [b] is indicated
[c] Group differs significantly from type (in row) where [a] and [b] are indicated

ANOVAs were used to determine whether significant differences existed between the 3 clusters of WWE fans based on other socio-demographic and behavioural variables.

TABLE 3: **ANOVA AND TUKEY'S POST HOC MULTIPLE COMPARISON RESULTS FOR MOTIVATIONAL FACTORS IN THREE CLUSTERS OF SUPPORTERS**

Characteristics	Cluster 1 Recr. Fans (n=120)	Cluster 2 Avid fans (n=119)	Cluster 3 Aficionados (n=140)	F-ratio	p-Value
Age	33[a]	32[a]	28[b]	10.325	0.001*
Group size	3	3	3	0.530	0.589
No. of people paid for	3	3	3	0.520	0.595
Nights in area	3	5	5	0.512	0.602
No. of tickets purchased	3	3	3	0.379	0.685
No. attend similar events	3	2	2	0.070	0.932
Spending per person[°]	R656.28	R727.62	R700.16	0.241	0.786

°Expenditure per person, which was calculated by adding the spending of the respondent on the various components asked, and dividing the total by the number of people respondents" indicated they were financially responsible for.
* Statistically significant difference: $p \leq 0.05$

[a] Group differs significantly from type (in row) where [b] is indicated.

As shown in Table 3, age was the only significant difference among the *Recreational fans*, *Avid fans* and *Aficionados* (p=0.001). *Recreational fans* and *Avid fans* were older (mean age of 33 and 32 year, respectively) than the *Aficionados*, who were the youngest visitors at the event with an average age of 28 years. Based on the other variables, there were no statistically significant differences between the 3 clusters. All 3 clusters travelled in groups of an average of 3 persons, were financially responsible for all 3 persons and purchased an average of 3

tickets. It seems that the *Avid fans* and *Aficionados* spend more nights in the area (an average of 5 nights) compared to *Recreational fans* (an average of 3 nights). However, *Recreational fans* were more inclined to attend more similar events a year (an average of 3 shows compared to 2 shows for the other 2 clusters). It is not surprising that the *Avid fans* and *Aficionados* were the higher spenders at the event (an average of R727.62 and R700.16 respectively), while the *Recreational fans* spent the least (an average of R656.28).

Cross-tabulations and chi-square test results

As Table 4 shows, there were statistically significant differences between the motivational clusters in terms of marital status (p= 0.036), level of education (p = 0.001), decision to attend (p=0.003), television (p=0.001), website (p=0.003), magazines (p=0.001) and newspapers (p=0.039) as sources of information, reasons for not attending similar events (*there were no events I was interested in*: p=0.043), Raw (p=0.026) as preferred to the WWE programme and personality type being adventurous (p=0.024). At a 10% level, word-of- mouth (p=0.066) and Facebook (p=0.089) as sources of information and Smackdown as preferred to the WWE show (p=0.077) also showed significant differences. These significant differences are discussed below.

***Marital status*:** More *Recreational* and *Avid fans* were married (57 and 51% respectively) compared to *Aficionados* who were mostly single or living together.

***Level of education*:** For *Avid fans* and *Aficionados*, matric was their highest level of education, while *Recreational fans* seem to have a higher level of education (diploma, degree).

***Decision to attend*:** More *Avid fans* and *Aficionados* made their decision to attend the event well in advance (when it was announced a year ago), while *Recreational fans* made their decision a month or two prior to the show.

***Preferred sources of information*:** More *Avid fans* and *Aficionados* heard about the event from television, the website, magazines, newspapers, word-of-mouth and Facebook, which emphasises the fact that these two markets were enthusiastic supporters and followers of the WWE storyline, watched the shows regularly and kept up to date with the latest WWE news. With the exception of television, *Recreational fans* did not make intensive use of other media sources, which could be explained by these visitors probably accompanying *Avid fans* or *Aficionados* to the event.

***Reasons for not attending similar events*:** More *Recreational fans* and *Aficionados* did not attend similar events because no events that interested them were available. It seemed that *Recreational fans* were not keen supporters of any type of event and once again stresses that these visitors just accompanied someone to the event. In the case of the *Aficionados*, this market

seemed to be serious wrestling fans and therefore most likely to attend only these types of events. *Avid fans*, on the other hand, are more likely to attend a variety of events.

TABLE 4: **CHI-SQUARE RESULTS OF VISITOR CHARACTERISTICS (N=414)**

Characteristics	**Motivational clusters**			CHI Square value	df	p-Value	PHI-value
	Cluster 1 Recr. Fans (n=120)	Cluster 2 Avid fans (n=119)	Cluster 3 Aficionados (n=140)				
Gender							
Male	74%	76%	67%	5.843	4	0.212	0.125
Female	26%	24%	33%				
Home language							
Afrikaans	45%	46%	43%	3.549	6	0.737	0.098
English	47%	42%	46%				
Other	7%	12%	11%				
Occupation							
Professional	31%	27%	28%	17.955	20	0.590	0.220
Self-employed	17%	14%	13%				
Technical	15%	11%	9%				
Sales	7%	11%	10%				
Work at mine	4%	4%	1%				
Civil service	1%	0%	1%				
Housewife	1%	3%	1%				
Pensioner	0%	0%	1%				
Student	15%	15%	22%				
Unemployed	1%	2%	3%				
Other	9%	13%	9%				
Province							
Western Cape	1%	1%	0%	23.458	20	0.267	0.249
Gauteng	78%	79%	84%				
Eastern Cape	0%	1%	0%				
North West	5%	7%	6%				
Mpumalanga	7%	0%	3%				
Northern Cape	3%	1%	0%				
KwaZulu-Natal	3%	2%	1%				
Limpopo	2%	5%	4%				
Free State	1%	3%	1%				
Outside RSA	1%	2%	1%				

TABLE 4 (cont.)

Characteristic	Cluster 1	Cluster 2	Cluster 3	CHI^2	df	p	PHI
Live closer than 30km from venue							
Yes	32%	31%	27%	1.015	2	0.602	0.052
No	68%	69%	73%				
Marital status							
Single	32%	40%	47%	16.484	8	0.036*	0.211
Married	57%	51%	38%				
Living together	8%	5%	13%				
Divorced	4%	3%	1%				
Widow/er	0%	1%	1%				
Level of educ.							
No school	3%	5%	1%	34.613	12	0.001*	0.312
Matric	27%	45%	49%				
Diploma, degree	46%	20%	25%				
Postgraduate	11%	5%	7%				
Professional	8%	12%	11%				
Other	6%	12%	8%				
Decision to attend							
Spontaneous	8%	12%	8%	23.004	8	0.003*	0.247
A month ago	24%	9%	9%				
Month+ ago	23%	18%	22%				
A year ago	39%	54%	58%				
Other	5%	7%	2%				
Initiator of attendance							
Self	34%	52%	42%	15.613	12	0.210	0.211
Friends	16%	11%	9%				
Media	1%	2%	3%				
Spouse	7%	9%	10%				
Family (kids)	35%	24%	30%				
Work	1%	0%	1%				
Boy/girlfriend	6%	2%	6%				
Preferred accommodation							
Local resident	56%	52%	55%	10.089	10	0.433	0.180
Family or friends	15%	20%	17%				
Guesthouse/B&B	8%	7%	6%				
Hotel	8%	6%	5%				
Rent full house	6%	6%	2%				
Other	6%	9%	15%				

TABLE 4 (cont.)

Characteristic	Cluster 1	Cluster 2	Cluster 3	CHI^2	df	p	PHI
Main sources of information							
Television	Yes=68%	Yes=87%;	Yes=81%	15.159	2	0.001*	0.199
Radio	Yes=27%	Yes=28%;	Yes=25%	0.254	2	0.881	0.028
Website	Yes= 8%	Yes=21%;	Yes=22%	11.567	2	0.003*	0.175
Magazines	Yes= 4%	Yes=19%;	Yes= 9%	13.358	2	0.001*	0.188

Newspapers	Yes= 4%	Yes=13%;	Yes= 9%	6.476	2	0.039*	0.131
Word-of-mouth	Yes= 6%	Yes=14%;	Yes=17%	5.427	2	0.066**	0.120
Facebook	Yes= 6%	Yes=14%;	Yes=12%	4.828	2	0.089**	0.113
Reasons not attending similar events							
Restricted money	Yes=15%	Yes=21%	Yes=15%	2.164	2	0.339	0.076
Restricted time	Yes=22%	Yes=16%	Yes=14%	3.606	2	0.165	0.098
No events interesting	Yes=31%	Yes=18%	Yes=29%	6.272	2	0.043*	0.129
Preferred wrestling programme							
Raw	Yes=69%	Yes=77%;	Yes=84%	7.311	2	0.026*	0.142
Smackdown	Yes=62%	Yes=73%;	Yes=74%	5.126	2	0.077**	0.009
Personality type							
Sociable	Yes=65%	Yes=56%;	Yes=60%	2.270	2	0.321	0.077
Outgoing	Yes=46%	Yes=50%;	Yes=47%	0.347	2	0.841	0.030
Adventurous	Yes=45%	Yes=42%;	Yes=58%	7.481	2	0.024*	0.140
Shy	Yes=14%	Yes=11%;	Yes=15%	0.994	2	0.608	0.051

** Significance = 5% level* *** Significance = 10% level*

***Preferred WWE programme*:** More *Avid fans* and *Aficionados* were avid supporters of Raw and Smackdown, compared to *Recreational fans* who watched occasionally.

***Personality type*:** More *Aficionados* described themselves as adventurous compared to *Recreational* and *Avid fans.*

There were no significant differences based on other socio-demographic and behavioural variables. All e clusters were predominantly male, either Afrikaans- or English-speaking, in a professional line of occupation (more *Aficionados* were students), local residents from Gauteng Province, live further than 30km from the venue, initiated their attendance themselves or were convinced by family (children) and described themselves as sociable and outgoing.

FINDINGS AND IMPLICATIONS

This research set out to provide possible answers to two questions pertaining to the motives of WWE fans: (1) What motivates fans to watch and attend live performances of the WWE, and (2) Do WWE fans in different countries have similar motives. In answering these questions, the results showed that WWE fans in South Africa are motivated by four reasons: *Unique experience and entertainment*; *Socialisation*; *Wrestling enjoyment*; and *Known-group affiliation and novelty*. These motives in general correspond with most of the motives identified for WWE fans in the US by Saunders (1998), Ashley *et al*. (2000), Burke (2001), Deeter-Schmeltz and Soijka (2004), James and Ross (2004), Ford (2007) and Wann *et al*. (2008). However, the grouping and combination of these motives differ significantly, for example the combined motives: *Unique experience and entertainment*; and *Known-group affiliation and novelty*. In addition, this research generated two motives: *Unique experience*; and *Novelty* that have not previously been identified. It, therefore, shows that regional or location differences do exist,

which implies that whatever is valid in one situation cannot necessarily be applied to another situation. It is clear that the WWE‟s success is based on its entertainment value. Therefore, spectator motives are significantly different to those of other sporting events.

WWE fans cannot be regarded as having homogeneous motives. Based on the travel motives, three distinct clusters of South African fans were identified: *Recreational fans*; *Avid fans*; and *Aficionados*. These clusters had significantly different motives for attending, with the *Avid fans* and *Aficionados* showing a greater interest in the „sport‟ and „entertainment‟ surrounding the WWE than *Recreational fans* who only watched the WWE occasionally and seemed to have accompanied either an *Avid fan* or *Aficionado* to the event. These clusters showed some similarities to the types of fans identified by Saunders (1998), and the differences between the clusters were not based on socio-demographic variables (with the exception of age), but rather on behavioural characteristics. These results differ significantly when compared to spectators of other sport events, as there is usually a greater combination of socio- demographic and behavioural characteristics. Once again, this can be ascribed to the entertainment phenomenon surrounding the WWE. Contrary to the stereotype surrounding WWE fans, the results support the findings by Ashley *et al*. (2000), that WWE fans are well educated in high-income occupations.

Based on the results and findings, this research has the following implications. *Recreational fans* are not committed fans of the WWE; they only watch it occasionally and, since they seem to accompany someone else to the event, watching the WWE on television is probably also unintentional. This cluster of fans is not a reliable market from an economic and sustainable point of view. However, marketers should focus their marketing efforts on the *Avid fans* and *Aficionados* markets. These fans are younger (therefore have long-term marketing potential), loyal to the WWE, serious about the sport, higher spenders and plan their attendance to these live events well in advance. In attracting these markets, the emphasis should be placed on the wrestling itself, the unique experience and entertainment surrounding the events, as well as group and family togetherness.

Since more *Avid fans* and *Aficionados* describe themselves as „adventurous‟, the „extreme‟ and „hardcore‟ nature of the WWE should also be incorporated in the marketing messages. The WWE should continue to build on their current “I was there campaign” to encourage fans to attend live events. As these events are not regular occurrences in South Africa, this campaign can further grow their South African fan base, since these fans want to feel part of the event. Based on the fans‟ preferred sources of information, marketing messages should be communicated via mass media (radio and television, especially during Raw and Smackdown), printed media (newspapers and magazines), as well as electronic media (the WWE website and social networks such as Facebook).

CONCLUSION

This research determined the travel motives of South African WWE fans attending a live wrestling event of the television programme Smackdown. Four travel motives were identified: *Unique experience and entertainment*; *Socialisation*; *Wrestling enjoyment*; and *Known-group affiliation and novelty* and, based on these motives, three distinct clusters of fans were identified: *Recreational fans*; *Avid fans*; and *Aficionados*. These fans differ significantly based on their travel motives and behavioural characteristics and results showed that WWE fans are a

heterogeneous market. For this reason, the marketing campaigns should be designed according to their individual needs and preferences. In sport entertainment, the interactive nature of the shows and live performances mean that the spectators or fans are extremely important to the sustainability of WWE‟s success and popularity.

This was the first time that WWE fans in South Africa were analysed and from this analysis several contributions were made. In particular, insight was gained in the profile of WWE fans and their travel motives in the country. According to the literature review, this is the only similar study conducted outside the USA, and the results were compared to the results of these studies. The research contributes to the field of knowledge, especially in the context of sport entertainment. Another important contribution is contextualising the important role that spectators play in sport entertainment, as without these spectators there most probably would not be a WWE.

It is recommended that further research explore the motives of fans at a live performance of Raw, since the superstars (wrestlers) and storylines differ from Smackdown. This will enhance insight into the demeanour of WWE fans. A greater understanding of sport interests of these fans would also give a greater understanding of sport entertainment versus sport in general. The motives of fans at other types of sport entertainment events, such as gladiator, dodgeball and poker tournaments, should also be analysed in order to compare results.

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EPIDEMIOLOGY OF INJURIES IN ELITE SOUTH AFRICAN NETBALL PLAYERS

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ABSTRACT

Netball places physically strenuous demands on players, such as quick acceleration, changing of direction and high jumps. Epidemiological studies provide the proof of risks for sports injuries, as well as the effects of preventative and therapeutic intervention. The objective of this research was to assess the incidence and severity of injuries in a cohort of elite South African netball players. The subjects were players (N=1280) who participated in three elite netball tournaments during the 2009 season. Team or tournament medical staff collected the injury data. A high incidence of 500.7 injuries per 1000 playing hours was reported. Most injuries occurred to the ankle joint (34%), followed by the knee (18%), fingers, hand and wrist (15%). Ligaments were the most commonly injured structures. The majority of injuries were minor. Factors associated with injuries included tournament play, previous injury, lack of core stability, neuromuscular and proprioceptive training. In order to reduce the amount of injuries to the lower extremities, it is recommended that netball players follow a structured programme to enhance core stability, neuromuscular control, and proprioception and to optimise biomechanical execution of functional movement patterns.

Key words: Netball; Epidemiology; Injury prevention; Sports injuries.

INTRODUCTION

Despite the benefits of regular physical activity, each sporting activity has an inherent risk of injury. In some instances it can lead to permanent damage (Bahr & Holme, 2003). Managers and coaches are responsible for the optimal physical and psychological preparation of athletes. The demands placed on athletes are physically and mentally challenging, and injuries occur when the physical load breaches a threshold (Van Tiggelen, 2008).

Netball has high physical requirements, such as quick acceleration, changing of direction, high jumps to receive a pass or to intercept an opponent's ball, which are only some of the requirements (Hopper & Elliott, 1993). These tasks leave the players vulnerable to injury. Most sporting activities entail a certain amount of risk of injury, even if reasonable preventative measures are put in place to prevent these injury risks. Therefore, governing bodies should be aware of the risks in sport and that steps are taken to limit these injury risks (Fuller & Drawer, 2004).

Epidemiological studies provide the evidence of risks in sport, as well as the efficacy of therapeutic intervention programmes (Fuller & Drawer, 2004). Seeing that the contents of these studies are of critical importance, it is imperative that the data presented are produced from sound methodology. When this is the case, the true risks and injury of the sporting code are reflected (Brooks & Fuller, 2006).

Decreases in injury rates can be established through pro-active initiatives (Elphinston & Hardman, 2006). Even though improved techniques to rehabilitate sports injuries are consistently developed, it may be of greater importance to prevent injuries (Bahr & Holme, 2003). Sports injuries often have detrimental long-term effects. Former elite athletes (variety of sporting codes) show greater knee abnormality and dysfunction of the lower extremities when compared to a control group (Kettunen *et al*., 2001). There is also an unacceptably high correlation between British professional soccer players who sustained acute injuries and osteoarthritis in the lower extremities (Drawer & Fuller, 2002). Therefore, monitoring, prevention and proper management of sports injuries are of great importance to athletes, the sport and the community (Bahr & Holme, 2003).

If an injury surveillance study can provide the evidence that a sport threatens the health of an athlete, the following step towards injury prevention would be to identify the risks. If the risks are identified, it is possible to implement prevention programmes to limit the risk and potential injuries to the athlete (Van Mechelen *et al*., 1992). No literature could be found that indicate the injury rates and tendencies in South African netball players. Without this link in the chain, effective limitation of risks and prevention of injuries cannot be accomplished.

The purpose of this study was firstly, to determine the epidemiology of injuries at the University Sport South Africa's (USSA) tournament, as well as the national u/19, u/21 and senior championships in 2009. The second purpose was to identify injury trends and possible associated factors at these tournaments, to compare it with available literature; and finally to make suggestions for interventions to limit the amount of injuries sustained by netball players.

METHODOLOGY

Subjects

The study population included all participants in the 2009 USSA and national u/19, u/21, and senior championships (n=1280). At each tournament teams competed in a round robin format over four to six days. The top four teams in each section played semi-final and final knockout matches to determine the winner of each tournament. Each team played one or two games per day.

Questionnaire

An injury questionnaire was used to collect data on all injuries. The questionnaire was based on one drafted by the Rugby Consensus group to monitor epidemiology of rugby injuries and was adapted for netball (Fuller *et al*., 2007). Team managers, coaches and medical staff were

instructed on how to complete the questionnaire. Completed questionnaires were collected daily. Reasonable measures were put in place to ensure that all data on injuries sustained at these tournaments were collected, in keeping with the accepted method of data collection of Hopper and Elliot (1993) and Hopper *et al*. (1995a).

Definitions

An injury was defined as any physical complaint that a player sustained during a netball match or netball training that forced the player to receive medical attention. A recurrent injury was defined as an injury of the same type and at the same site as an index injury and that occurred after a player's return to full participation from the index injury. Injury severity was determined as the number of matches the player had missed due to injury. Exposure was defined as the amount of game time (minutes) a player participated before the injury occurred. The full quarter (15 minutes) is counted in which the player's injury was sustained. These definitions are similar, but not identical to the definition of an injury, recurrent injury, injury severity and exposure time as presented in the consensus statements for epidemiological studies in rugby and football injuries (Fuller *et al*., 2006; Fuller *et al*., 2007).

Statistical analysis and interpretation of data

All data were captured in Microsoft Excel 2007. The SAS version 9.1.3 statistical software was used for the further analysis. Means and standard deviations or medians and percentiles were used for numeric data. Frequencies and percentages were calculated for categorical data. The statistical significance and/or confidence intervals were calculated to compare data with that found in the literature (alpha=0.05). The Research Ethics Committee of the University of the Free State approved the study.

RESULTS AND DISCUSSION

Incidence of injury

A total of 1280 players that participated in 447 games at the three netball tournaments were included in the study. One hundred and ninety-two (192) players sustained 205 injuries. This is

equal to 15% of players that sustained one or more injuries. The injury rate was calculated at 500.7 injuries per 1000 playing hours. The direct probability that a player could sustain an injury was calculated at 0.15 per player. Ninety-one per cent (91%) of the injuries were acute and 8.8% of the injuries were recurrent or chronic in nature. Ninety-five per cent (95%) of the injuries were sustained during matches played at these tournaments. Three per cent (3%) of injuries were sustained during warm up and 2% during a practice session. In 60.8% of the cases there was contact with another player that lead to the injury.

In a study of netball players 10 years and older (Victoria, Australia), the incidence of injuries were calculated at 9.49 injuries per 1000 players (0.0095 injuries per player), which is 17 times lower than the current results (Otago & Peak, 2007). In this study, data were collected by means of claims that were made to a medical insurance company. If data is collected in this manner, there is the potential of only serious injuries being identified and of

underreporting causing collection bias. Other studies also reported much lower injury rates of 11.3 to 14 injuries per 1000 playing hours among non-elite players over one to two seasons (Stevenson *et al*., 2000; Finch *et al*., 2002; McManus *et al*., 2006).

The current subjects were elite players who were competing in a tournament, which could have contributed to the higher injury rate. There is evidence to suggest that players in A- sections and in higher age groups, who by implication have higher levels of skill, are more susceptible to injury (Hopper & Elliot, 1993; Hopper *et al*., 1995a; Hopper *et al*., 1995b). Evidence exists that injury rates in sport are higher in tournaments than compared to games played during the course of a season (Hawkins & Fuller, 1999; Hägglund *et al*., 2003; Arnason *et al.*, 2004; Junge *et al*., 2004a; Junge *et al*., 2004b; Yoon *et al*., 2004). This, as well as the exclusion of minor injuries, can explain the low injury rate of 0.054 injuries per player found in players who were competing during the course of a 14-week season (Hopper *et al*., 1995a).

Inclusion criteria for earlier studies were that the players had to be free from any sport injuries for the past three months (Stevenson *et al.*, 2000; Finch *et al*., 2002; McManus *et al*., 2006). Previous injuries could leave an athlete vulnerable to recurrent injuries (Thacker *et al*., 1999; Murphy *et al*., 2003). The participants in the current study probably did not have sufficient time to heal from or rehabilitate previous injuries before the start of each tournament.

Two studies were found in the literature that revealed similar or higher rates of injury when compared to the current results. The probability of injury was 0.23 per player participating in the Australian netball championships, while the risk of injury was calculated at 0.14 injuries per player during the New South Wales netball championships (Hopper & Elliot, 1993; Hume & Steele, 2000). Both these studies were conducted at netball tournaments of similar age categories. The current results (0.15 injuries per player) supports the premise that higher injury rates occur at netball tournaments when compared to games played during the course of the season. It is clear that methodological differences between these studies, especially the method of collection of injury data and the definition of injury have a significant influence on the outcomes and make studies difficult to compare. Epidemiological data on sports injuries should be interpreted with this in mind.

Figure 1 illustrates the anatomical site of injuries. The ankle sustained the majority (36.1%) of injuries. This was followed by injuries to the knee joint (18.5%), wrist, hand, and fingers (16.1%), and lower leg/Achilles tendon (11.7%). Other studies also reported the highest

incidence of netball injuries to the lower extremities (Hopper & Elliot, 1993; Hopper *et al*., 1995a; Hopper *et al*., 1995b; McManus *et al*., 2006; Fong *et al*., 2007; Otago & Peak, 2007). If the injuries to the hand area are separated from each other, the fingers sustained 9.3% of the total amount of injuries, 4.9% to the wrist and 1.9% to the hand. Five per cent (5%) of all injuries were sustained to the face, 3.4% to the elbow and 2.9% to the lower back. The rest of the injuries that were sustained to the neck, ribs, shoulder, hip, groin, anterior and posterior thigh, feet and toes accounted for 0.9 to 2.4% of the total amount of injuries.

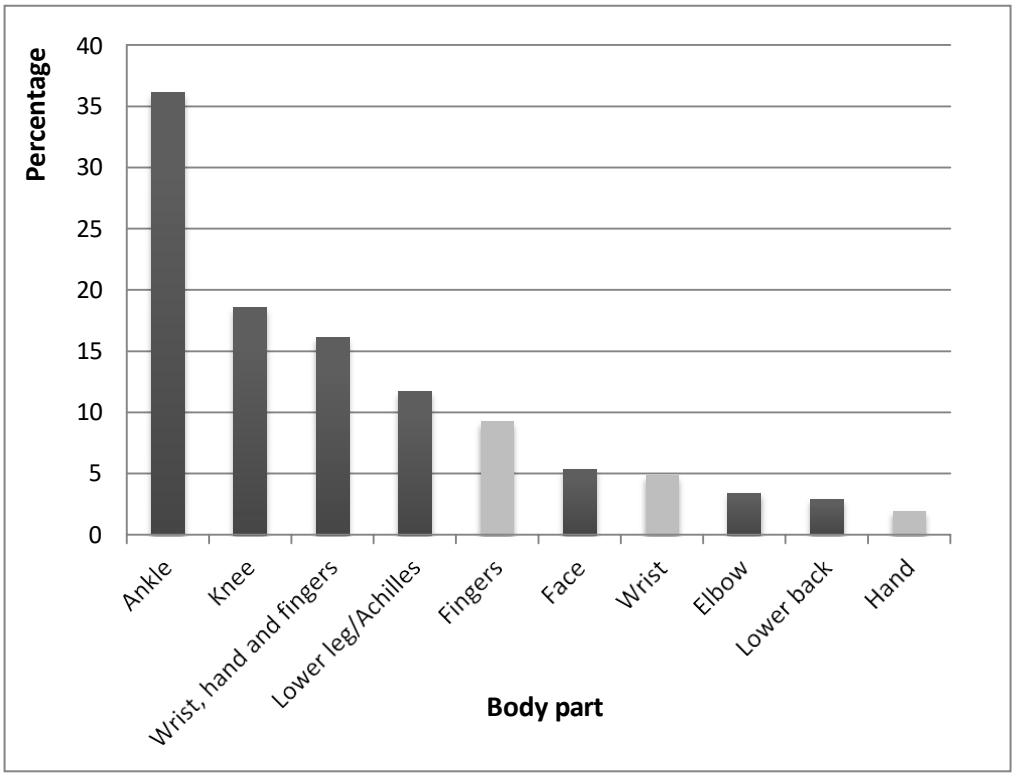

FIGURE 1: **ANATOMICAL SITE OF INJURIES IN ELITE NETBALL PLAYERS IN SOUTH AFRICA**

Figure 2 indicates the most frequently injured structures. As reported in earlier studies, ligaments were the most commonly injured structures in netball players (Hopper & Elliot, 1993; Hopper *et al*., 1995a; Hume & Steel, 2000; Finch *et al*., 2002; McManus *et al*., 2006). Ligaments were involved in 46.8% of the total injuries in this study. Bruising/haematomas were found to be the second most common injuries that were sustained (14.8%), followed by muscle (12.3%), meniscus (8.9%) and other bone injuries (5.4%). Eighty-nine per cent (89%) of ankle injuries involved the ligaments, of which 38% were to the lateral ligament complex and 4.9% to the deltoid ligament. The majority of injuries at the knee were sustained to the menisci (36.1%). Haematomas/bruising (19.4%) and lacerations (11.1%) also occurred at the knee joint. Injuries to the medial collateral ligament (2.5%), lateral collateral ligament (1.2%), anterior cruciate ligament (0.6%) and patellofemoral pain were uncommon.

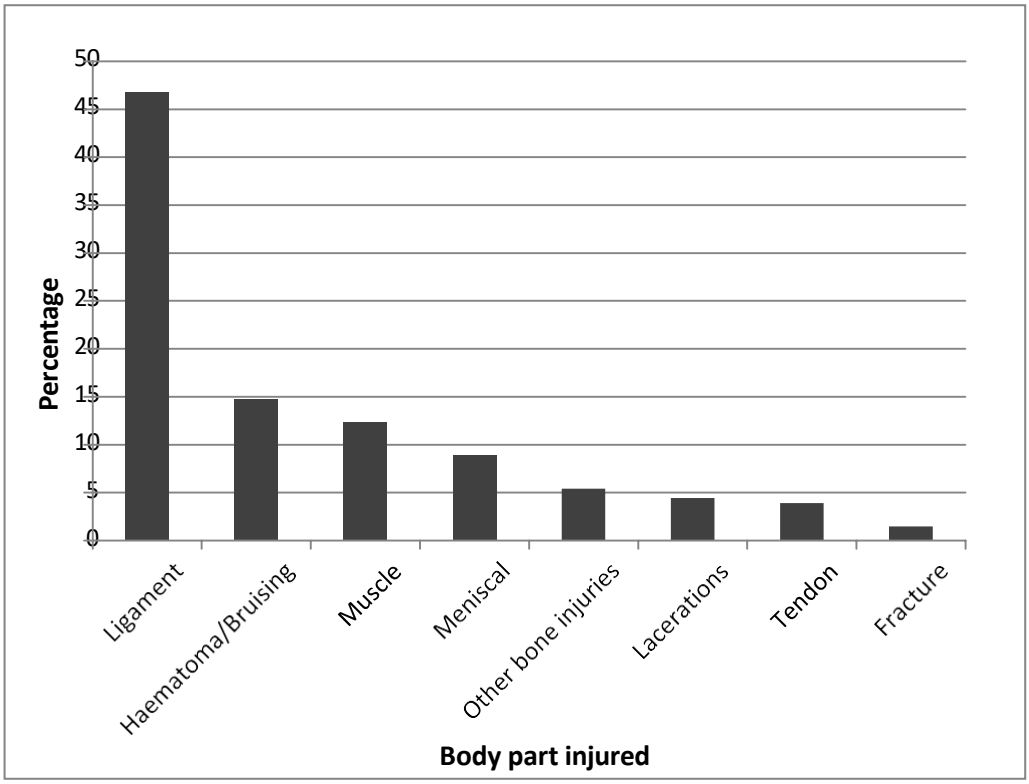

FIGURE 2: **STRUCTURES MOST FREQUENTLY INJURED DURING THE ELITE NETBALL TOURNAMENTS IN SOUTH AFRICA**

Recurrent injuries

Of the 205 injuries that occurred, 148 (72.2%) were new injuries and 57 (27.8%) were recurrent. The results show that 36 (48.7%) of the 74 ankle injuries were recurrent in nature. Recurrent injuries at the knee were only responsible for 21.1% of the knee injuries. At the lower leg/Achilles, 29% of injuries were recurrent in nature and 10.5% at the fingers.

Severity of injury

The ankle suffered the majority (41.7%) of the serious injuries, where a player was not able to compete for longer than 7 days. This is in contrast to the results of Hopper *et al*. (1995a), where a higher number of serious knee injuries were found. The majority of injuries in the current study were, however, minor in nature with 70.7% of all injured players being available for the next game. Another 11.4% missed 1 to 2 games because of injury. Two per cent (2%) of injured players missed 3 to 5 games, while 3.5% of injuries were severe enough

to keep the player out of action for 7 days. In 12.4% of cases the player could not return to play

for more than 7 days.

FIGURE 3: **TIME OF INJURY DURING GAMES**

Figure 3 indicates there was a tendency for injuries to increase in each quarter of the game, with the majority of injuries occurring in the middle 30 minutes, reaching a peak in the third quarter (26%). The final quarter showed a decrease in the amount of injuries that occurred. Players in goal defence also sustained the majority (22%) of injuries, which corresponds with findings in the limited literature, followed by injuries in players playing in the centre position (17.6%) (Hopper *et al*., 1995a). There was no significant association between the position of the player and the time of injury (r=0.1131; p-value=0.1073), which is also in accordance with the literature (Hopper *et al*., 1995a).

Exercise habits of netball players

The literature suggests that improvements in core stability can limit sports injuries, specifically knee injuries (Kibler *et al*., 2006; Zazulak *et al*., 2007a; Zazulak *et al*., 2007b). An incorrect landing technique is one of the main contributing factors in ankle and knee injuries (Hopper & Elliot, 1993; Hopper *et al*., 1995a; Hopper *et al*., 1995b; Hume & Steele, 2000). There is growing evidence that improvements in neuromuscular control (NMC) and biomechanics (improved landing technique) contribute to injury prevention (McLean *et al*., 2004; McLean *et al*., 2005; Hu *et al*., 2006; Powers, 2007).

Various authors emphasised the value of proprioceptive exercise as part of the training programme, as it has been proven to limit injuries to the lower extremities, especially to the ankle (Bahr *et al*., 1997; Wedderkopp *et al*., 1999; Stasinopoulos, 2004; Verhagen *et al*.,

2004; Emery *et al*., 2005). These are all modalities that should be incorporated in netball players' training programmes for the prevention of injuries.

CONCLUSIONS

The probability of a player being injured was 0.15 injuries per player. This is similar to other epidemiological studies that were conducted at tournaments, but higher than studies reporting on injuries sustained during the season. This is an indicator that injury rates are higher at tournaments than games played though the year. This could be due to the decrease in recovery time as teams played two games per day.

There were discrepancies in the rate of injury found in the literature, due to different methods of data collection, different netball populations, as well as different definitions of an injury and the interpretation thereof. It is recommended that the international netball governing body draft a consensus statement that standardises the methodology and definitions for future epidemiological studies, as were done for other sport codes (Orchard *et al*., 2005; Fuller *et al*., 2006; Fuller *et al*., 2007; Pluim *et al*., 2009).

A substantial amount of injuries (60.8%) occur because of contact with another player. As in soccer, colour cards can be used to warn a player against unnecessary contact. Previous injury is a known predisposing factor to injuries (McKay *et al*., 2001). Netball injuries should be properly rehabilitated before returning to play in order to reduce the high incidence of recurrent injuries. Ankle braces has been shown to be successful in limiting ankle inversion, but the ability of the braces to limit inversion cannot be equated to the prevention of ankle sprains (Masharawi *et al*., 2003). Because the players in goal defence seem to be more susceptible to injury, their defensive techniques should be investigated to determine whether it is a contributing factor to injuries.

This study reported a high incidence of injuries among elite netball players in South Africa and revealed clear factors associated with injuries. If these factors are addressed and its effects monitored, a great contribution can be made to the prevention of netball injuries.

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INDIVIDUAL MATCH APPROACH TO BOWLING PERFORMANCE MEASURES IN CRICKET

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ABSTRACT

Match conditions can play a significant role in player performances in a cricket match. If the pitch is in a good condition, the batsmen can achieve good scores, making it difficult for the bowlers. In the case of an uneven pitch or adverse weather conditions, the bowlers may have the upper hand. In order to measure bowlers' performances in a fair way, it is desirable that the match conditions should be taken into account in the calculation of bowling performance measures. The purpose of this study was to provide a fair method to select the best bowler of a series or tournament. This is achieved by means of the individual match approach, which is introduced in the present study. Its essence is to scale the number of runs conceded by a bowler down when the

batting conditions are favourable and to scale them up when batting conditions are adverse. The measure proposed is used to rank the bowlers in the ICC World Twenty20 series of 2010. The use of these adjusted runs can have a significant effect on the ranking of bowlers compared to the situation where the original number of runs is used in the same measure.

Key words: Bowling performance; Cricket; Cricket pitch; Wicket weights.

INTRODUCTION

During the past decade or two, a large number of papers have been published on cricket performance measures and prediction methods. The majority of these papers concentrate on batting performances in limited overs matches. The most important are those dealing with the Duckworth-Lewis method, which is used to adjust the target in the case of rain-interrupted matches (Duckworth & Lewis, 2002; O‟Riley & Evans, 2006). Much less attention has been paid to bowling measures.

The traditional bowling performance measures are the bowling average, the economy rate and the strike rate (Kimber, 1993). Various authors used graphic methods based on these measures to compare bowlers‟ performances (Kimber, 1993; Skinner, 1995; Barr & Kantor, 2004; Barr *et al*., 2008; Van Staden, 2009). The approaches are very similar, with the strike rate being plotted on the vertical axis and the economy rate on the horizontal axis. The bowlers whose co-ordinates lie closest to the origin are seen to be the best ones. The definition of the strike rate used by Barr and Kantor (2004) and Barr *et al*. (2008) is the inverse of the definition used by the others. Measures, which combine two of the measures, can be found in Croucher (2000), Barr and Kantor (2004) and Basevi and Binoy (2007).

Lemmer (2002) proposed a measure based on all three measures and gave a further refinement in Lemmer (2004). Other approaches can be found in Bairam *et al*. (1990), who used a production function approach to determine the best batting and bowling strategy to maximize the probability of winning. Cohen (2002) used the strike rates of bowlers to calculate the probability of dismissing the opposing team. Beaudoin and Swartz (2003) proposed a statistic „runs per match‟ that can be used for batsmen and bowlers alike. It utilises the Duckworth/Lewis resource table in a very sensible way. Its use is restricted, especially in the case of bowlers, by the fact that data recording is such that it requires an enormous effort to extract the necessary data for analyses. In the present study the method of Lemmer (2002) is adapted to the situation where a small number of matches had been played and the fact that match conditions might have differed and had to be taken into account.

BOWLING PERFORMANCE MEASURES

Traditionally the bowling average is defined by A=R/W, with R the number of runs conceded and W the number of wickets taken by the bowler, the economy rate by E=R/O, where O denotes the number of overs bowled, and the strike rate by S=B/W, with B the number of balls bowled. These definitions are in agreement with those shown in television broadcasts and used on the Cricinfo (2010b) and other cricket web pages. Bairam *et al*. (1990) called the strike rate „attacking bowling‟ and the economy rate „defensive bowling‟. In the graphic methods some of the measures are defined differently. Barr and Kantor (2004) defined the strike rate as SB=W/B,

the economy rate as EB=R/B and the average as AB=W/R. It is easy to see that AB=1/A, EB=E/6 and SB=1/S in terms of the traditional definitions. See also Barr *et al*. (2008).

According to Kimber (1993) the average has traditionally been used to compare bowlers, but the economy rate and strike rate have more recently increased in popularity. He mentioned that as early as 1950, Sir Donald Bradman used the strike rate as a measure of the „worth" of a bowler (Bradman, 1950). Each of these measures is important in its own right, but some authors use combinations of these measures. Croucher (2000) defined the bowling index BI=A×S, and used this to rank bowlers. Basevi and Binoy (2007) used CALC=A ×E/6. Barr *et al*. (2008) used as the measure of bowling performance a weighted product of their strike rate and average, namely:

$$BHK = SB^{\alpha} \times (AB)^{1-\alpha}, \quad 0 \leq \alpha \leq 1.$$

By using different values of α, the importance of the strike rate relative to the average can be varied. They used α=0.5 and α=0.75 for illustrative purposes. A more comprehensive measure that has been designed to take A, E and S deliberately into account is the combined bowling rate

$$CBR = 3R/(W + O + W \times R/B)$$

for use in limited overs matches (Lemmer, 2002). In CBR the economy rate is heavily weighted because in a limited overs match it is much more important to limit the scoring rate of batsmen than to take wickets. In Lemmer (2002), CBR was defined as the harmonic mean between A, E and S:

$$CBR = 3/(1/A + 1/E + 1/S) = 3R/(W + O + W \times R/B).$$

Among the measures mentioned, only CBR contains all of A, E and S explicitly.

It is interesting to note that CBR can also be written as CBR=c ×RG, where c is a constant and $RG=(A_s + E_s + S_s)/3$ the arithmetic mean between the standardised values of A, E and S. Here A_s =A/AM, where AM denotes the average of A from a given data set (E_s and S_s have similar definitions) (Lemmer, 2002). The value of the constant c depends on the data set used and c=7.65 for the specific data set. This form gives a further perspective on CBR, but is not suitable for calculation purposes.

Many factors influence the performance of a bowler, such as the pitch condition, the weather, light quality, the strength of the opposing batsmen, the fielding of his own team members, the judgements of the umpires, etc. In the long run, most of these factors tend to balance out, but in a short series of matches (a World Cup series) such factors should be taken into account as far as possible in order to get a fair comparison between bowlers. None of the measures mentioned make specific provision for the case of a small number of matches. Lemmer (2005) showed how the measure CBR could be adjusted to make provision for this case. The rationale of his approach was that a bowler who had taken the wickets of the four top-order batsmen had performed better than one who had taken the wickets of the four tail-enders. It was proposed that one should not simply count the number of wickets taken by a bowler, but that weights should be allocated to the wickets taken and that one should work with W*, the sum of the weights of the wickets taken by the bowler. The formula CBR then becomes

$$CBR^* = 3R/(W^* + O + W^* \times R/B).$$

In the present study, involving Twenty20 matches, the weights for ODIs in Table 1 of Lemmer

(2005) (Table 1) will be used, because both Twenty20 and ODI matches are limited overs matches. As soon as sufficient international Twenty20 data become available, wicket weights will have to be calculated for these types of matches.

TABLE 1: **WEIGHTS OF WICKETS ACCORDING TO BATTING POSITION**

Batting position	Weight	Batting position	Weight
1	1.30	7	0.98
2	1.35	8	0.79
3	1.40	9	0.59
4	1.45	10	0.39
5	1.38	11	0.19
6	1.18	**Total**	11.00

INDIVIDUAL MATCH APPROACH

A method designed to eliminate the effect of factors like pitch and weather conditions will now be introduced. Assuming that a fixed number of overs can be bowled in a match and that 20 wickets can be taken, the above-mentioned conditions will best be reflected by the total number of runs conceded. Under favourable batting conditions bowlers will concede more

runs than under difficult conditions. In measuring a bowler‟s overall performance after a series of matches it should be taken into account that match conditions could have differed markedly between matches. It is therefore necessary for overall bowling performance measures to be adapted to take this into account.

The approach in this paper is as follows: if two bowlers had bowled the same number of overs and taken the same number of wickets, the one who had conceded the least number of runs had performed best. If they had conceded the same number of runs, the one who had played under the better match conditions had performed best, because he could limit the number of runs scored despite favourable batting conditions. It remains to quantify the degree of difficulty of the match conditions. A bowler‟s economy rate (or the average number of runs conceded per ball bowled) gives a good indication of his ability to restrict scoring. Now calculate the runs conceded per ball bowled, RPB=R/B for the bowler, and also, for all bowlers in the whole match, RPBM=total number of runs scored divided by the total number of balls bowled. If a bowler‟s RPB is less than RPBM, he performed better than the average for the match, so it is logical to scale his number of runs conceded, R, down by using the ratio RPB/RPBM in a suitable way.

By using a downscaling similar to that of BP_{26} in Lemmer (2008a), his adjusted number of runs conceded is taken as $AR=R\times(RPB/RPBM)^{0.50}$. Thus, the match conditions adjusted number of runs conceded, AR, replaces each bowler‟s number of runs conceded. This is done for every match in which the bowler had played. Let $R^{\#}$ denote the sum of his adjusted runs, AR, in the series. This is used in the formula of CBR*, which then becomes

$$CBR^{\#} = 3R^{\#}/(W^* + O + W^* \times R^{\#}/B)$$

with O the total number of overs bowled by the bowler in the series.

RESULTS

The measure $CBR^{\#}$ has been used to compare bowlers‟ performances in the ICC Twenty20 series played during March and April 2010. The full scorecards obtained from Cricinfo (2010a) have been used to calculate the sum of the weights of all the wickets taken by each bowler, W*. The bowling figures, obtained from Cricinfo (2010b), have been used to calculate the RPBM values for each match and the AR values for all the bowlers in all the matches. For comparative purposes it was required that a bowler should have bowled at least 12 overs (the number of overs that a bowler is allowed to bowl in 3 matches). The bowlers‟ statistics are given in Table 2, where they have been ranked according to $CBR^{\#}$.

Langeveldt bowled extremely well, and took the wickets of mainly good batsmen, resulting in W*=12.87 for his 11 wickets. His economy rate was almost the same as that of the group, with the result that his $R^{\#}$=104.36 differed very little from R=104. Sammy‟s very good economy brought R=72 down to $R^{\#}$=64.36, his match conditions adjusted number of runs conceded. This caused CBR=8.72 to be replaced by the more appropriate measure $CBR^{\#}$=7.97. Keeping in mind that small values of these measures indicate good performances, his value of $CBR^{\#}$ indicates an 8.57% better performance than does CBR*. In the case of Tait the „improvement‟ was 11.14%. Watson, on the other hand, was very uneconomical, with the result that his value of $CBR^{\#}$ (=30.89) was 14.36% worse than that of CBR* (=27.01).

TABLE 2: **RANKING OF BOWLERS ACCORDING TO $CBR^{\#}$**

Rank	Name	O	R	$R^{\#}$	W	W*	CBR*	$CBR^{\#}$	A	
1	C Langeveldt	16.0	104	104.36	11	12.87	7.29	7.30	9.45	
2	DJG Sammy	13.4	72	64.36	6	5.91	8.72	7.97	12.00	
3	DP Nannes	26.0	183	176.46	14	17.94	8.45	8.24	13.07	
4	GP Swann	22.0	144	136.66	10	13.33	8.66	8.34	14.40	
5	SW Tait	23.4	131	113.27	9	8.7	9.73	8.64	14.56	
6	MG Johnson	22.2	145	133.45	10	11.57	9.37	8.81	14.50	
7	KAJ Roach	12.0	77	75.18	5	6.24	9.27	9.11	15.40	
8	A Nehra	20.0	156	157.23	10	13.29	9.26	9.30	15.60	
9	M Morkel	15.0	119	123.55	8	10.02	9.33	9.56	14.88	
10	SPD Smith	23.0	163	164.77	11	12.73	9.63	9.71	14.82	
11	Saeed Ajmal	22.2	169	168.84	11	13.06	9.78	9.77	15.36	
12	N McCullum	19.0	124	124.17	7	8.63	10.05	10.06	17.71	
13	SCJ Broad	20.5	140	133.31	8	9.07	10.48	10.11	17.50	
14	R Sidebottom	21.3	160	163.55	10	11.69	10.07	10.22	16.00	
15	NO Miller	12.0	63	54.79	2	2.14	11.80	10.42	31.50	
16	AD Mathews	12.0	83	82.46	4	5.35	10.59	10.54	20.75	
17	M Aamer	23.0	152	142.74	8	8.54	11.14	10.61	19.00	

O = No. of overs R = No. of runs $R^{\#}$ = Adjusted no. of runs W = No. of wickets

W* = Sum of weights of wickets CBR* = Combined bowling rate
CBR# = Combined bowling rate adjusted A = Bowling average E = Economy rate

Continued on next page ...

TABLE 2 (cont.)

Rank	Name	O	R	R#	W	W*	CBR*	CBR#	A	
18	DL Vettori	19.1	109	101.60	3	2.94	13.13	12.34	36.33	
19	DW Steyn	19.0	131	136.07	5	6.41	11.99	12.35	26.20	
20	MH Yardy	20.0	136	133.73	4	5.36	12.98	12.80	34.00	
21	JH Kallis	15.0	96	87.57	2	2.70	13.99	12.92	48.00	
22	SJ Benn	12.0	78	76.15	2	2.73	13.23	12.97	39.00	
23	SL Malinga	20.5	165	174.10	6	7.76	12.75	13.26	27.50	
24	DJ Bravo	14.0	116	123.26	5	5.53	12.81	13.38	23.20	
25	SE Bond	19.0	145	154.22	5	6.52	12.86	13.47	29.00	
26	BAW Mendis	18.0	128	132.94	4	4.75	13.53	13.95	32.00	
27	YK Pathan	16.0	140	146.14	4	5.43	14.31	14.76	35.00	
28	Shahid Afridi	24.0	182	180.24	4	5.06	15.40	15.28	45.50	
29	TT Bresnan	22.0	158	162.75	3	3.34	16.16	16.57	52.67	
30	Harb. Singh	20.0	123	112.40	0	0	18.45	16.86	-	
31	M Hafeez	14.0	123	133.32	2	2.70	17.87	19.06	61.50	
32	RA Jadeja	12.0	117	141.34	2	2.85	18.02	20.74	58.50	
33	SR Watson	16.0	163	188.54	2	0.78	27.01	30.89	81.50	1

O = No. of overs R = No. of runs R# = Adjusted no. of runs W = No. of wickets taken
W* = Sum of weights of wickets taken CBR* = Combined bowling rate CBR# = Combined bowling rate adjusted A = Bowling average E = Economy rate S = Strike rate

These and other cases clearly illustrate the importance of using the match conditions adjustment method. It not only gives a more accurate assessment of a bowler‟s performance, but can also give rise to a different ranking of the bowlers. Tait ranked 10th according to CBR*, but 5th according to CBR#. Kallis and Vettori also ranked 5 positions better after taking match conditions into account. On the other hand, CBR# ranked Malinga, Bravo and Bond 4 positions lower than CBR* because they had generally bowled less economically per match than the group as a whole. There is obviously very high correlation between CBR#, CBR* and CBR. The ordinary correlation between CBR# and CBR* is 0.98 and the Spearman correlation is 0.97. Despite these high correlations CBR# remains the appropriate measure to use in a series of matches because the numerical values of CBR# and CBR* can differ markedly.

DISCUSSION

At the end of a World Cup or other series a player is appointed as the man of the series. It is desirable that the panel should be able to determine which bowler (and batsman) was the best, because a medal, an amount of money and much prestige are involved. It can be very helpful to calculate the CBR# values just before (or immediately after) the final match in order to identify the best bowler objectively.

The calculation of W*, the sum of the weights of the wickets taken by each bowler, and of R#, the sum of the adjusted number of runs, can easily be performed by working on the scorecards of the individual matches. It is then easy to calculate CBR# for each bowler. The determination of wicket weights specifically for Twenty20 matches has to wait until a sufficient number of batsmen have played at least 20 international Twenty20 matches, the minimum requirement (Lemmer, 2005) for such a study. To date, a very small number of players meet this requirement. In order to be fair to players, special attention should be paid to the question of the most reliable performance measure in the case of a small number of scores.

The measure CBR# has been designed specifically to determine which bowler has performed best in the series. It cannot be used to say that this bowler is currently the best. Short-term form is highly variable, and the same bowler can be far down in the ranking of the next series. For bowler rankings based on career data, the measures CBR of Lemmer (2002) and CBRW of Lemmer (2007) are much more appropriate. These measures are based on large data sets where influences of pitch and weather conditions tend to balance out.

CONCLUSION

The traditional and other bowling performance measures make no provision for the case of a small number of matches. If the bowling performances of bowlers have to be compared after a series (or a small number of matches), it is essential that the most suitable measure should be used. The use of wicket weights in Lemmer (2005) was the first step in this direction. The use of the individual match approach to address the problem of differing match conditions in the present study is the second step, and has led to the measure CBR#. Besides its theoretical justification of making the playing field more even, as far as match-specific conditions are

concerned, its application to the bowling performances in the ICC Twenty20 Series of 2010, has shown that it makes a difference to the rankings.

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MINIMAL CHANGES IN INDIRECT MARKERS OF MUSCLE DAMAGE AFTER AN ACUTE BOUT OF INDOOR PRE-SEASON FAST BOWLING

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ABSTRACT

The aim of the study was to determine the effect of pre-season indoor fast bowling on indirect markers of muscle damage. Ten elite male, fast bowlers (22±1 yrs) participated in the study. Each participant bowled 48 balls off a full run up during a practice session. The bowling load was eight overs with six balls bowled/over. The overs were separated by a three-minute standing rest period. Creatine kinase (CK) activity, Visual Analogue Scale (VAS) muscle pain ratings, hip, knee and ankle joint range of motion and maximal quadriceps and hamstring isometric strength were measured 24 hours before, one hour and 24 hours after bowling and analysed using a one way ANOVA. Significance was set at $p \leq 0.05$. Maximal isometric strength of the quadriceps and hamstrings for both legs was unchanged. CK activity was significantly elevated at one hour and 24 hours. Pain rating for quadriceps (trailing leg) and gastrocnemius (leading leg) were elevated at one hour and at 24 hours. Ankle range of motion was significantly reduced at 24 hours for the trailing and leading legs. The indoor pre-season fast bowling had no effect on maximal isometric strength and a minimal effect on other indirect markers.

Key words: Cricket; Eccentric; Creatine kinase; Delayed Onset Muscle Soreness (DOMS); Injury.

INTRODUCTION

The prevalence, nature and aetiology of cricket related injuries are important to understand in order to ensure the optimal health and performance of cricketers. Research conducted on first class cricketers in Australia from 1995/96 to 2000/01, reported that injury rates varied from 19.0 per 10 000 playing hours in domestic first class matches to 38.5 per 10 000 playing hours in one-day internationals (Orchard *et al.*, 2002). It was also found that the average seasonal incidence was around 19.2 per 25 players per 20 matches played (Orchard *et al*., 2002). Furthermore, the research identified that fast bowlers have a higher injury rate (14%) compared to other cricketers (Orchard *et al*., 2002; Dennis *et al*., 2005; Davies *et al*., 2008).

Fast bowlers are predisposed to higher injury rates due to the biomechanical and physical demands they are exposed to during bowling (Dennis *et al.*, 2005). Fast bowlers who bowl more than 20 overs (>120 balls bowled) in the week leading up to a match have an increased risk of sustaining a bowling related injury (Orchard *et al*., 2002). A further risk is seen in bowlers bowling second in a match (Orchard *et al*., 2002). Recently, it was reported that fast bowling accounts for 41% of all injuries that occur in cricket, with 47% of these injuries occurring in young up and coming bowlers (Davies *et al.*, 2008). The researchers found that

the majority (41%) of injuries occurred at the knee, followed by lower back (37%) and shoulder (16%) (Davies *et al*., 2008).

Factors associated with the increased incidence of fast bowling related injuries include: poor bowling mechanics and inappropriate bowling technique that are associated with an increase in rotational forces in the lumber spine; inappropriate strength and conditioning regimes; inadequately rehabilitated injuries; and over-bowling (bowling too many balls/overs) and under-bowling (not bowling enough balls/overs, and therefore, being inadequately prepared/conditioned) (Dennis *et al*., 2005; Davies *et al*., 2008).

Guidelines have been developed in an attempt to reduce the rate of injuries in fast bowlers (Davies *et al*., 2008). These guidelines specify that senior players (≥19 yrs) must be limited to three spells of eight overs per match (total of 24 overs or 144 deliveries) with a minimum of an hour's rest between each spell (Davies *et al*., 2008). It is also recommended that a senior bowler should bowl no fewer than 123 deliveries and no more than 188 deliveries per week between games (Dennis *et al*., 2005). These guidelines were developed to ensure that bowlers are not predisposed to overuse injuries and that they are adequately conditioned for fast bowling (Dennis *et al*., 2005). Further research, however, is required to examine the link between injury rate and the number of deliveries per season/ week/match.

An important factor that may contribute to lower leg injuries in fast bowling is the high ground reaction forces experienced with each delivery. Ground reaction forces can be four to nine times that of gravity for back and front foot landing respectively (Noakes & Durandt, 2000). Studies have suggested that the human musculoskeletal system is poorly designed to deal with the repetitive nature of fast bowling, as well as the increased forces placed on the body during the landing phase (Noakes & Durandt, 2000).

Fast bowlers are also exposed to repeated, elevated eccentric muscle contraction forces during the bowling landing phase or delivery stride that may result in lower limb muscle or tissue damage. The stability of the knee joint and of the back and front leg during the landing and delivery phases is maintained through powerful eccentric contractions of the quadriceps femoris muscles (Noakes & Durandt, 2000). Research in other sport has demonstrated that unaccustomed or strenuous, eccentric muscle contractions increased indirect markers of skeletal muscle damage (Tiidus, 2008).

Exercise-induced muscle damage has been examined in humans (Ebbeling & Clarkson, 1989; Hoffman *et al.*, 2002) with plasma creatine kinase (CK) activity commonly reported as an indirect marker of skeletal-muscle damage (Takarada, 2003; Peake *et al.*, 2005). While elevated CK has been reported after competitive match play in contact sport (Takarada, 2003; Suzuki *et al.*, 2004; Kraemer *et al.*, 2009), suggesting that significant skeletal muscle damage occurs during such contact sport, there is limited information available relating the impact of cricket fast bowling on skeletal-muscle damage or CK. Importantly, although eccentric muscular contractions have traditionally been considered the predominant contributor to increased CK after exercise (Brancaccio *et al.*, 2007), recent evidence suggests that significant increases in CK may also occur as a result of physical collisions and blunt force trauma (Hoffman *et al*., 2002; Smart *et al.*, 2008). It is the view of the authors that the high ground reaction forces experienced during fast bowling may also be considered a physical

collision or blunt force trauma that starts at the foot and travels upwards through the lower limbs of a bowler. These forces together with the eccentric contractions may increase the level of skeletal-muscle damage and together contribute to increasing CK levels, as well as other indirect markers of muscle damage.

Therefore, despite the existence of bowling guidelines, currently there is limited information regarding the effects of a single spell of fast bowling on indirect markers of muscle damage or the subsequent recovery thereof. Due to the high incidence of injury in fast bowlers, additional information relating to muscle damage and recovery may aid in the planning of conditioning and injury prevention programmes and possibly prolonging the careers of fast bowlers. Therefore, the aim of this study was to determine the effect of a recommended match spell of eight overs (48 balls bowled) of fast bowling on indirect markers of muscle damage in elite senior players. It was hypothesised that there would be an increase in the indirect markers of muscle damage immediately after bowling and that these would be further elevated at 24 hours post.

METHODOLOGY

Subjects

Ten male, elite (defined as a member of a professional provincial squad), fast bowlers participated in the study. The demographics of the fast bowlers were: seven right hand and three left hand bowlers; age 22±1 years; stature181±6.1 cm; mass 87.3±12.9 kg; with a body fat percentage of 13.1±6.0. A fast bowler was defined as any bowler to which the wicket keeper stands back (and not close to the wickets) and bowls between 120 to 135 km/h. The participants were tested approximately 3 months into the cricket off-season (July, 2009) and 3 months prior to the start of the 2009/2010-season. The mean and standard deviation for last time bowled was 1.24±0.80 months at pre-testing. An attempt was made to reduce the effect of training on baseline readings by performing the bowling intervention and pre- and post-data collection during a rest week of the strength and conditioning mesocycle. Prior to commencement of the study, participants read and signed an informed consent form and completed medical and cricket history questionnaires approved by the Institution's Research Ethics Committee. All participants were asymptomatic of any diseases or injuries and were not on any pain or anti-inflammatory medication.

Testing protocol

Baseline testing (Day 1) was performed in the Discipline of Sport Sciences, Human Performance Laboratory (HPL) (22^{o}C, 50% humidity) between 09h00 and11h00 with stature, body mass, per cent body fat (chest, abdomen and thigh skinfolds) (Jackson & Pollock, 1985) and flexibility assessed after a 15-minute seated resting period. Capillary blood creatine kinase (CK) activity levels were then measured, followed by Visual Analogue Scale (VAS) muscle pain ratings, range of motion (ROM) and maximal isometric strength testing. Day 2 and Day 3 were designated rest days with the participants performing limited physical activity to reduce the impact on the dependant variables.

The bowling spell was performed on Day 4 between 08h30 and 11h30. Resting CK levels were measured immediately prior to a standardised 15-minute warm up (dynamic, bowling

specific warm-up) to ensure that they were similar to the baseline levels measured on Day 1. A paired t-test indicated that the CK levels of Day 4 were not statistically different from Day 1 and were, therefore, used in the final statistical analysis. The intervention took place in an indoor cricket centre. Participants were required to wear non-spiked cricket shoes due to the indoor surface. They were asked to treat the bowling spell as a match situation. Each player bowled 8, 6-ball overs (48 balls in total) with an average rest time between each over bowled of 3 minutes (calculated by averaging the rest time between 10 overs during a live international limited overs match).

After each delivery the participants returned to their full-length run up and performed each delivery with maximal effort for the duration of the testing protocol. Within an hour following completion of the bowling spell, participants were transported to the HPL where the same testing protocol as Day 1 was performed. During this time the bowlers did not perform any recovery interventions such as stretching but were permitted to continue with their normal dietary and hydration practices. The bowlers then returned to the HPL 24 hours later and measurements were repeated (Day 5). During this time the players were requested to avoid any pain or anti-inflammatory medication, participate in any recovery sessions using modalities/techniques, for example, massage, which could impact on the variables measured in the study.

CK activity was determined using a Reflotron blood analyser, which uses, a colorometric assay procedure (Boehringer Mannheim GmbH, Germany). The within-series precision (CV) of the Reflotron ranges from 1.8 to 3.0%, while the day-to-day precision ranges from 2.2 to 3.0%. Capillary blood (32ul) was pipetted onto a Reflotron CK strip (Roche Diagnostics, Indianapolis, USA). The strip was inserted into the Reflotron analyser for 180 seconds. Results were recorded from the value seen on the Reflotron blood analyser digital display.

The VAS was used to assess the severity of skeletal muscle pain. Players were asked to gently palpate and move various muscle groups through a comfortable range of motion. They were then asked to rate each muscle group individually, by placing an 'X' along a visual analogue scale (VAS) of 100 mm. The verbal anchors on this scale were: '1=normal'; and '100=very, very sore' (Grant *et al.*, 1999). The distance in centimetres, from the beginning of the scale to their mark, was measured and this represented the muscle soreness score for that particular muscle group. Palpation occurred at the followings sites: 10 and 15cm above the superior pole of the patellae, as well as 5cm laterally and medially from the 15cm mark, on the quadriceps. In addition, they were palpated along the midline of the calf muscle 15cm from the joint margin of the tibiofemoral joint. The same investigator administered the VAS measurements to ensure standardisation of the palpation of the muscle groups. Range of motion was determined using a goniometer (Lafayette Guymon). Hamstring and hip flexor flexibility was assessed using the supine straight-leg flexion test (Davis, 2008) and ROM of the ankle was assessed using the plantar- and dorsiflexion tests (Moseley *et al.*, 2001).

All participants completed strength testing on the Biodex System 3 (Biodex Medical Systems, New York, USA). To obtain bilateral maximal isometric strength of the quadriceps and hamstrings, participants performed a maximal knee extension and flexion at 45˚ for a

period of 5 seconds. All participants completed 2 trial repetitions, 1 at a submaximal level and the other maximal (for 2 seconds), per leg before each testing protocol. These 2 practice

trials per leg were used to improve the reliability of the maximal 5-second effort. The order of testing of the legs (trail or leading leg first) was randomised.

Statistical analysis

The statistical analysis was performed using GraphPad Prism version 5.00 for Windows, (GraphPad Software, San Diego, California, USA). The data were analysed with a 1-sample nonparametric test (Kolmogorov-Smirnov test) to determine whether the data distribution was normal. A one-way analysis of variance (ANOVA) was used to analyse the following dependant variables: CK, VAS muscle pain ratings, ROM, as well as maximal isometric torque. The levels of each variable at 1 hour and 24 hours after the bout of bowling were compared to pre-bowling levels. Post hoc testing was performed using Tukey's multiple comparison test. Significance was set a $p \leq 0.05$.

RESULTS

Range of motion

There were significant differences at 24 hours for trailing ($p=0.004$) and leading ($p=0.0008$) leg ankle dorsiflexion (Table 1) representing a relative decrease in range of motion from baseline of -29.8 and -27.2% respectively.

Pain ratings (Visual Analogue Scale)

Significant differences in VAS pain ratings were found at various palpation points on the trailing leg quadriceps group (Table 1). At 1 hour ($p=0.02$) and 24 hours ($p=0.03$) post intervention, there were significant increases at 15cm above the superior pole and 5cm lateral of the patella. The VAS score at 1 hour increased from baseline by 177%, while the score at 24 hours represented an increase of 59%. At 1 hour post intervention there was a significant difference ($p=0.01$) for the quadriceps 10cm above the superior pole. The VAS score at 1 hour was 35% higher than baseline. A significant difference was found at 1 hour ($p=0.04$) post intervention for 15cm above the superior pole of the trailing leg with an increase of 130%. There was a significant difference ($p=0.03$) in the VAS scores at 1 hour and 24 hours for the gastrocnemius of the leading leg (Table 1), with increases from baseline of 168 and 122% respectively.

Creatine kinase activity

Significant differences in CK activity were found at 1 hour ($p=0.03$) and 24 hours ($p=0.04$) post intervention compared to baseline (Figure 1), with relative increases from baseline at 1 hour and 24 hours of 108.6 and 77.2% respectively.

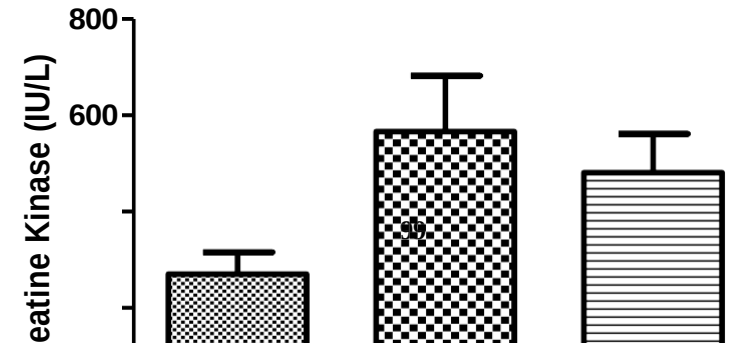
Maximal isometric torques

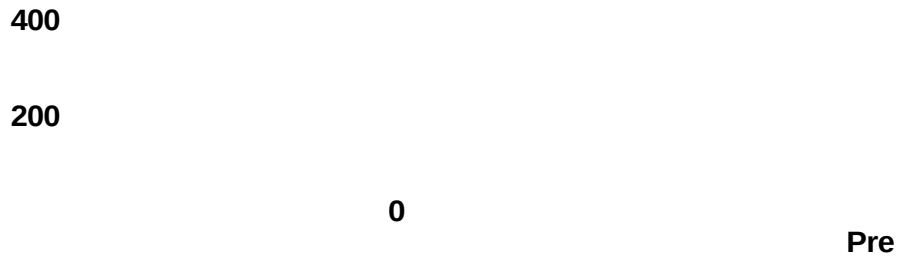
Compared to baseline there were no changes in the leading or trailing limb maximal isometric torques after the spell of fast bowling (Table 1).

TABLE 1: **RANGE OF MOTION, VAS SCORES, LIMB CIRCUMFERENCES, MAXIMAL ISOMETRIC TORQUE**

Variable	Pre Mean (SE)	1-h post Mean (SE)	24-h post Mean (SE)
Dorsiflexion ROM (degrees)			
Trailing leg	20.4(1.1)	20.0(1.1)	*14.9(1.3)
Leading leg	21.2 (1.3)	21.6(0.9)	*15.2(1.3)
Plantarflexion ROM (degrees)			
Trailing leg	35.6 (4.1)	42.1 (2.2)	38.9 (1.8)
Leading leg	38.7 (3.8)	42.2 (2.3)	38.8 (1.9)
Hamstring ROM (degrees)			
Trailing leg	63.2 (3.9)	65.6 (3.1)	65.3 (2.6)
Leading leg	60.3 (4.2)	64.0 (2.3)	66.6 (3.5)
VAS Quadriceps (mm)			
Trailing leg			
5cm above superior pole of patella	22.7 (5.5)	36.8 (7.7)	27.6 (6.3)
10cm above superior pole of patella	13.2 (3.3)	#24.4 (4.8)	8.2 (2.2)
15cm above superior pole of patella	9.9 (1.9)	#26.0 (7.4)	13.2 (3.4)
15cm above superior pole and 5cm lateral of patella	11.4 (4.7)	#31.6 (6.2)	#18.1 (3.6)
Leading leg			
5cm above superior pole of patella	17.4 (4.3)	35.9 (6.5)	22.9 (5.5)
10cm above superior pole of patella	14.2 (4.0)	24.0 (5.6)	8.8 (1.9)
15cm above superior pole of patella	10.9 (3.9)	24.3 (5.7)	13.8 (3.3)
15cm above superior pole and 5cm lateral of patella	14.6 (6.2)	32.3 (8.2)	18.7 (4.5)
VAS Gastrocnemius (mm)			
Trailing Leg	37.9 (0.7)	38.0 (0.7)	38.2 (0.9)
Leading Leg	12.6 (3.9)	#33.8 (6.81)	#28.0(5.8)
Isometric Torque (N.m)			
Trailing leg			
quadriceps extension	180 (8.7)	198 (19)	206 (12)
hamstring flexion	143 (11)	142 (15)	147 (10)
Leading Leg			
quadriceps extension	201 (10)	185 (13)	207 (7.3)
hamstring flexion	146 (14)	147 (17)	157 (14)

* $p<0.01$ # <0.05

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Pre

1 h

Time (h)

24 h

FIGURE 1: **TOTAL CREATINE KINASE ACTIVITY**
*Significantly elevated at 1-h (p=0.03) and 24-h (p=0.04) compared to pre-measure.

DISCUSSION

The main finding of this study was that a recommended match spell of pre-season, indoor fast bowling had a significant effect on some indirect markers of muscle damage at 1 hour and 24 hours post intervention, while it had no effect on others. The alterations possibly reflect the physiological load of a spell of fast bowling rather than excessive, exercise-induced muscle or tissue damage that would inhibit performance or prolong recovery. This is the first study to provide information regarding the acute effect of recommended fast bowling guidelines (Davies *et al*., 2008) on indirect markers of muscle damage (muscle pain as measured by the VAS, ROM and isometric strength). In addition, it provides an indication of the possible CK reference limits that could be expected after a spell of fast bowling in professional cricketers.

The increases in CK at 1 hour and 24 hours after the bowling spell were within the normal reference CK limits (82–1083 U/L) reported for well trained and elite male athletes (Mougios, 2007). However, comparison with baseline (normal) male reference intervals for the general non-athlete population (upper reference limit <350U/L) (Wong *et al.*, 1983), could be interpreted as reflecting the existence of exercise-induced muscle or tissue damage. Although even higher baseline CK levels (upper reference limit of 532U/L) (Lev *et al.*, 1999), and 491U/L (Mougios, 2007) have been reported in the non-athlete male population. This result highlights the importance of sports medicine physicians, coaches and conditioning specialists having access to sports specific reference intervals for CK, as sport have quite different demands in terms of strength, speed, endurance, flexibility and technique, which all impact CK levels (Mougios, 2007).

Creatine kinase usually peaks between 24 to 48 hours post exercise-induced muscle damage (Tiidus, 2008). However, the results in the present study indicate that CK activity was returning to baseline levels by 24 hours. It is generally agreed that the CK response to exercise induced muscle damage is due to variability in the susceptibility of muscles to injury (Warren *et al.*, 2006). In addition, the time of CK release into and clearance (Warren *et al*., 2006) from the circulation depends on the level of training and conditioning, and the type, intensity and duration of exercise (Brancaccio *et al*., 2007). These factors may have contributed to the results in the present study.

There were significant decreases in dorsiflexion ROM for both the leading and trailing legs at 24 hours which suggests that muscle damage may have occurred in either or all of the lower leg muscles of the shin and calf. Although the VAS was not used to assess pain in the tibialis anterior, the participants experienced a significant increase in pain in the gastrocnemius of the leading leg at 1 hour and 24 hours post bowling. The associated muscle damage may have increased muscle tightness in the gastrocnemius (antagonist) that manifested at 24 hours, which would have played a role in limiting dorsiflexion ROM at 24-h.

Eccentrically induced muscle contractions or the ground reaction forces may have been the contributing factor to the muscle pain experienced post intervention in specific muscle groups of the leading and trailing legs. The pain reported in the thigh, however, does not correlate with the finding of no change in maximal extension isometric strength. There was a significant increase in pain of the gastrocnemius of the leading leg at 1 hour; yet the trailing leg seemed to experience a greater amount of pain. Possible reasons for increased pain in the trailing leg include increased rotational forces (Hurrion *et al*., 2000), landing position (Davies *et al*., 2008), knee angle, as well as eccentric muscle contractions (Noakes & Durandt, 2000), compared to the leading leg, although further research is required in this area.

Eccentric muscle actions can disrupt cytoskeletal elements involved in force transmission, damage the muscle cell membrane and impair excitation-contraction coupling together resulting in a loss of force production (Tiidus, 2008). However, in the present study there were no significant changes in the maximal isometric strength of both the trail and leading leg at any time point after the bowling spell, which indicates no disruption of excitation-coupling. This provides further evidence that the bowling spell caused minimal muscle or tissue damage, specifically in the quadriceps and hamstrings.

Damage related eccentric muscle actions could alter the pattern of lower limb muscle fibre recruitment (Noakes & Durandt, 2000). In addition, research has indicated that damaged muscles of the lower limb become less able to store the energy of the ground reaction forces upon landing, and therefore, are less able to maintain the same level of energy output for the subsequent toe off (Noakes & Durandt, 2000). Although there was an increase in muscle pain and stiffness in the lower limb in the present study that could reflect the existence of muscle damage, it is believed that this was not severe enough to alter recruitment patterns or energy output of the lower limb muscles. The role that exercise-induced muscle damage plays in altering muscle fibre recruitment patterns and reducing muscle energy output in fast bowlers needs to be examined further, particularly after multiple spells of fast bowling over a day or consecutive days. Understanding this relationship could help clarify whether fatigue, reduced

performance and susceptibility to injury are associated with the eccentric muscle contractions that occur in the lower limbs during the fast bowling action.

CONCLUSION

The results indicate that a fast bowling spell of eight six-ball overs produces significant changes in various indirect markers of muscle damage. However, these alterations, specifically the small elevation in CK, if interpreted together with the maintenance of maximal isometric strength, possibly reflect the physiological load of the bowling spell rather than eccentrically induced muscle damage. A recommended spell of eight six-ball overs for fast bowlers, therefore, seems to be safe and does not result in a reduction in subsequent performance. Further research is required to examine the effects of multiple spells of fast bowling on indirect markers of muscle damage over a single day, as well as over consecutive days.

The practical implication is that an eight-over spell of indoor, fast bowling, performed pre-season will result in a small increase in muscle stiffness, muscle pain and CK that lasts up to

at least 24 hours after the spell. However, maximal isometric strength does not change, suggesting that an eight-over spell does not induce muscle damage that would inhibit subsequent performance.

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HOST RESIDENTS' PERCEPTIONS OF THE IMPACT OF THE 2009 WORLD GAMES ON KAOHSIUNG: A LONGITUDINAL PERSPECTIVE

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ABSTRACT

This study assesses host residents' perceived impacts of the 2009 Kaohsiung World Games (the Games) on their communities. The main purpose was to investigate host residents' perceptions concerning the impact of staging the Games, looking at the issues affecting communities both before and after the event. Importantly the study introduces a new theoretical basis for assessing event tourism impacts. From a

statistical perspective, significant differences were found concerning perceived general benefits, as well as negative impacts. The Nicosia model was used to help explain the findings. Overall, residents held relatively high expectations of general benefits, benefits of community involvement and development, in addition to economic and image benefits. Subsequent to the Games, residents realised that tangible or more direct benefits (such as additional recreational opportunities, short and long term boosts to the local economy and increased employment) were lower than expected. The study concludes by emphasising the importance of adopting a strategic approach, which focuses on engaging beneficiaries (host residents) in the early stages of event development. Planners should also seek to match the destination's development policies to the desired outcomes of the event.

Key words: World Games; Sports mega-events; Residents‟ perceptions; Nicosia model.

INTRODUCTION

The 2009 World Games (the Games) hosted by Kaohsiung City took place over an 11-day period, from 16 to 26 July 2009. The host city welcomed approximately 5000 delegates and athletes from 103 countries, competing for 1485 medals in 31 sporting events. During the closing ceremony, the President of the International World Games Association described the Games as the best event ever, a great honour for the organising committee and the event‟s 6000 plus volunteers.

In preparation for the Games, the Kaohsiung City Government increased the development of public infrastructure and made improvements to the transportation network. It was anticipated that the Games would attract 400 000 visitors to the city (Ma *et al*., 2011). Such preparations included spending several million US dollars on the construction of two new sport facilities

(Main Stadium and Kaohsiung Dome), the refurbishment of 22 competition venues (Lotus Lake), and the renovation of infrastructure (Wi-Fi environment, Zhongshan Road, Formosa Boulevard and Bo-ai World Games Boulevard).

The Games featured 31 sporting events, including artistic and dance sport (acrobatic gymnastics, dance sport, aerobic gymnastics, artistic roller skating, rhythmic gymnastics, and trampoline and tumbling gymnastics); ball sports (beach handball, fist ball, canoe polo, tchoukball, korfball, racquetball, rugby sevens, softball and squash); martial arts (ju-jitsu, sumo, karate, and wushu); precision sport (billiards, boules sport, archery and bowling); strength sport (bodybuilding, tug-of-war and power lifting); and trend sport (air sport, climbing, fin swimming, dragon boat racing, flying disc, lifesaving, orienteering, roller sport and water skiing). In all, 274 769 tickets were sold (72.87 % of all tickets), contributing a total of NT$63.34 million (USD$1.38 million) to the event.

Kaohsiung, the second largest city in southern Taiwan, was once symbolic of the Taiwanese economic boom of the 1980s and 1990s. It now faces a post-industrial era similar to that experienced in many western European economies during the 1970s and 1980s. The high unemployment rate is strongly associated with significant changes to the industrial structure (Ma *et al*., 2006). While the economy was previously reliant on production-based activities, it

has now shifted towards high technology and services. Kaohsiung citizens have long criticised the employment situation confronting their city. Official statistics show that unemployment rates in Kaohsiung have remained higher than the national average from 2003 to 2007 and the national unemployment figures during this period were: 4.9%, 4.4%, 4.1%, 3.9% and 3.9% respectively, as compared with Kaohsiung unemployment figures during this period: 5.2%, 4.6%, 4.2%, 4.2%, and 4.2% respectively (Department of Budget, Accounting and Statistics, Kaohsiung City Government, 2008; Directorate General of Budget, Accounting and Statistics, Executive Yuan, R.O.C., 2008).

In response to key aspects of the economic recession, the Kaohsiung City Government (KCG) dealt with criticism by initiating a wide range of strategies, including hosting large events such as the Games (Ma *et al*., 2006). While Kaohsiung citizens felt very proud to host an event of such magnitude as the Games, some were concerned about the large amounts of tax money being spent by the KCG. The total expenditure was estimated at NTD$23.15 billion (USD$723.4 million) (Ma, 2009), including the cost for the organising committee (USD$77.5 million), construction and refurbishment of sport facilities (USD$407.2 million), road construction (USD$21.1 million) and telecommunications (USD$217.3 million). Whilst the Games were being widely publicised by the local Government, many residents were becoming sceptical of the benefits of hosting such a large-scale event.

Given the increasing reliance of many cities on hosting major events to catalyse redevelopment and promotion, the need to establish effective strategies to assess community impacts has become an important factor (Ma *et al*., 2006). More significantly, local residents are often influential groups and the success of the event is largely dependent on a supportive and involved local community (Fredline, 2006). It is also noted that event planners and stakeholders use the views of the community as a measure of the success and sustainability of their investment (Williams & Lawson, 2001). An understanding of the level of support the host community has for the hosting of events could well inform policy makers in the planning

and promotion of future events (Bull & Lovell, 2007).

While much is known about the perceived economic and social impact of certain types of major sporting events, such as the Olympic Games, there has been comparatively little evaluation of other types of events, such as the World Games. The issues studied in relation to the Games so far, include bidding strategies (Jeng, 2007), event planning (Hsueh, 2007), sport facilities and urban re-development (Li, 2006), sport mega-events and urban development (Chang & Huang, 2009; Liu, 2009), destination and national image (Lai, 2006; Tsai, 2006; Hsu & Haung, 2007), mass rapid transit (Weng, 2007), the impacts of social development (Research, Development and Evaluation Commission, Kaohsiung City Government, 2010), the application of the photovoltaic system in sport facilities (Lien, 2006), the development of World Games (Tsai, 2007) and the management of volunteers involved in large scale sport events (Hsieh, 2006). Despite a number of research studies being conducted with regards to the Games, no empirical research has focused, on the host residents‟ perceptions. In addition, no research to date has developed a longitudinal approach to attempt to better understand how or why host residents‟ perceptions may vary over time.

However, a growing number of studies (Soutar & McLeod, 1993; Mihalik & Simonetta, 1999; Deccio & Baloglu, 2002; Waitt, 2003; Kim & Petrick, 2005; Kim *et al*., 2006; Lorde *et*

al., 2010) have suggested the importance of examining host residents‟ perceptions about the impact of hosting such an event. Furthermore, it was advocated that such studies should consider relevant time-periods and would assist policy-making and planning. Against this background, the purpose of this study is to investigate host residents‟ perceptions regarding the impact of staging the Games (both before and after the event). The research compares residents‟ perceptions between the two time-periods and develops a new theoretical base for the analysis of event tourism.

LITERATURE REVIEW

Theoretical foundation

Modern social exchange theory is a general sociological theory regarding the exchange of resources between individuals and groups in the context of an interactive situation (Ap, 1992). This interaction suggests that when some kind of benefit is derived from the exchange, an individual or group would be willing to exchange something with another party. The theory has previously been applied to the study of residents' perceptions of tourism (Bryant & Napier, 1981; Ap, 1992; Perdue *et al*., 1999; Deccio & Bloglu, 2002).

Lankford and Howard (1994) argue that those who receive direct benefits from tourism are less likely to attribute negative social and environmental consequences to it, and hold more positive attitudes toward its expanded development. The extent to which local residents accept or reject changes attributable to tourism, depend to a large extent, on residents' perceptions of how it affects their own personal welfare and lifestyle. In addition, social representation theory has used an alternative (Moscovici, 1982; Pearce *et al*., 1996), which refers to „systems of preconceptions, images and values‟ about a phenomenon (Kim *et al*., 2006). In tourism literature, it is noted that when local residents are likely to understand a new event around them (a sport event), their past experiences, knowledge and values of the

event are regarded as a „reference point‟ (Fredline & Faulkner, 2002). The theory implies that residents may interact with various information sources that shape their primary perceptions and simultaneously informs their representations of tourism, which show their feelings of its impacts (Fredline, 2006).

Recognising that organising a large-scale event is particularly complicated, the researcher borrowed a model (Nicosia model) from the field of consumer behaviour, to help understand the interrelationships between 'attitudes' and 'attributes' within the context of this study. The Nicosia model comprises of a flow diagram, which illustrates a consumer‟s decision-making process. The model assumes that “no prior consumer knowledge or experience with the product exists” (Vignali *et al.*, 2001:463). Consumers in this case study (the host residents) had never before experienced a sports mega-event like the World Games. According to the model, the salient features begin with the flow of a message from a company to the „internalisation‟ of the message by a consumer. Perception of the message is determined by the attributes of both the company and consumer (Gilligan & Wilson, 2003). At this stage of the process, internalisation is used to signify operations, such as the physical perception of the stimulus attributes, environmental attributes prevailing at the moment of perception, and cognitive structures that give meaning to the stimulus and its components (Nicosia, 1968). A consequence is that it may lead to the development of an attitude towards the product.

The following stage consists of a search process, both internal and external. The consumer is to search for the product that is evaluated by means of information from social psychological fields (internal search) concerning advertising messages, the product, the brand's sellers and so on, or by means of information associated with the attitude from overt activities (external search), such as shopping and self-exposure to advertisements. The search process may or may not lead to the purchase of the product. The experience of consumption then becomes a factor that can influence the consumer's psychological state and plays a part in the consumer's disposition, leading to a decision on whether to purchase the product or not. Therefore, it forms a feedback loop. Despite being criticised as oversimplifying the decision-making process of consumer behaviour, the Nicosia model has been widely adopted in understanding consumer behaviour (Ma, 2009).

Actions taken by event planners represent organisational attributes (attributes of the Kaohsiung Organising Committee [KOC] and the KCG). The interaction between these attributes generates a message (the preparatory work) to the consumer (the host residents). The perception of the message is determined by organisational attributes at this stage. However, it should be noted that the consumer could possibly be further exposed to the message, which reshapes the „consumer attributes". This process is called internalisation of the message, which denotes operations, such as perception of economic, social and environmental impacts (event attributes) generated by preparatory work. Consequently, the results may lead to the formation of an attitude toward the product (Games). The Nicosia model underlies the mechanism between actions by event planners and the evaluation of attitudes towards and perceptions of impact. Previous studies (Kim *et al*., 2006; Lorde *et al*., 2010) investigating the changes of host residents" perceptions regarding the impact of major sport events usually draw on „prospect theory" and „social exchange theory" as theoretical bases. The current study, based on the Nicosia Model, has cast new light on the analysis of event tourism.

Perceived impacts of mega-events

Mega-events are increasingly seen as tourist attractions (Getz, 1989). Consequently, hosting major events has become an integral part of the tourism marketing strategies for many cities (Getz, 1989; Thorne & Munro-Clark, 1989; Ritchie & Smith, 1991; Mules & Faulkner, 1996; Fredline & Faulkner, 1998). The benefits are broader than just the immediate tourism effects (Hall, 1992). Local residents develop expectations regarding potential impacts from the moment the decision is made to stage an event. They perceive these, both positively and negatively, during and long after the event.

A wide variety of consequences have been seen regarding the staging of mega-events. Economic benefits range from urban regeneration (Gratton *et al*., 2005; Solberg & Preuss, 2007), employment (Spilling, 1998; Masterman, 2004), business leveraging (Masterman, 2004; O"Brien, 2006), providing opportunities for recreational activities (Allen *et al*., 1993), sources of income (Kang & Purdue, 1994; Madden, 2002), tourism (Solberg & Preuss, 2007), as well as a change in consumer habits (Frey *et al*., 2007).

Positive social impacts involve an increase in: community engagement (Hillier, 1998; Fredline, 2006; Leonardsen, 2007; Shipway, 2007), community pride (Hall, 1989; Waitt, 2003), social equity (Bramwell, 1997; London Organising Committee of the Olympic and

Paralympic Games & Olympic Delivery Authority [LOCOG & ODA], 2007a), cultural exchange (Garcia, 2003, 2004; Shipway & Brown, 2007), sport participation (Collins *et al*., 1999) and health promotion (Frey *et al*., 2007; LOCOG & ODA, 2007b; Wang & Theodoraki, 2007). It has also been suggested that environmental projects benefit from cities hosting major events (Preuss, 2004). High profile events are likely to generate an increased interest in natural landscapes and local heritage conservation, placing environmental projects in a position to attract greater funding instead of being potentially ignored (IOC, 1999; Deccio & Baloglu, 2002).

Along with producing a huge range of positive benefits to host destinations (to local communities in particular), it is acknowledged that financial costs may generate opposition from local communities. For instance, the staging of mega-events can result in price inflation of goods, services and property, placing a huge burden on local residents (Deccio & Baloglu, 2002). Furthermore, mismanagement of public funds can actually increase costs over time, a situation which is likely to intensify any negative perceptions of hosting events (Deccio & Baloglu, 2002; Ritchie *et al*., 2009). The lessons are still vivid from the experiences of the 1976 Montreal Olympic Games and the 1991 Sheffield World Student Games, which both resulted in debts of around £692 million (Gratton & Taylor, 2000), and £10.4 million (Bramwell, 1997) respectively. Sheffield will be repaying their debt until 2025 (Wallace, 2001).

Major events may also result in negative social impact. For example, the interests of marginalised groups are frequently ignored (Cashman, 2006), traffic congestion may occur during the construction of event venues or during the event itself (Fredline, 2004) and crime may increase due to an influx of visitors to the host destination (Ritchie *et al*., 2009). In addition, the planning of the event may influence the image of the host community held by prospective visitors. This may be due, for example, to increased costs (Ritchie, 1984; Hillier, 1998). Furthermore, political turmoil may occur as a result of a lack of community wide participation and empowerment in the decision-making process (Roche, 1994). Such a situation occurred during the 1991 Sheffield World Student Games where the main local political party was negatively affected as a result of alienating the community from decision-making processes (Bramwell, 1997). Likewise, with regards to the 1988 Olympics and the 2002 World Cup in Korea, Kim *et al*. (2006) argue that the residents‟ dissatisfaction with the actual benefits (such as economic benefits) may be attributed to their lack of involvement in the planning and decision-making process. Apart from the economic and social impact of hosting a major event, consideration needs to be given to the adverse effects of such an event on the natural and physical environment. This may be through changes of land use (Gursoy & Kendall, 2006), pollution of beaches and lakes caused by the construction of competition sites and a deterioration of historical or natural resources (Kim *et al*., 2006).

RESEARCH METHODS

Setting

Kaohsiung is the largest commercial harbour and the second largest city in Taiwan, with a population of 1.5 million. Kaohsiung is situated on the southwestern coast of Taiwan and comprises an area of 154 square kilometres. The local economy is dependent mostly on heavy industry and the production of petrochemicals. The city is comprised of 11 districts, with the

Zuoying and Cianjnn Districts being most relevant to this study. These districts are relevant firstly, because competition sites such as the Main Stadium, the Lotus Lake, the Kaohsiung Dome and the World Games Boulevard are located in Zuoying District. The Love Riverside, situated in Cianjnn District was the area used for Boules Sports. This area has long been the most popular site to hold various national and international festivals. Therefore, people living in these areas were more aware of events taking place and the events had a more immediate impact on their lives. Secondly, the areas targeted within each district were most likely to be influenced by the staging of the Games. This research examined the „main effects", as they happened within the host areas, rather than the „spill over effects", as they occurred within general areas.

As Finn *et al*. (2000) highlighted, an accurate sampling frame does not always exist, therefore non-probability samples, which are usually found in visitor attractions and sporting events, were used in our research. In studying this case, purposive sampling of non-probability was used for the survey, given an accurate sampling frame was unavailable. This was largely due to the ambiguous boundaries between host and non-host zones. While this sample cannot be representative of the larger population, it is recognised to be more representative of the majority of residents from host communities.

Survey and data-collection procedures

The tool used for data collection was a tourism impact scale, specifically developed for major sports events. This scale was used in a previous study conducted by Ma *et al*. (2011), which investigated residents" attitudes regarding the potential impact of the Games prior to the event. The scale is composed of 26 items based on the Verified Tourism Impact Attitude Scale (VTIAS) developed by Ma *et al*. (2011), as well as a number of sources in event tourism literature (Ritchie, 1984; Getz, 1991, 1997; Hall, 1992; Lankford & Howard, 1994; Shultis *et*

al., 1996, Twynam & Johnston, 2004). The VTIAS was developed by Lankford and Howard (1994) and has been previously used to assess residents" attitudes toward tourism. However, it is also noted that the impact of major events are generally quite similar to those of tourism (Fredline & Faulkner, 2002). Consequently, the VTIAS may be used to assess and interpret residents" perspectives of event tourism (Twynam & Johnston, 2004). The VTIAS measured various dimensions of the Games, including 5 statements on the economic impact, and 21 statements on the social and environmental impact of the event. Responses to the items of VTIAS were given on a 5-point Likert scale where 1 was equivalent to "strongly disagree", 3 was equivalent to "no opinion" and 5 was equivalent to "strongly agree". Basic demographic items were also included such as gender, marital status, age, occupation, educational attainment and annual personal income.

Data were collected from host communities located close to the 4 competition venues (the Main Stadium, the Kaohsiung Dome, the Lotus Lake and the Love River) in Kaohsiung City. Those selected for the questionnaires were citizens whose residence was close to the chosen survey sites. They were considered to be more exposed to the impacts of the event, including the preparatory work (construction work, the hosting of pre-events, etc.), and the actual competitions themselves. A total of 720 face-to-face questionnaires were undertaken to gauge host residents" views in early June (pre-event) and late November (post-event) 2009. Of the 720 questionnaires, 655 were used in our study. In order to minimise any sampling errors and

to reduce potential bias to an acceptable level, various influential factors such as timing (weekdays vs. weekends, office hours vs. non-office hours), exact locations (precise streets and blocks), weather and residential proximity (tourism zones vs. non-tourism zones) were carefully considered.

For example, to account for fewer people being available at home on weekdays rather than weekends, weather restrictions and limited access to some houses, site visits to survey locations were scheduled to help reduce these problems. Furthermore, the surveyors were directed to seek an equal proportion of male and female respondents, yielding a response rate of 48% from males and 52% from females. This sampling plan was designed with the specific purpose to reflect the characteristics of the residents and their proximity to the host areas (Denscombe, 2003). More importantly, a pilot study was conducted in 2007 and the experience gained made it possible to pursue a smaller sampling frame in more targeted households.

A team of trained research assistants administered the pre-event surveys. The research team included undergraduate and master‟s degree students enrolled in the leisure, sport and tourism management program at the National Pingtung University of Science and Technology. The research assistants were selected based on their familiarity with the target areas. In addition, the research assistants participated in conducting a survey for a pilot study regarding the Games, carried out by the authors. The research team was instructed to visit host communities living close to the 4 competition venues. Citizens whose residences were closest to the selected survey sites were the most likely to be contacted. All respondents were well informed of the purpose of the study and they completed the questionnaire on the spot.

The research assistants who implemented the pre-event survey also conducted the post-games surveys. Again, the same survey sites and the same methods of data collection were employed. This research was a repeated cross-sectional study for which the data collection was conducted at various times using a different sample for each collection. This differs from longitudinal research, which surveys the same panel of participants over time in order to see how individuals change (Menard, 1991). The study also examined residents‟ perceptions over time in a similar method to other longitudinal studies focusing on major sport events, which indicated temporary changes in perceptions (Soutar & Mcleod, 1993; Mihalik & Simonetta, 1999; Kim & Petrick, 2005; Kim *et al*., 2006; Lorde *et al*., 2010).

Design and data analysis procedures

A series of statistical techniques were used, including an independent samples t-test, an exploratory factor analysis (construct validity), and a reliability analysis (Cronbach‟s alpha coefficient), to test and refine the VTIAS. Statistical procedures were conducted with data obtained prior to the Games, while data collected after the Games were used to validate the results of the exploratory factor analysis. By ranking each subject‟s total score from the highest to the lowest on VTIAS, 27% of both the highest and the lowest rankings were assigned to group 1 and group 2 respectively. With the assistance of Statistical Package for Social Sciences (SPSS) for Windows, the result of the equality test of means on each item, between the 2 groups was produced. If the item reached a significant level ($p<0.05$ or $p0<0.01$), it meant that it was able to effectively explore the level of reaction made by each

respondent.

Once this first step was complete, the exploratory factor analysis technique could be applied to test the „construct validity" of the scale. The function of this technique is to reduce or summarise a set of data by using a smaller set of factors or components (Pallant, 2001). Using this technique raised an issue for sample size. The range of the sample size varied, for example, from a minimum 100 (Gorsuch, 1983; Kline, 1994) to 200 (Guilford, 1956), and 300 cases (Tabachnick & Fidell, 2007). Gorsuch (1983) and Tabachnick and Fidell (2007) recommend that 5 cases for each item are adequate in most situations. Given the above considerations in the context of this research, the sample size (n=372 before the games; n=282 after the Games) satisfied the requirement of at least 100 and the ratio requirement of 5 to 1 (27x5=135 observations) was also satisfied. This research, therefore, satisfied the sample size requirement for factor analysis.

One-way MANOVA was performed to examine the changes in host residents" perceptions of the impact of the Games, both pre- and post-event. The mega-event (World Games) was treated as the independent variable and the four factors measuring residents" perceptions as the dependent variables.

RESULTS

TABLE 1: **DEMOGRAPHIC PROFILES OF RESIDENTS**

	Before the Games (n=372)		**After the Games** (n=283)		
Demographic characteristics	Frequency	%	Frequency	%	**Total**
Gender					
Male	173	47	143	51	316
Female	199	53	140	49	339
Age group					
Below 20 years	182	49	188	66	370
20-29 years	47	13	32	11	79
30-39 years	39	10	36	13	75
40-49 years	41	11	18	7	59
50-59 years	8	2	9	3	17
60 years and over	55	15	0	0	55
Marital status					
Single	266	72	205	72	471
Married	106	28	78	28	184
Occupation					
Shopkeeper	41	11	50	18	91
Student	179	48	155	55	334
Employed	105	28	41	14	146
Unemployed	8	3	13	5	21
Retired	5	1	9	3	14
Other	34	9	15	5	49
Educational level					
Junior High (& lower)	31	9	28	10	59
Senior High	119	32	84	30	203

Occupational School	112	30	73	26	185
College/University	105	28	86	30	191
Graduate (+above)	5	1	12	4	17
Annual income					
Below 240 000 NTD[a]	229	62	192	68	421
240 000-360 000 NTD	55	15	22	8	77
370 000-480 000 NTD	19	5	10	4	29
490 000-600 000 NTD	11	3	17	6	28
610 000-720 000 NTD	12	3	15	5	27
730 000-840 000 NTD	9	2	12	4	21
850 000-960 000 NTD	12	3	7	2	9
960 000 & above NTD	25	7	8	3	33

[a] One US Dollar was approximately equivalent to 32 New Taiwan Dollar (NTD) at the time of this study.

Demographic profile of respondents

Table 1 summarises the demographic profile of the study sample. Across the sample of 655 respondents, 48% were male and 52% were female. The majority of respondents were aged below 20 (72%), while groups aged over 50 made up 10% of respondents. A total of 72% of the participants were single, while 28% were married. The respondents reported their occupations as: shopkeeper (14%), student (51%), employed (22%), unemployed (3%), retired (2%), and other (8%). The majority of respondents had at least a senior or above education (91%), and 9% were educated at junior high school level or below. Eighty-four per cent (84%) earned below NT$600,000 (≈ USD$20,000) per year, while 16% were above the national income level of NT$600,000.

Factor analysis and reliability

When conducting the independent-samples t-test, items not reaching an appropriate significance level were removed from the analysis. Principal components extraction with varimax rotation was conducted. Three items were removed after 3 analyses because each of them covered only 1 item (3 to 7 items are required). Twenty-three items were left remaining.

For the factor analysis, the number of factors was determined using an eigenvalue equal to or greater than 1.0. Items with loadings of lower than 0.40 and with double loading were eliminated (Stevens, 1996). For each factor, an alpha coefficient equal to or greater than 0.50 is the minimum coefficient that could be accepted (Baumgartner & Jackson, 1999). The results of the factor analysis and reliability are presented in Table 2, using data collected before the Games. A four-factor solution was identified, with a total of 60.74% of the variance explained. The Cronbach alpha coefficient of all sub-scales on the VTIAS ideally ranged from 0.78 to 0.90, along with 0.91 on the total scale. According to the construct of VTIAS, content validity was achieved through rigorous research design and appropriate data analysis, supported by practical information coming from field observations. This analysis was finalized with 4 factors totalling 23 items. Table 3 shows the means scores and standard deviations for the samples before and after the Games.

Host residents' perceptions before and after the Games

A one-way between-groups multivariate analysis of variance was performed to investigate the change in perceptions of pre- and post-event impact (Table 4). Four dependent variables were used: general benefits; community involvement and development; negative impact; and

economic and image benefits. The independent variable was the mega-event. There was a statistically significant difference between pre- and post-event on the dependent variables, F (4, 649)=8.07, p<0.001; Wilk‟s Lambda=0.95, partial eta squared=0.04. When the results for the dependent variables were considered separately, the differences to reach statistical significance using Bonferroni adjusted alpha levels of 0.005 and 0.000, were general benefits, F (1, 655)= 4.33, p<0.05, partial eta squared=0.007, and negative impact, F (1, 655)=23.95, p<0.001, partial eta squared=0.036.

An inspection of the mean scores indicated that post-event reported slightly higher levels of general benefits (M=4.04, SD=0.65) than pre-event (M=3.94, SD=0.61), while post-event showed higher levels of negative impact (M=3.36, SD=0.76) than pre-event (M=3.08, SD=0.68). Overall, expected benefits („community involvement and development‟ and „economic and image benefits‟) had higher mean scores than perceived benefits, with the exception of „general benefits‟ regarding those items, such as „residents‟ pride‟, „interest in participating in sport‟ and „additional recreational opportunities‟. This suggests that local residents had higher expectations with regards to the benefits that the Games would generate for their community, which were not fully met.

TABLE 2: **RESULTS OF EXPLORATORY FACTOR ANALYSIS (Pre-Games)**

Factors	**Factor Loading**	**% of Variance**	**Cronbach Alpha**
General benefits		**22.71**	**0.90**
3. The city government made the right decision in hosting of the World Games	0.78		
5. City residents' pride has risen because of the World Games	0.76		
6. I believe the World Games should be actively supported in the local area	0.74		
1. I would like to see the city government to host sports mega-events like the World Games	0.73		
2. Hosting the World Games will give Kaohsiung more opportunities to host other sporting events	0.69		
4. Because of the World Games I will have more recreational opportunities	0.60		
16. The benefits of hosting the World Games will outweigh any of its negative impacts	0.57		
7. The World Games will increase local peoples' interest in participating in sport	0.55		
12. Hosting the World Games will enhance the city‟s beauty	0.48		
Community involvement and development		**14.72**	**0.82**
13. The city government listens to residents about their concerns with the World Games	0.70		
20. The World Games will boost this area's long-term economy	0.69		
17. Overall I believe my standard of living will be increased because of the World Games	0.68		
15. I support the World Games because of its vital role in our community	0.53		
18. Hosting the World Games will make Kaohsiung more of a tourist destination	0.52		
Negative impacts		**11.90**	**0.78**
23. The World Games will increase the crime rate in the local community	0.78		

22. The World Games will negatively impact the environment	0.73		
26. The World Games will result in price increase	0.72		
25. The World Games will result in traffic congestion	0.70		
24. Hosting the World Games will leave Kaohsiung with a negative image	0.69		
Economic and image benefits		**11.42**	**0.80**
9. The World Games will provide a short-term boost to the economy in this area	0.77		
8. Visitors to the World Games will contribute a sizable revenue to the local economy	0.67		
11. The World Games will draw national and international attention to this area	0.64		
10. The World Games will provide jobs for local people	0.60		
Total		**60.74**	**0.91**

TABLE 3: **MEAN AND SD OF IMPACT STATEMENTS (Pre- and Post-Games)**

Statements	**Pre-Games M±SD**	**Post-Games M±SD**
1. I would like to see the city government to host sports mega-events like the World Games	4.01±0.76	4.08±0.79
2. Hosting the World Games will give Kaohsiung more opportunities to host other sporting events	4.07±0.72	4.16±0.76
3. The city government made the right decision in hosting of the World Games	4.03±0.81	4.14±0.83
4. Because of the World Games I will have more recreational opportunities	3.92±0.84	3.89±0.96
5. City residents' pride has risen because of the World Games	3.98±0.82	4.19±0.84
6. I believe the World Games should be actively supported in the local area	3.91±0.79	4.01±0.81
7. The World Games will increase local people' interest in participating in sport	3.77±0.83	3.97±0.94
8. Visitors to the World Games will contribute a sizable revenue to the local economy	3.85±0.92	3.78±1.05
9. The World Games will provide a short-term boost to the economy in this area	4.03±0.80	3.98±0.93
10 The World Games will provide jobs for local people	3.53±0.96	3.45±1.00
11. The World Games will draw national and international attention to this area	4.09±0.77	4.09±0.85
12. Hosting the World Games will enhance the city"s beauty	3.94±0.87	4.06±0.87
13. The city government listens to residents about their concerns with the World Games	3.48±0.94	3.57±0.99
15. I support the World Games because of its vital role in our community	3.73±0.80	3.86±0.88
16. The benefits of hosting the World Games will outweigh any of its negative impacts	3.79±0.81	3.41±0.99
17. Overall I believe my standard of living will be increased because of the World Games	3.51±0.90	4.07±0.75
18. Hosting the World Games will make Kaohsiung more of a tourist destination	3.97±0.74	3.83±0.89
20. The World Games will boost this area's long-term economy	3.46±0.94	3.19±1.00

22. The World Games will negatively impact the environment	2.82±0.95	3.57±0.92
23. The World Games will increase the crime rate in the local community	3.32±0.88	3.85±0.94
24. Hosting the World Games will leave Kaohsiung with a negative image	3.65±0.93	2.89±1.16
25. The World Games will result in traffic congestion	2.56±0.94	3.31±1.02
26. The World Games will result in price increase	3.05±0.95	3.88±0.95

The 5-point Likert scale has been reversed on five negative items (22, 23, 24, 25, 26).
SD = Standard Deviation

The positive impacts that were expected prior the Games included „general benefits" (M=3.94), followed by „economic and image benefits" (M=3.88) and „community involvement and development" (M=3.63). The highly perceived positive impacts after the World Games were „general benefits" (M=4.04), followed by „economic and image benefits" (M=3.83), as well as „community involvement and development" (M=3.62). The largest gap score (0.10) between pre- and post-event surveys of positive impact was found with regard to „general benefits".

Expected costs (M=3.08) had a significantly lower mean score than perceived costs (M=3.35), indicating that local residents initially had "high" expectations about negative impacts as a result of the Games. However, throughout the phases of planning and event management, negative impacts as a result of the Games were lower than anticipated. The high expected costs prior to the Games were „traffic congestion" (M=2.56), followed by „environment impact" (M=2.82), „price increase" (M=3.05) and „crime rate" (M=3.32). „Negative image of Kaohsiung" (M=3.65) was expected to have the least impact. After the Games, highly perceived negative impacts, surprisingly, were „negative image of Kaohsiung" (M=2.89), followed by „traffic congestion" (M=3.31), „environmental impact" (M=3.57) and „crime rate" (M=3.58). „Price increase" (M=3.88) was ranked the lowest. It should be noted that the „negative image of Kaohsiung" is the only item that created a negative gap score between the two time periods.

TABLE 4: **MEANS AND ANOVA RESULTS BEFORE AND AFTER THE GAMES**

Factors	**Mean** Before	After	**Mean Diff.**	**F-test**	**p**
General benefits	3.94	4.04	0.10	4.19*	0.041
Community involvement and development	3.63	3.62	0.01	0.05	0.815
Negative Impacts	3.08	3.35	0.28	24.71***	0.000
Economic and Image Benefits	3.88	3.83	0.05	0.80	0.369

All items assessed on a 5-point scale (1= strongly disagree; 3= no opinion; 5= strongly agree).
* p<0.05 ** p<0.01 *** p<0.001

DISCUSSION AND CONCLUSIONS

The application of the Nicosia model and the longitudinal perspective develops this research beyond the typical impact study of event tourism. The Nicosia model offers a means to understand how host residents expect and perceive attributes and impacts of a major sport event over a period of time.

Host residents‟ perceptions of the positive and negative impacts changed significantly over time. This was particularly associated with „general benefits‟ and „negative impacts‟. The findings indicate that host residents‟ pre-event expectations of general benefits were comparatively high. Post-event perceptions were even higher than their expectations, with the exception of „more recreational opportunities‟ and „benefits outweigh any of its negative impacts‟. This may explain that while host residents supported the Games enthusiastically prior to the event, due to pride, increased sport participation and beautifying the city, they felt recreational facilities and opportunities would not increase dramatically after the event. The results may further relate to host residents‟ perceptions, that the benefits of hosting the event would not be worth the costs incurred.

Regarding pre-event perceptions of positive impacts, residents held relatively high expectations of general benefits, benefits of community involvement and development, as well as economic and image benefits. Nonetheless, subsequent to the Games, they realised that tangible or more direct benefits (additional recreational opportunities, short- and long-term boosts to the local economy and employment) were lower than expected. The results are consistent with findings by Mihalik (2000), Kim and Petrick (2005), Kim *et al*. (2006), and Lorde *et al*. (2010) and may be explained by applying the Nicosia model. During the pre-event period, host residents received messages generated from event agencies, so that perceptions of messages (or impacts) were essentially determined by organisational attributes. Given that host residents continue to be influenced by well-prepared messages for political purposes at the expense of more realistic challenges, the expectations regarding impact may possibly remain high. An individual‟s perceptions during the Games became the basis for their decision on whether to ignore them or become involved, forming a feedback loop. Based on this, residents modified their perceptions, post-games, which triggered another loop. Furthermore, another possible explanation for the results may be the high unemployment rate in Kaohsiung (noted earlier). Even if major sport events generate a wide variety of host benefits, residents are more concerned about personal issues, such as additional income, increased employment opportunities and increased amounts of visitors to the host destination (Crompton *et al*., 1998).

Even if the differences between host residents‟ pre- and post-games perceptions of „community involvement and development‟ were small, the fact is that post-game perceptions declined. This study is similar to previous research (Teye *et al*., 2002; Gursoy & Kendall, 2006), which suggests that community involvement in the phases of planning, decision-making and management of events in developing countries, tends to be limited. For example, a study undertaken two years prior to the Games demonstrated a lack of community involvement in relation to decision-making (M=3.59) (Ma *et al*., 2011). Accordingly, this study highlights that host residents‟ attitudes are relatively consistent with their perceptions (M=3.57). The results suggest that despite the importance of recognising host communities‟ views in ensuring event sustainability (Frey *et al*., 2007) and the involvement of the host community in portraying positive messages to visitors (Getz, 2005; Bowdin *et al*., 2006), political issues are given top priority.

In terms of negative impacts of hosting the Games, „traffic congestion" and „overall environmental impact" were expected to have the largest negative impacts, followed by „price increase" and „crime rate". „Negative image of Kaohsiung City" was considered to be the least significant problem. Post-game perceptions suggest that actual congestion and overall environmental impact were less than originally expected. The present findings reveal gap scores for negative impact that were comparatively large and positive, suggesting that these issues did not occur as much as anticipated during the Games. This was consistent with previous research by Soutar & McLeod (1993), Kim *et al*. (2006) and Lorde *et al*. (2010), indicating that the Games were held without major negative social impacts, traffic congestion, or environmental impact (pollution).

Traffic congestion was expected to be a serious problem during the event. The post-event perceptions of the impact of traffic, indicates that it was handled much better than expected. Current findings were consistent with previous studies (Kim *et al*., 2006; Lorde *et al*., 2010),

suggesting that the commitment made by the organising committee and the KCG to implement an efficient traffic plan, was well executed and successfully eased the feelings of uncertainty among local residents. However, host residents were increasingly concerned about the impact of a „negative image of Kaohsiung". A survey undertaken two years prior to the Games (Ma *et al*., 2011) indicates that a „negative image of Kaohsiung" was the least anticipated negative impact. The outcome of the aforementioned survey is consistent with the results of this study. Surprisingly, residents perceived it as the most serious post-event impact. It was postulated that the withdrawal of the Chinese team during the opening and closing ceremonies, could have been a possible reason. Furthermore, it may have been due to the political disputes over the budget as reported in Taiwanese newspapers (Shan, 2009). It should be noted, that Ma *et al.*"s (2011) study was carried out at a time when the same party governed both the central Government and Kaohsiung City. However, this was undertaken at a time when different parties governed the central Government and Kaohsiung City. According to Smith (2005), many cities adopt sport as part of a re-imaging strategy, though such initiatives do not necessarily boost the credibility of a destination and can even hinder the city"s reputation. Indeed, future studies could evaluate the extent to which the re-imaging strategies are in conjunction with the hosting of the Games, as it may be used to assess how this may contribute to attracting visitors.

Kaohsiung City is likely to host other major sport events in future. Information based on host residents" pre- and post-event perceptions may assist policy makers, event planners and entrepreneurs to better understand factors that are key to the success of future events, but were not well managed during the planning stage of the Games. The Games were subsidised through public expenditure, similar to other events such as the 2002 World Cup in South Korea and the 2007 ICC Cricket in the Caribbean area. In other words, host communities are directly and significantly affected by the events, particularly with regard to contributing intensive public resources and capital. Therefore, if the reasons for hosting a major event are political in nature, then the opinion of host communities is more likely to influence its success.

The regular assessment of residents" perceptions has long been requested, as the cumulative information may be more informative and insightful (Ritchie & Lyons, 1987; Kim *et al*.,

2006; Ritchie *et al*., 2009; Lorde *et al*., 2010). For example, intervals from three to six months between pre- and post-game periods were commonly adopted. However, this raised a question as to how long or how often assessments should be made. On some occasions, it is possible that another major event of a similar magnitude may be planned (including in nearby areas) before or during post-games surveys are conducted. The event will become a moderator, which interacts with the targeted event. Therefore, it is argued that pre- and post-data are obtained only once, with a one-month lead and four-month lag, otherwise data may not be sufficient to measure views on perceived impacts due to an interactive relationship between an individual and the Games. It is strongly recommended that for future research, the consideration of regular assessment of residents‟ be appraised.

Determining the number of impacts to include in the survey required a sufficient review of the related literature. To create comparable benchmarks across different cases, it needs to be understood why previous study designs were used to determine the contents of the survey (Kim *et al*., 2006; Lorde *et al*., 2010) including this study. Yet, the character of each host

location and event differ. The current study suggests that "impacts" should be justified specifically based on the multifaceted nature of event magnitude and character, as well as the development stage of a host city. Consequently, the results might be more informative. For example, findings of this study indicate that host residents were increasingly concerned about economic output of the Games. This corresponds to the high unemployment rate in local areas.

From a practical standpoint, the findings of our study suggest that for the most part, host respondents agree that the KCG made the right decision with regard to hosting the Games. It should be noted, that these views are derived from host rather than non-host communities. Event organisers cannot assume that most Kaohsiung citizens hold similar views. Perhaps in future event studies, it might be appropriate to survey the perceptions of non-host residents also in order to ascertain if they differ or are similar over time. Furthermore, it is known that challenges regarding economic issues did exist in terms of organising the Games. Obviously, some of the expected rewards from staging a major sport event are yet to be seen, such as to the „trickle-down effect‟ of sport participation and health improvement. For how long and to what extent does staging a major sport event play in encouraging sport participation and thus improve the health of residents in a host city? How is this measured? The answers to these questions need to be investigated so that evidence of the trickle-down effect can be scientifically studied.

Hosting major events is a part of a strategy in response to solving Kaohsiung City's economic problems. However, to achieve a positive change, it is clear that longer-term issues need to be addressed and relevant strategies put in place. For instance, the event venues such as the Main Stadium (developed with public funding) are a significant long-term economic challenge. When the Games ended, the Main Stadium became an icon of Kaohsiung City. However, it costs approximately USD$2.5 million each year for it to be operational. Such issues are not only relevant to other host cities, but also require substantial solutions from event studies. Firstly, in order to establish a long-term relationship with local communities, Government authorities such as the Sports Department and public health officials can partner with local schools and universities, to design and implement Physical Education curricula that are specific for local residents. This will enhance the patronage of sport facilities. Secondly, in

future events the Games themed programs can involve local residents before and during the event, as well as recruiting volunteers from host residents to manage the facilities and environments in the long-term. Thirdly, to enhance the usage rate and to maximise the return on investment, relevant authorities should consider potential solutions, such as attracting the health industry to the Main Stadium. Potential examples include using the facility as a sport club, setting up a memorial hall and promoting the Main Stadium as a tourist attraction. The Sports Department of the KCG could assign a team, which would be responsible for theme marketing, activities, as well as national and international events and programming.

As the areas under the jurisdiction of Kaohsiung City have been expanded from 11 to 37 in 2010, this may suggest a need for rethinking a brand new event strategy in the future, which differs from the Games. Districts located on the edge of the jurisdiction are generally abundant with natural resources, yet lack infrastructure (the expanded areas). The public sector should initiate measures to balance the economic disparities that exist in these areas in comparison to those areas in the urban centre of the city. To this end, the Central Place

Theory (Malizia & Feser, 1999; Daniels, 2007), which examines why some destinations are better suited to tourism development than others, may offer some additional insight for future research. Along with the use of the Nicosia model, the Central Place Theory may be used to assist in better understanding the multi-faceted nature of mega-events through externally driven effects.

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HOST RESIDENTS' PERCEPTIONS OF THE IMPACT OF THE 2009 WORLD GAMES ON KAOHSIUNG: A LONGITUDINAL PERSPECTIVE

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ABSTRACT

This study assesses host residents' perceived impacts of the 2009 Kaohsiung World Games (the Games) on their communities. The main purpose was to investigate host residents' perceptions concerning the impact of staging the Games, looking at the issues affecting communities both before and after the event. Importantly the study introduces a new theoretical basis for assessing event tourism impacts. From a statistical perspective, significant differences were found concerning perceived general benefits, as well as negative impacts. The Nicosia model was used to help explain the findings. Overall, residents held relatively high expectations of general benefits, benefits of community involvement and development, in addition to economic and image benefits. Subsequent to the Games, residents realised that tangible or more direct benefits (such as additional recreational opportunities, short and long term boosts to the local economy and increased employment) were lower than expected. The study concludes by emphasising the importance of adopting a strategic approach, which focuses on engaging beneficiaries (host residents) in the early stages of event development. Planners should also seek to match the destination's development policies to the desired outcomes of the event.

Key words: World Games; Sports mega-events; Residents‟ perceptions; Nicosia model.

INTRODUCTION

The 2009 World Games (the Games) hosted by Kaohsiung City took place over an 11-day period, from 16 to 26 July 2009. The host city welcomed approximately 5000 delegates and

athletes from 103 countries, competing for 1485 medals in 31 sporting events. During the closing ceremony, the President of the International World Games Association described the Games as the best event ever, a great honour for the organising committee and the event‟s 6000 plus volunteers.

In preparation for the Games, the Kaohsiung City Government increased the development of public infrastructure and made improvements to the transportation network. It was anticipated that the Games would attract 400 000 visitors to the city (Ma *et al*., 2011). Such preparations included spending several million US dollars on the construction of two new sport facilities

(Main Stadium and Kaohsiung Dome), the refurbishment of 22 competition venues (Lotus Lake), and the renovation of infrastructure (Wi-Fi environment, Zhongshan Road, Formosa Boulevard and Bo-ai World Games Boulevard).

The Games featured 31 sporting events, including artistic and dance sport (acrobatic gymnastics, dance sport, aerobic gymnastics, artistic roller skating, rhythmic gymnastics, and trampoline and tumbling gymnastics); ball sports (beach handball, fist ball, canoe polo, tchoukball, korfball, racquetball, rugby sevens, softball and squash); martial arts (ju-jitsu, sumo, karate, and wushu); precision sport (billiards, boules sport, archery and bowling); strength sport (bodybuilding, tug-of-war and power lifting); and trend sport (air sport, climbing, fin swimming, dragon boat racing, flying disc, lifesaving, orienteering, roller sport and water skiing). In all, 274 769 tickets were sold (72.87 % of all tickets), contributing a total of NT$63.34 million (USD$1.38 million) to the event.

Kaohsiung, the second largest city in southern Taiwan, was once symbolic of the Taiwanese economic boom of the 1980s and 1990s. It now faces a post-industrial era similar to that experienced in many western European economies during the 1970s and 1980s. The high unemployment rate is strongly associated with significant changes to the industrial structure (Ma *et al*., 2006). While the economy was previously reliant on production-based activities, it has now shifted towards high technology and services. Kaohsiung citizens have long criticised the employment situation confronting their city. Official statistics show that unemployment rates in Kaohsiung have remained higher than the national average from 2003 to 2007 and the national unemployment figures during this period were: 4.9%, 4.4%, 4.1%, 3.9% and 3.9% respectively, as compared with Kaohsiung unemployment figures during this period: 5.2%, 4.6%, 4.2%, 4.2%, and 4.2% respectively (Department of Budget, Accounting and Statistics, Kaohsiung City Government, 2008; Directorate General of Budget, Accounting and Statistics, Executive Yuan, R.O.C., 2008).

In response to key aspects of the economic recession, the Kaohsiung City Government (KCG) dealt with criticism by initiating a wide range of strategies, including hosting large events such as the Games (Ma *et al*., 2006). While Kaohsiung citizens felt very proud to host an event of such magnitude as the Games, some were concerned about the large amounts of tax money being spent by the KCG. The total expenditure was estimated at NTD$23.15 billion (USD$723.4 million) (Ma, 2009), including the cost for the organising committee (USD$77.5 million), construction and refurbishment of sport facilities (USD$407.2 million), road construction (USD$21.1 million) and telecommunications (USD$217.3 million). Whilst the Games were being widely publicised by the local Government, many residents were becoming sceptical of the benefits of hosting such a large-scale event.

Given the increasing reliance of many cities on hosting major events to catalyse redevelopment and promotion, the need to establish effective strategies to assess community impacts has become an important factor (Ma *et al*., 2006). More significantly, local residents are often influential groups and the success of the event is largely dependent on a supportive and involved local community (Fredline, 2006). It is also noted that event planners and stakeholders use the views of the community as a measure of the success and sustainability of their investment (Williams & Lawson, 2001). An understanding of the level of support the host community has for the hosting of events could well inform policy makers in the planning and promotion of future events (Bull & Lovell, 2007).

While much is known about the perceived economic and social impact of certain types of major sporting events, such as the Olympic Games, there has been comparatively little evaluation of other types of events, such as the World Games. The issues studied in relation to the Games so far, include bidding strategies (Jeng, 2007), event planning (Hsueh, 2007), sport facilities and urban re-development (Li, 2006), sport mega-events and urban development (Chang & Huang, 2009; Liu, 2009), destination and national image (Lai, 2006; Tsai, 2006; Hsu & Haung, 2007), mass rapid transit (Weng, 2007), the impacts of social development (Research, Development and Evaluation Commission, Kaohsiung City Government, 2010), the application of the photovoltaic system in sport facilities (Lien, 2006), the development of World Games (Tsai, 2007) and the management of volunteers involved in large scale sport events (Hsieh, 2006). Despite a number of research studies being conducted with regards to the Games, no empirical research has focused, on the host residents‟ perceptions. In addition, no research to date has developed a longitudinal approach to attempt to better understand how or why host residents‟ perceptions may vary over time.

However, a growing number of studies (Soutar & McLeod, 1993; Mihalik & Simonetta, 1999; Deccio & Baloglu, 2002; Waitt, 2003; Kim & Petrick, 2005; Kim *et al*., 2006; Lorde *et al*., 2010) have suggested the importance of examining host residents‟ perceptions about the impact of hosting such an event. Furthermore, it was advocated that such studies should consider relevant time-periods and would assist policy-making and planning. Against this background, the purpose of this study is to investigate host residents‟ perceptions regarding the impact of staging the Games (both before and after the event). The research compares residents‟ perceptions between the two time-periods and develops a new theoretical base for the analysis of event tourism.

LITERATURE REVIEW

Theoretical foundation

Modern social exchange theory is a general sociological theory regarding the exchange of resources between individuals and groups in the context of an interactive situation (Ap, 1992). This interaction suggests that when some kind of benefit is derived from the exchange, an individual or group would be willing to exchange something with another party. The theory has previously been applied to the study of residents' perceptions of tourism (Bryant & Napier, 1981; Ap, 1992; Perdue *et al*., 1999; Deccio & Bloglu, 2002).

Lankford and Howard (1994) argue that those who receive direct benefits from tourism are less likely to attribute negative social and environmental consequences to it, and hold more positive attitudes toward its expanded development. The extent to which local residents accept or reject changes attributable to tourism, depend to a large extent, on residents' perceptions of how it affects their own personal welfare and lifestyle. In addition, social representation theory has used an alternative (Moscovici, 1982; Pearce *et al*., 1996), which refers to „systems of preconceptions, images and values" about a phenomenon (Kim *et al*., 2006). In tourism literature, it is noted that when local residents are likely to understand a new event around them (a sport event), their past experiences, knowledge and values of the

event are regarded as a „reference point" (Fredline & Faulkner, 2002). The theory implies that residents may interact with various information sources that shape their primary perceptions and simultaneously informs their representations of tourism, which show their feelings of its impacts (Fredline, 2006).

Recognising that organising a large-scale event is particularly complicated, the researcher borrowed a model (Nicosia model) from the field of consumer behaviour, to help understand the interrelationships between 'attitudes' and 'attributes' within the context of this study. The Nicosia model comprises of a flow diagram, which illustrates a consumer"s decision-making process. The model assumes that "no prior consumer knowledge or experience with the product exists" (Vignali *et al.*, 2001:463). Consumers in this case study (the host residents) had never before experienced a sports mega-event like the World Games. According to the model, the salient features begin with the flow of a message from a company to the „internalisation" of the message by a consumer. Perception of the message is determined by the attributes of both the company and consumer (Gilligan & Wilson, 2003). At this stage of the process, internalisation is used to signify operations, such as the physical perception of the stimulus attributes, environmental attributes prevailing at the moment of perception, and cognitive structures that give meaning to the stimulus and its components (Nicosia, 1968). A consequence is that it may lead to the development of an attitude towards the product.

The following stage consists of a search process, both internal and external. The consumer is to search for the product that is evaluated by means of information from social psychological fields (internal search) concerning advertising messages, the product, the brand's sellers and so on, or by means of information associated with the attitude from overt activities (external search), such as shopping and self-exposure to advertisements. The search process may or may not lead to the purchase of the product. The experience of consumption then becomes a factor that can influence the consumer's psychological state and plays a part in the consumer's disposition, leading to a decision on whether to purchase the product or not. Therefore, it forms a feedback loop. Despite being criticised as oversimplifying the decision-making process of consumer behaviour, the Nicosia model has been widely adopted in understanding consumer behaviour (Ma, 2009).

Actions taken by event planners represent organisational attributes (attributes of the Kaohsiung Organising Committee [KOC] and the KCG). The interaction between these attributes generates a message (the preparatory work) to the consumer (the host residents). The perception of the message is determined by organisational attributes at this stage. However, it should be noted that the consumer could possibly be further exposed to the message, which reshapes the „consumer attributes". This process is called internalisation of

the message, which denotes operations, such as perception of economic, social and environmental impacts (event attributes) generated by preparatory work. Consequently, the results may lead to the formation of an attitude toward the product (Games). The Nicosia model underlies the mechanism between actions by event planners and the evaluation of attitudes towards and perceptions of impact. Previous studies (Kim *et al.*, 2006; Lorde *et al*., 2010) investigating the changes of host residents‟ perceptions regarding the impact of major sport events usually draw on „prospect theory‟ and „social exchange theory‟ as theoretical bases. The current study, based on the Nicosia Model, has cast new light on the analysis of event tourism.

Perceived impacts of mega-events

Mega-events are increasingly seen as tourist attractions (Getz, 1989). Consequently, hosting major events has become an integral part of the tourism marketing strategies for many cities (Getz, 1989; Thorne & Munro-Clark, 1989; Ritchie & Smith, 1991; Mules & Faulkner, 1996; Fredline & Faulkner, 1998). The benefits are broader than just the immediate tourism effects (Hall, 1992). Local residents develop expectations regarding potential impacts from the moment the decision is made to stage an event. They perceive these, both positively and negatively, during and long after the event.

A wide variety of consequences have been seen regarding the staging of mega-events. Economic benefits range from urban regeneration (Gratton *et al*., 2005; Solberg & Preuss, 2007), employment (Spilling, 1998; Masterman, 2004), business leveraging (Masterman, 2004; O‟Brien, 2006), providing opportunities for recreational activities (Allen *et al*., 1993), sources of income (Kang & Purdue, 1994; Madden, 2002), tourism (Solberg & Preuss, 2007), as well as a change in consumer habits (Frey *et al*., 2007).

Positive social impacts involve an increase in: community engagement (Hillier, 1998; Fredline, 2006; Leonardsen, 2007; Shipway, 2007), community pride (Hall, 1989; Waitt, 2003), social equity (Bramwell, 1997; London Organising Committee of the Olympic and Paralympic Games & Olympic Delivery Authority [LOCOG & ODA], 2007a), cultural exchange (Garcia, 2003, 2004; Shipway & Brown, 2007), sport participation (Collins *et al*., 1999) and health promotion (Frey *et al*., 2007; LOCOG & ODA, 2007b; Wang & Theodoraki, 2007). It has also been suggested that environmental projects benefit from cities hosting major events (Preuss, 2004). High profile events are likely to generate an increased interest in natural landscapes and local heritage conservation, placing environmental projects in a position to attract greater funding instead of being potentially ignored (IOC, 1999; Deccio & Baloglu, 2002).

Along with producing a huge range of positive benefits to host destinations (to local communities in particular), it is acknowledged that financial costs may generate opposition from local communities. For instance, the staging of mega-events can result in price inflation of goods, services and property, placing a huge burden on local residents (Deccio & Baloglu, 2002). Furthermore, mismanagement of public funds can actually increase costs over time, a situation which is likely to intensify any negative perceptions of hosting events (Deccio & Baloglu, 2002; Ritchie *et al*., 2009). The lessons are still vivid from the experiences of the 1976 Montreal Olympic Games and the 1991 Sheffield World Student Games, which both resulted in debts of around £692 million (Gratton & Taylor, 2000), and £10.4 million (Bramwell, 1997) respectively. Sheffield will be repaying their debt until 2025 (Wallace,

2001).
Major events may also result in negative social impact. For example, the interests of marginalised groups are frequently ignored (Cashman, 2006), traffic congestion may occur during the construction of event venues or during the event itself (Fredline, 2004) and crime may increase due to an influx of visitors to the host destination (Ritchie *et al*., 2009). In addition, the planning of the event may influence the image of the host community held by prospective visitors. This may be due, for example, to increased costs (Ritchie, 1984; Hillier, 1998). Furthermore, political turmoil may occur as a result of a lack of community wide

participation and empowerment in the decision-making process (Roche, 1994). Such a situation occurred during the 1991 Sheffield World Student Games where the main local political party was negatively affected as a result of alienating the community from decision-making processes (Bramwell, 1997). Likewise, with regards to the 1988 Olympics and the 2002 World Cup in Korea, Kim *et al*. (2006) argue that the residents‟ dissatisfaction with the actual benefits (such as economic benefits) may be attributed to their lack of involvement in the planning and decision-making process. Apart from the economic and social impact of hosting a major event, consideration needs to be given to the adverse effects of such an event on the natural and physical environment. This may be through changes of land use (Gursoy & Kendall, 2006), pollution of beaches and lakes caused by the construction of competition sites and a deterioration of historical or natural resources (Kim *et al*., 2006).

RESEARCH METHODS

Setting

Kaohsiung is the largest commercial harbour and the second largest city in Taiwan, with a population of 1.5 million. Kaohsiung is situated on the southwestern coast of Taiwan and comprises an area of 154 square kilometres. The local economy is dependent mostly on heavy industry and the production of petrochemicals. The city is comprised of 11 districts, with the Zuoying and Cianjnn Districts being most relevant to this study. These districts are relevant firstly, because competition sites such as the Main Stadium, the Lotus Lake, the Kaohsiung Dome and the World Games Boulevard are located in Zuoying District. The Love Riverside, situated in Cianjnn District was the area used for Boules Sports. This area has long been the most popular site to hold various national and international festivals. Therefore, people living in these areas were more aware of events taking place and the events had a more immediate impact on their lives. Secondly, the areas targeted within each district were most likely to be influenced by the staging of the Games. This research examined the „main effects‟, as they happened within the host areas, rather than the „spill over effects‟, as they occurred within general areas.

As Finn *et al*. (2000) highlighted, an accurate sampling frame does not always exist, therefore non-probability samples, which are usually found in visitor attractions and sporting events, were used in our research. In studying this case, purposive sampling of non-probability was used for the survey, given an accurate sampling frame was unavailable. This was largely due to the ambiguous boundaries between host and non-host zones. While this sample cannot be representative of the larger population, it is recognised to be more representative of the majority of residents from host communities.

Survey and data-collection procedures

The tool used for data collection was a tourism impact scale, specifically developed for major sports events. This scale was used in a previous study conducted by Ma *et al*. (2011), which investigated residents‟ attitudes regarding the potential impact of the Games prior to the event. The scale is composed of 26 items based on the Verified Tourism Impact Attitude Scale (VTIAS) developed by Ma *et al*. (2011), as well as a number of sources in event tourism literature (Ritchie, 1984; Getz, 1991, 1997; Hall, 1992; Lankford & Howard, 1994; Shultis *et al*., 1996, Twynam & Johnston, 2004). The VTIAS was developed by Lankford and Howard (1994) and has been previously used to assess residents‟ attitudes toward tourism. However, it is also noted that the impact of major events are generally quite similar to those of tourism (Fredline & Faulkner, 2002). Consequently, the VTIAS may be used to assess and interpret residents‟ perspectives of event tourism (Twynam & Johnston, 2004). The VTIAS measured various dimensions of the Games, including 5 statements on the economic impact, and 21 statements on the social and environmental impact of the event. Responses to the items of VTIAS were given on a 5-point Likert scale where 1 was equivalent to “strongly disagree”, 3 was equivalent to “no opinion” and 5 was equivalent to “strongly agree”. Basic demographic items were also included such as gender, marital status, age, occupation, educational attainment and annual personal income.

Data were collected from host communities located close to the 4 competition venues (the Main Stadium, the Kaohsiung Dome, the Lotus Lake and the Love River) in Kaohsiung City. Those selected for the questionnaires were citizens whose residence was close to the chosen survey sites. They were considered to be more exposed to the impacts of the event, including the preparatory work (construction work, the hosting of pre-events, etc.), and the actual competitions themselves. A total of 720 face-to-face questionnaires were undertaken to gauge host residents‟ views in early June (pre-event) and late November (post-event) 2009. Of the 720 questionnaires, 655 were used in our study. In order to minimise any sampling errors and to reduce potential bias to an acceptable level, various influential factors such as timing (weekdays vs. weekends, office hours vs. non-office hours), exact locations (precise streets and blocks), weather and residential proximity (tourism zones vs. non-tourism zones) were carefully considered.

For example, to account for fewer people being available at home on weekdays rather than weekends, weather restrictions and limited access to some houses, site visits to survey locations were scheduled to help reduce these problems. Furthermore, the surveyors were directed to seek an equal proportion of male and female respondents, yielding a response rate of 48% from males and 52% from females. This sampling plan was designed with the specific purpose to reflect the characteristics of the residents and their proximity to the host areas (Denscombe, 2003). More importantly, a pilot study was conducted in 2007 and the experience gained made it possible to pursue a smaller sampling frame in more targeted households.

A team of trained research assistants administered the pre-event surveys. The research team included undergraduate and master‟s degree students enrolled in the leisure, sport and tourism management program at the National Pingtung University of Science and Technology. The research assistants were selected based on their familiarity with the target areas. In addition, the research assistants participated in conducting a survey for a pilot study regarding the

Games, carried out by the authors. The research team was instructed to visit host communities living close to the 4 competition venues. Citizens whose residences were closest to the selected survey sites were the most likely to be contacted. All respondents were well informed of the purpose of the study and they completed the questionnaire on the spot.

The research assistants who implemented the pre-event survey also conducted the post-games surveys. Again, the same survey sites and the same methods of data collection were employed. This research was a repeated cross-sectional study for which the data collection was conducted at various times using a different sample for each collection. This differs from longitudinal research, which surveys the same panel of participants over time in order to see how individuals change (Menard, 1991). The study also examined residents‟ perceptions over time in a similar method to other longitudinal studies focusing on major sport events, which indicated temporary changes in perceptions (Soutar & Mcleod, 1993; Mihalik & Simonetta, 1999; Kim & Petrick, 2005; Kim *et al*., 2006; Lorde *et al*., 2010).

Design and data analysis procedures

A series of statistical techniques were used, including an independent samples t-test, an exploratory factor analysis (construct validity), and a reliability analysis (Cronbach‟s alpha coefficient), to test and refine the VTIAS. Statistical procedures were conducted with data obtained prior to the Games, while data collected after the Games were used to validate the results of the exploratory factor analysis. By ranking each subject‟s total score from the highest to the lowest on VTIAS, 27% of both the highest and the lowest rankings were assigned to group 1 and group 2 respectively. With the assistance of Statistical Package for Social Sciences (SPSS) for Windows, the result of the equality test of means on each item, between the 2 groups was produced. If the item reached a significant level ($p<0.05$ or $p0<0.01$), it meant that it was able to effectively explore the level of reaction made by each respondent.

Once this first step was complete, the exploratory factor analysis technique could be applied to test the „construct validity‟ of the scale. The function of this technique is to reduce or summarise a set of data by using a smaller set of factors or components (Pallant, 2001). Using this technique raised an issue for sample size. The range of the sample size varied, for example, from a minimum 100 (Gorsuch, 1983; Kline, 1994) to 200 (Guilford, 1956), and 300 cases (Tabachnick & Fidell, 2007). Gorsuch (1983) and Tabachnick and Fidell (2007) recommend that 5 cases for each item are adequate in most situations. Given the above considerations in the context of this research, the sample size (n=372 before the games; n=282 after the Games) satisfied the requirement of at least 100 and the ratio requirement of 5 to 1 (27x5=135 observations) was also satisfied. This research, therefore, satisfied the sample size requirement for factor analysis.

One-way MANOVA was performed to examine the changes in host residents‟ perceptions of the impact of the Games, both pre- and post-event. The mega-event (World Games) was treated as the independent variable and the four factors measuring residents‟ perceptions as the dependent variables.

RESULTS

TABLE 1: **DEMOGRAPHIC PROFILES OF RESIDENTS**

	Before the Games (n=372)		**After the Games** (n=283)		
Demographic characteristics	Frequency	%	Frequency	%	**Total**
Gender					
Male	173	47	143	51	316
Female	199	53	140	49	339
Age group					
Below 20 years	182	49	188	66	370
20-29 years	47	13	32	11	79
30-39 years	39	10	36	13	75
40-49 years	41	11	18	7	59
50-59 years	8	2	9	3	17
60 years and over	55	15	0	0	55
Marital status					
Single	266	72	205	72	471
Married	106	28	78	28	184
Occupation					
Shopkeeper	41	11	50	18	91
Student	179	48	155	55	334
Employed	105	28	41	14	146
Unemployed	8	3	13	5	21
Retired	5	1	9	3	14
Other	34	9	15	5	49
Educational level					
Junior High (& lower)	31	9	28	10	59
Senior High	119	32	84	30	203
Occupational School	112	30	73	26	185
College/University	105	28	86	30	191
Graduate (+above)	5	1	12	4	17
Annual income					
Below 240 000 NTD[a]	229	62	192	68	421
240 000-360 000 NTD	55	15	22	8	77
370 000-480 000 NTD	19	5	10	4	29
490 000-600 000 NTD	11	3	17	6	28
610 000-720 000 NTD	12	3	15	5	27
730 000-840 000 NTD	9	2	12	4	21
850 000-960 000 NTD	12	3	7	2	9
960 000 & above NTD	25	7	8	3	33

[a] One US Dollar was approximately equivalent to 32 New Taiwan Dollar (NTD) at the time of this study.

Demographic profile of respondents

Table 1 summarises the demographic profile of the study sample. Across the sample of 655 respondents, 48% were male and 52% were female. The majority of respondents were aged below 20 (72%), while groups aged over 50 made up 10% of respondents. A total of 72% of

the participants were single, while 28% were married. The respondents reported their occupations as: shopkeeper (14%), student (51%), employed (22%), unemployed (3%), retired (2%), and other (8%). The majority of respondents had at least a senior or above education (91%), and 9% were educated at junior high school level or below. Eighty-four per cent (84%) earned below NT$600,000 (≈ USD$20,000) per year, while 16% were above the national income level of NT$600,000.

Factor analysis and reliability

When conducting the independent-samples t-test, items not reaching an appropriate significance level were removed from the analysis. Principal components extraction with varimax rotation was conducted. Three items were removed after 3 analyses because each of them covered only 1 item (3 to 7 items are required). Twenty-three items were left remaining.

For the factor analysis, the number of factors was determined using an eigenvalue equal to or greater than 1.0. Items with loadings of lower than 0.40 and with double loading were eliminated (Stevens, 1996). For each factor, an alpha coefficient equal to or greater than 0.50 is the minimum coefficient that could be accepted (Baumgartner & Jackson, 1999). The results of the factor analysis and reliability are presented in Table 2, using data collected before the Games. A four-factor solution was identified, with a total of 60.74% of the variance explained. The Cronbach alpha coefficient of all sub-scales on the VTIAS ideally ranged from 0.78 to 0.90, along with 0.91 on the total scale. According to the construct of VTIAS, content validity was achieved through rigorous research design and appropriate data analysis, supported by practical information coming from field observations. This analysis was finalized with 4 factors totalling 23 items. Table 3 shows the means scores and standard deviations for the samples before and after the Games.

Host residents' perceptions before and after the Games

A one-way between-groups multivariate analysis of variance was performed to investigate the change in perceptions of pre- and post-event impact (Table 4). Four dependent variables were used: general benefits; community involvement and development; negative impact; and economic and image benefits. The independent variable was the mega-event. There was a statistically significant difference between pre- and post-event on the dependent variables, $F(4, 649)=8.07$, $p<0.001$; Wilk‟s Lambda=0.95, partial eta squared=0.04. When the results for the dependent variables were considered separately, the differences to reach statistical significance using Bonferroni adjusted alpha levels of 0.005 and 0.000, were general benefits, $F(1, 655)= 4.33$, $p<0.05$, partial eta squared=0.007, and negative impact, $F(1, 655)=23.95$, $p<0.001$, partial eta squared=0.036.

An inspection of the mean scores indicated that post-event reported slightly higher levels of general benefits (M=4.04, SD=0.65) than pre-event (M=3.94, SD=0.61), while post-event showed higher levels of negative impact (M=3.36, SD=0.76) than pre-event (M=3.08, SD=0.68). Overall, expected benefits („community involvement and development‟ and „economic and image benefits‟) had higher mean scores than perceived benefits, with the exception of „general benefits‟ regarding those items, such as „residents‟ pride‟, „interest in participating in sport‟ and „additional recreational opportunities‟. This suggests that local residents had higher expectations with regards to the benefits that the Games would generate for their community, which were not fully met.

TABLE 2: **RESULTS OF EXPLORATORY FACTOR ANALYSIS (Pre-Games)**

Factors	Factor Loading	% of Variance	Cronbach Alpha
General benefits		**22.71**	**0.90**
3. The city government made the right decision in hosting of the World Games	0.78		
5. City residents' pride has risen because of the World Games	0.76		
6. I believe the World Games should be actively supported in the local area	0.74		
1. I would like to see the city government to host sports mega-events like the World Games	0.73		
2. Hosting the World Games will give Kaohsiung more opportunities to host other sporting events	0.69		
4. Because of the World Games I will have more recreational opportunities	0.60		
16. The benefits of hosting the World Games will outweigh any of its negative impacts	0.57		
7. The World Games will increase local peoples' interest in participating in sport	0.55		
12. Hosting the World Games will enhance the city‟s beauty	0.48		
Community involvement and development		**14.72**	**0.82**
13. The city government listens to residents about their concerns with the World Games	0.70		
20. The World Games will boost this area's long-term economy	0.69		
17. Overall I believe my standard of living will be increased because of the World Games	0.68		
15. I support the World Games because of its vital role in our community	0.53		
18. Hosting the World Games will make Kaohsiung more of a tourist destination	0.52		
Negative impacts		**11.90**	**0.78**
23. The World Games will increase the crime rate in the local community	0.78		
22. The World Games will negatively impact the environment	0.73		
26. The World Games will result in price increase	0.72		
25. The World Games will result in traffic congestion	0.70		
24. Hosting the World Games will leave Kaohsiung with a negative image	0.69		
Economic and image benefits		**11.42**	**0.80**
9. The World Games will provide a short-term boost to the economy in this area	0.77		
8. Visitors to the World Games will contribute a sizable revenue to the local economy	0.67		
11. The World Games will draw national and international attention to this area	0.64		
10. The World Games will provide jobs for local people	0.60		
Total		**60.74**	**0.91**

TABLE 3: **MEAN AND SD OF IMPACT STATEMENTS (Pre- and Post-Games)**

Statements	Pre-Games M±SD	Post-Games M±SD
1. I would like to see the city government to host sports mega-events like the World Games	4.01±0.76	4.08±0.79
2. Hosting the World Games will give Kaohsiung more opportunities to host other sporting events	4.07±0.72	4.16±0.76
3. The city government made the right decision in hosting of the World Games	4.03±0.81	4.14±0.83
4. Because of the World Games I will have more recreational opportunities	3.92±0.84	3.89±0.96
5. City residents' pride has risen because of the World Games	3.98±0.82	4.19±0.84
6. I believe the World Games should be actively supported in the local area	3.91±0.79	4.01±0.81
7. The World Games will increase local people' interest in participating in sport	3.77±0.83	3.97±0.94
8. Visitors to the World Games will contribute a sizable revenue to the local economy	3.85±0.92	3.78±1.05
9. The World Games will provide a short-term boost to the economy in this area	4.03±0.80	3.98±0.93
10 The World Games will provide jobs for local people	3.53±0.96	3.45±1.00
11. The World Games will draw national and international attention to this area	4.09±0.77	4.09±0.85
12. Hosting the World Games will enhance the city‟s beauty	3.94±0.87	4.06±0.87
13. The city government listens to residents about their concerns with the World Games	3.48±0.94	3.57±0.99
15. I support the World Games because of its vital role in our community	3.73±0.80	3.86±0.88
16. The benefits of hosting the World Games will outweigh any of its negative impacts	3.79±0.81	3.41±0.99
17. Overall I believe my standard of living will be increased because of the World Games	3.51±0.90	4.07±0.75
18. Hosting the World Games will make Kaohsiung more of a tourist destination	3.97±0.74	3.83±0.89
20. The World Games will boost this area's long-term economy	3.46±0.94	3.19±1.00
22. The World Games will negatively impact the environment	2.82±0.95	3.57±0.92
23. The World Games will increase the crime rate in the local community	3.32±0.88	3.85±0.94
24. Hosting the World Games will leave Kaohsiung with a negative image	3.65±0.93	2.89±1.16
25. The World Games will result in traffic congestion	2.56±0.94	3.31±1.02
26. The World Games will result in price increase	3.05±0.95	3.88±0.95

The 5-point Likert scale has been reversed on five negative items (22, 23, 24, 25, 26).
SD = Standard Deviation

The positive impacts that were expected prior the Games included „general benefits‟ (M=3.94), followed by „economic and image benefits‟ (M=3.88) and „community involvement and development‟ (M=3.63). The highly perceived positive impacts after the World Games were „general benefits‟ (M=4.04), followed by „economic and image benefits‟ (M=3.83), as well as „community involvement and development‟ (M=3.62). The largest gap

score (0.10) between pre- and post-event surveys of positive impact was found with regard to

„general benefits".

Expected costs (M=3.08) had a significantly lower mean score than perceived costs (M=3.35), indicating that local residents initially had "high" expectations about negative impacts as a result of the Games. However, throughout the phases of planning and event management, negative impacts as a result of the Games were lower than anticipated. The high expected costs prior to the Games were „traffic congestion" (M=2.56), followed by „environment impact" (M=2.82), „price increase" (M=3.05) and „crime rate" (M=3.32). „Negative image of Kaohsiung" (M=3.65) was expected to have the least impact. After the Games, highly perceived negative impacts, surprisingly, were „negative image of Kaohsiung" (M=2.89), followed by „traffic congestion" (M=3.31), „environmental impact" (M=3.57) and „crime rate" (M=3.58). „Price increase" (M=3.88) was ranked the lowest. It should be noted that the „negative image of Kaohsiung" is the only item that created a negative gap score between the two time periods.

TABLE 4: **MEANS AND ANOVA RESULTS BEFORE AND AFTER THE GAMES**

Factors	Mean		Mean Diff.	F-test	p
	Before	After			
General benefits	3.94	4.04	0.10	4.19*	0.041
Community involvement and development	3.63	3.62	0.01	0.05	0.815
Negative Impacts	3.08	3.35	0.28	24.71***	0.000
Economic and Image Benefits	3.88	3.83	0.05	0.80	0.369

All items assessed on a 5-point scale (1= strongly disagree; 3= no opinion; 5= strongly agree).
* p<0.05 ** p<0.01 *** p<0.001

DISCUSSION AND CONCLUSIONS

The application of the Nicosia model and the longitudinal perspective develops this research beyond the typical impact study of event tourism. The Nicosia model offers a means to understand how host residents expect and perceive attributes and impacts of a major sport event over a period of time.

Host residents" perceptions of the positive and negative impacts changed significantly over time. This was particularly associated with „general benefits" and „negative impacts". The findings indicate that host residents" pre-event expectations of general benefits were comparatively high. Post-event perceptions were even higher than their expectations, with the exception of „more recreational opportunities" and „benefits outweigh any of its negative impacts". This may explain that while host residents supported the Games enthusiastically prior to the event, due to pride, increased sport participation and beautifying the city, they felt recreational facilities and opportunities would not increase dramatically after the event. The results may further relate to host residents" perceptions, that the benefits of hosting the event would not be worth the costs incurred.

Regarding pre-event perceptions of positive impacts, residents held relatively high

expectations of general benefits, benefits of community involvement and development, as well as economic and image benefits. Nonetheless, subsequent to the Games, they realised that tangible or more direct benefits (additional recreational opportunities, short- and long-term boosts to the local economy and employment) were lower than expected. The results are consistent with findings by Mihalik (2000), Kim and Petrick (2005), Kim *et al*. (2006), and Lorde *et al*. (2010) and may be explained by applying the Nicosia model. During the pre-event period, host residents received messages generated from event agencies, so that perceptions of messages (or impacts) were essentially determined by organisational attributes. Given that host residents continue to be influenced by well-prepared messages for political purposes at the expense of more realistic challenges, the expectations regarding impact may possibly remain high. An individual‟s perceptions during the Games became the basis for their decision on whether to ignore them or become involved, forming a feedback loop. Based on this, residents modified their perceptions, post-games, which triggered another loop. Furthermore, another possible explanation for the results may be the high unemployment rate in Kaohsiung (noted earlier). Even if major sport events generate a wide variety of host benefits, residents are more concerned about personal issues, such as additional income, increased employment opportunities and increased amounts of visitors to the host destination (Crompton *et al*., 1998).

Even if the differences between host residents‟ pre- and post-games perceptions of „community involvement and development‟ were small, the fact is that post-game perceptions declined. This study is similar to previous research (Teye *et al*., 2002; Gursoy & Kendall, 2006), which suggests that community involvement in the phases of planning, decision-making and management of events in developing countries, tends to be limited. For example, a study undertaken two years prior to the Games demonstrated a lack of community involvement in relation to decision-making (M=3.59) (Ma *et al*., 2011). Accordingly, this study highlights that host residents‟ attitudes are relatively consistent with their perceptions (M=3.57). The results suggest that despite the importance of recognising host communities‟ views in ensuring event sustainability (Frey *et al*., 2007) and the involvement of the host community in portraying positive messages to visitors (Getz, 2005; Bowdin *et al*., 2006), political issues are given top priority.

In terms of negative impacts of hosting the Games, „traffic congestion‟ and „overall environmental impact‟ were expected to have the largest negative impacts, followed by „price increase‟ and „crime rate‟. „Negative image of Kaohsiung City‟ was considered to be the least significant problem. Post-game perceptions suggest that actual congestion and overall environmental impact were less than originally expected. The present findings reveal gap scores for negative impact that were comparatively large and positive, suggesting that these issues did not occur as much as anticipated during the Games. This was consistent with previous research by Soutar & McLeod (1993), Kim *et al*. (2006) and Lorde *et al*. (2010), indicating that the Games were held without major negative social impacts, traffic congestion, or environmental impact (pollution).

Traffic congestion was expected to be a serious problem during the event. The post-event perceptions of the impact of traffic, indicates that it was handled much better than expected. Current findings were consistent with previous studies (Kim *et al*., 2006; Lorde *et al*., 2010),

suggesting that the commitment made by the organising committee and the KCG to

implement an efficient traffic plan, was well executed and successfully eased the feelings of uncertainty among local residents. However, host residents were increasingly concerned about the impact of a „negative image of Kaohsiung". A survey undertaken two years prior to the Games (Ma *et al*., 2011) indicates that a „negative image of Kaohsiung" was the least anticipated negative impact. The outcome of the aforementioned survey is consistent with the results of this study. Surprisingly, residents perceived it as the most serious post-event impact. It was postulated that the withdrawal of the Chinese team during the opening and closing ceremonies, could have been a possible reason. Furthermore, it may have been due to the political disputes over the budget as reported in Taiwanese newspapers (Shan, 2009). It should be noted, that Ma *et al.*"s (2011) study was carried out at a time when the same party governed both the central Government and Kaohsiung City. However, this was undertaken at a time when different parties governed the central Government and Kaohsiung City. According to Smith (2005), many cities adopt sport as part of a re-imaging strategy, though such initiatives do not necessarily boost the credibility of a destination and can even hinder the city"s reputation. Indeed, future studies could evaluate the extent to which the re-imaging strategies are in conjunction with the hosting of the Games, as it may be used to assess how this may contribute to attracting visitors.

Kaohsiung City is likely to host other major sport events in future. Information based on host residents" pre- and post-event perceptions may assist policy makers, event planners and entrepreneurs to better understand factors that are key to the success of future events, but were not well managed during the planning stage of the Games. The Games were subsidised through public expenditure, similar to other events such as the 2002 World Cup in South Korea and the 2007 ICC Cricket in the Caribbean area. In other words, host communities are directly and significantly affected by the events, particularly with regard to contributing intensive public resources and capital. Therefore, if the reasons for hosting a major event are political in nature, then the opinion of host communities is more likely to influence its success.

The regular assessment of residents" perceptions has long been requested, as the cumulative information may be more informative and insightful (Ritchie & Lyons, 1987; Kim *et al*., 2006; Ritchie *et al*., 2009; Lorde *et al*., 2010). For example, intervals from three to six months between pre- and post-game periods were commonly adopted. However, this raised a question as to how long or how often assessments should be made. On some occasions, it is possible that another major event of a similar magnitude may be planned (including in nearby areas) before or during post-games surveys are conducted. The event will become a moderator, which interacts with the targeted event. Therefore, it is argued that pre- and post-data are obtained only once, with a one-month lead and four-month lag, otherwise data may not be sufficient to measure views on perceived impacts due to an interactive relationship between an individual and the Games. It is strongly recommended that for future research, the consideration of regular assessment of residents" be appraised.

Determining the number of impacts to include in the survey required a sufficient review of the related literature. To create comparable benchmarks across different cases, it needs to be understood why previous study designs were used to determine the contents of the survey (Kim *et al*., 2006; Lorde *et al*., 2010) including this study. Yet, the character of each host

location and event differ. The current study suggests that "impacts" should be justified

specifically based on the multifaceted nature of event magnitude and character, as well as the development stage of a host city. Consequently, the results might be more informative. For example, findings of this study indicate that host residents were increasingly concerned about economic output of the Games. This corresponds to the high unemployment rate in local areas.

From a practical standpoint, the findings of our study suggest that for the most part, host respondents agree that the KCG made the right decision with regard to hosting the Games. It should be noted, that these views are derived from host rather than non-host communities. Event organisers cannot assume that most Kaohsiung citizens hold similar views. Perhaps in future event studies, it might be appropriate to survey the perceptions of non-host residents also in order to ascertain if they differ or are similar over time. Furthermore, it is known that challenges regarding economic issues did exist in terms of organising the Games. Obviously, some of the expected rewards from staging a major sport event are yet to be seen, such as to the „trickle-down effect" of sport participation and health improvement. For how long and to what extent does staging a major sport event play in encouraging sport participation and thus improve the health of residents in a host city? How is this measured? The answers to these questions need to be investigated so that evidence of the trickle-down effect can be scientifically studied.

Hosting major events is a part of a strategy in response to solving Kaohsiung City's economic problems. However, to achieve a positive change, it is clear that longer-term issues need to be addressed and relevant strategies put in place. For instance, the event venues such as the Main Stadium (developed with public funding) are a significant long-term economic challenge. When the Games ended, the Main Stadium became an icon of Kaohsiung City. However, it costs approximately USD$2.5 million each year for it to be operational. Such issues are not only relevant to other host cities, but also require substantial solutions from event studies. Firstly, in order to establish a long-term relationship with local communities, Government authorities such as the Sports Department and public health officials can partner with local schools and universities, to design and implement Physical Education curricula that are specific for local residents. This will enhance the patronage of sport facilities. Secondly, in future events the Games themed programs can involve local residents before and during the event, as well as recruiting volunteers from host residents to manage the facilities and environments in the long-term. Thirdly, to enhance the usage rate and to maximise the return on investment, relevant authorities should consider potential solutions, such as attracting the health industry to the Main Stadium. Potential examples include using the facility as a sport club, setting up a memorial hall and promoting the Main Stadium as a tourist attraction. The Sports Department of the KCG could assign a team, which would be responsible for theme marketing, activities, as well as national and international events and programming.

As the areas under the jurisdiction of Kaohsiung City have been expanded from 11 to 37 in 2010, this may suggest a need for rethinking a brand new event strategy in the future, which differs from the Games. Districts located on the edge of the jurisdiction are generally abundant with natural resources, yet lack infrastructure (the expanded areas). The public sector should initiate measures to balance the economic disparities that exist in these areas in comparison to those areas in the urban centre of the city. To this end, the Central Place

Theory (Malizia & Feser, 1999; Daniels, 2007), which examines why some destinations are

better suited to tourism development than others, may offer some additional insight for future research. Along with the use of the Nicosia model, the Central Place Theory may be used to assist in better understanding the multi-faceted nature of mega-events through externally driven effects.

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ADOLESSENTE LEEFSTYLPATRONE: 'N OPNAME IN GESELEKTEERDE HOËRSKOLE VAN DIE WES-KAAPSE ONDERWYSDEPARTEMENT

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ABSTRACT

Adolescence is regarded as a phase of development and growth characterised by excellent health. Unfortunately this does not seem to be the case in the 21st century. The health of adolescents is influenced by technology, crime, poor eating habits, the absence of Physical Education in schools, urbanisation, overpopulation and less available space for children to play. These aspects lead to a sedentary lifestyle, which may impact health in the form of hypokinetic diseases. In this study, the lifestyle patterns of adolescents in selected Western Cape high schools were determined. The lifestyle patterns were related to different ethnic groups and those of boys and girls and a comparison made between these lifestyle patterns with those of adolescents 10 years ago. Two questionnaires, one for the adolescents and one for the Life Orientation teachers, were used. Both White and Coloured adolescents found school sport unimportant and did not partake on a regular basis. Adolescent boys were much more active than the girls. Adolescent girls preferred sedentary activities like listening to music and reading books. Both White and Coloured adolescents, and boys and girls, found their health to be excellent despite the fact that recent research showed the opposite to be true.

Key words: Lifestyle patterns; Adolescents; Gender; Race; Physical Education; Western Cape.

INLEIDING

Adolessensie is die periode tussen die kinderjare en volwassenheid. Dit verteenwoordig die tydperk tussen die ouderdomme van 11 en 21 jaar (Louw *et al*., 1998; Gouws *et al*., 2000; Wait *et al*., 2005; Louw & Louw, 2007). In kontras met die volwasse fase, is adolessensie 'n periode van groei, ontwikkeling en goeie gesondheid (Africa, 2006). Ongelukkig word adolessensie in die 21ste eeu toenemend as 'n risiko-tydperk beskou omdat gedragsvorme soos ongesonde eetgewoontes, fisieke onaktiwiteit, geweld, misdaad, dwelms, seks en alkoholmisbruik by adolessente bespeur word (Zastrow & Kirst-Ashman, 2004; Africa, 2006).

Die meeste adolessente weet hoe belangrik die handhawing van 'n gesonde leefstyl is, maar aanvaar goeie gesondheid as vanselfsprekend (Aktur, 2004; Dupuis, 2007). Verstedeliking, leefstylveranderinge en moderne tegnologie het sedentêre leefstylpatrone onder adolessente laat posvat. Dit kan tot hipokinetiese siektes soos hipertensie, tipe 2-diabetes, obesiteit, hartsiektes, arteriosklerose en selfs kanker aanleiding gee (Africa, 2006; Somers *et al.*, 2006; Wolwegner & Horchem, 2009). Adolessente bring eerder daagliks tyd voor die televisie en rekenaar deur as om aan sport of rekreasie-aktiwiteite deel te neem (Pratt *et al.*, 2004; Engelbrecht & Nel, 2009).

Volgens Mashego (2003) dra die sosio-ekonomiese status (SES) van adolessente grootliks daartoe by dat hulle nie by fisieke aktiwiteite betrokke raak nie. Anders as vroeër jare is dit

dikwels die geval dat beide ouers vandag beroepe beklee om met die stygende lewenskostes tred te hou. Dit laat die adolessent smiddae alleen tuis sonder vervoer na en vanaf sport geleenthede en buitemuurse aktiwiteite (Van Deventer, 2004; Rambau, 2008). Hulle word die "latchkey kids" genoem (Rambau, 2008:10). Die term "latchkey kids" verwys na kinders tussen die ouderdom van ses en 16 wat middae, naweke en vakansies alleen gelaat word by broers en suster omdat beide ouers professionele beroepe beklee (Rambau, 2008:10).

Adolessente se leefstylpatrone word verder deur 'n afname in die belangrikheid van Liggaamlike Opvoeding op skoolvlak benadeel. In 'n wêreldwye opname deur Hardman en Marshall (2001) oor die stand en status van die vak, is gevind dat dit toenemend onder druk geplaas word. As gevolg van tekorte aan fasiliteite, geld en opgeleide personeel verdwyn Liggaamlike Opvoeding van skoolroosters af. In 'n tweede wêreldwye opname het Hardman en Marshall (2009) gevind dat die internasionale stand en status van Liggaamlike Opvoeding as skoolvak nie sedert 2001 verander het nie.

Die stand en status van Liggaamlike Opvoeding in Suid-Afrikaanse skole lyk net so beroerd. Die Suid-Afrikaanse skoolkurrikulum was voor 1994 op die tradisionele doelstelling- en doelwitsisteem, of 'n inhoudsgebaseerde sisteem gebaseer (DoE, 2002; Steyn *et al*., 2003; Fourie & Vermeulen, 2007). In die vorige bedeling is skoolkurrikula vanuit 19 verskillende onderwysdepartemente bestuur. Dit het leerders landwyd volgens demografie, ras en ideologie verdeel (DoE, 2002). Die verskillende onderwyssisteme het kinders verskillend vir beroepe na skool opgevoed soos die apartheidsbeleid bepaal het (DoE, 2002). Na die eerste demokratiese verkiesing in 1994 het grootskaalse transformasie op vele terreine in Suid-Afrika plaasgevind. Transformasie in die onderwys was veral gerig op hervorming en om die agterstande, veroorsaak deur die skoolkurrikula van die vorige bedeling, aan te spreek (Christiaans, 2006; Van Deventer, 2009).

Die *Lifelong Learning through a National Curriculum Framework* wat in 1996 gepubliseer is, bespreek onder andere die toekoms van onderwys in Suid-Afrika en Kurrikulum 2005 (DoE, 2002). Kurrikulum 2005, wat op uitkomsgebaseerde onderwys berus, is amptelik in 1998 in Suid-Afrikaanse skole geïmplementeer (Malan, 2000; Van Deventer, 2009). Die implementering van Kurrikulum 2005 het sterk teenstand ondervind en baie probleme opgelewer. Dit is in 2000 hersien in 'n poging om die probleme wat ervaar is op te los en het daarna as die Hersiene Nasionale Kurrikulum Verklaring bekend gestaan (Christiaans, 2006; Van Deventer, 2009). Vandag word dit die Nasionale Kurrikulum Verklaring genoem (Christiaans, 2006; Van Deventer, 2009) wat in 2009 hersien is en nou as die Kurrikulum- en Assesseringsbeleid Verklaring bekend staan. Die Kurrikulum- en Assesseringsbeleid Verklaring sal tussen 2012 en 2014 in skole geïmplementeer word.

Lewensoriëntering is 'n nuwe vak wat saam met Kurrikulum 2005 geïmplementeer is en kom in twee bande in die Nasionale Kurrikulum Verklaring voor. In die Algemene Onderrig- en Opleidingsband (Graad R-9) is Lewensoriëntering 'n leerarea wat uit vyf leeruitkomstes bestaan: Gesondheidsbevordering; Sosiale Ontwikkeling; Persoonlike Ontwikkeling; Fisieke Ontwikkeling en Beweging; en Oriëntering tot die Wêreld van Werk (DoE, 2002). In die Verdere Onderrig- en Opleidingsband (Graad 10-12), is Lewensoriëntering 'n vak wat uit vier leeruitkomstes bestaan: Persoonlike Welstand; Burgerskapsopvoeding; Liggaamlike Opvoeding; en Beroepe en Beroepskeuses (DoE, 2003).

Alhoewel die vak Lewensoriëntering nuut is, is die inhoud hoofsaaklik afkomstig van vier nie-eksamen vakke wat tydens die vorige bedeling deel van die skoolkurrikulum was. Die vakke is Godsdiensonderrig, Skoolvoorligting, Jeugweerbaarheid en Liggaamlike Opvoeding wat tussen 1994 en 1997 uit die meeste skole verdwyn het (Rooth, 2005; Christiaans, 2006). Hierdie samestellende komponente is struikelblokke in die implementering van Lewensoriëntering. Dit blyk dat baie skoolhoofde steeds vasklou aan die negatiewe persepsies wat daaraan toegeskryf was (Christiaans, 2006). Verder beskik baie van die onderwysers wat aangewys word om die vak aan te bied nie oor genoegsame kennis van al die verskillende komponente nie (Christiaans, 2006).

Onvoldoende onderrigtyd dra sterk by tot die negatiewe status wat Lewensoriëntering huidig geniet. Navorsing toon dat slegs 54% van skole in Suid-Afrika in 2007, periodes vir Liggaamlike Opvoeding op hul roosters geskeduleer het (Mciza *et al*., 2007). Skole wat dit wel geskeduleer het, het aangetoon dat die periodes meestal vir ander doeleindes aangewend was. Die afwesigheid van Liggaamlike Opvoeding in skole is net een van die faktore wat tot die afname in deelname aan fisieke aktiwiteit by leerders bydra. Dit is dus verstaanbaar waarom obesiteit in die afgelope paar dekades met 3.2% onder jong seuns en met 17.9% onder jong meisies toegeneem het (Mciza *et al*., 2007).

Volgens Hendricks (2004) is die tyd wat die Nasionale Kurrikulum Verklaring aan Liggaamlike Opvoeding-periodes toeken onvoldoende vir die aanleer en handhawing van 'n gesonde leefstyl. In die Algemene Onderrig- en Opleidingsband is die tydstoedeling 40 minute per week en in die Verdere Onderrig- en Opleidingsband 60 minute per week (Hendricks, 2004). Hierdie situasie word verder benadeel deurdat die meeste Suid-Afrikaanse skole nie gekwalifiseerde Liggaamlike Opvoeding-personeel in diens het nie. Volgens Van Deventer (2009) is dit waar vir 60% van Wes-Kaapse laer- en hoërskole. In dié skole word daar nie veel aandag aan die bewegingskomponent van Lewensoriëntering geskenk nie. Die tyd word eerder aan vakke soos Wiskunde, Wetenskap en Tegnologie, wat as belangriker beskou word, bestee (Christiaans, 2006; Van Deventer, 2009).

Bogenoemde argumente bewys dat die belangrikheid van Liggaamlike Opvoeding, en die deelname van adolessente aan fisieke aktiwiteite, wêreldwyd gering geskat word, al is die gesondheidsvoordele en noodsaaklikheid daarvan welbekend. Die doel van die onderhawige studie was om in die lig van hierdie argumente, en veral die stand van Liggaamlike Opvoeding in Suid-Afrikaanse skole, adolessente se leefstylpatrone te bepaal.

PROBLEEMSTELLING

Die hoofprobleem fokus op die bepaling van adolessente se leefstylpatrone in geselekteerde hoërskole van die Wes-Kaapse Onderwysdepartement. Die volgende sub-probleme is aangespreek:

- Die vergelyking van die leefstylpatrone van verskillende etniese groepe;
- Die vergelyking van die leefstylpatrone van seuns en meisies;
- Die vergelyking van die leefstylpatrone van huidige adolessente met adolessente van 10 jaar gelede.

METODOLOGIE

Navorsingsontwerp

Die studie kan as 'n opname getipeer word. Beskrywende kwantitatiewe data is deur 'n vraelys in geselekteerde hoërskole van die Wes-Kaapse Onderwysdepartement bekom.

Steekproef

'n Eenvoudige ewekansige steekproef is geneem om die skole (N=30) in Wes-Kaapland te selekteer. Daar is op die metode besluit sodat alle skole 'n gelyke kans sou staan om aan die studie deel te neem.

Proefpersone

Uit elke hoërskool is 60 leerders ewekansig geselekteer. Uit elke groep Graad 9 en Graad 11 leerders by die geselekteerde skole is 15 seuns en 15 meisies tussen die ouderdomme van 15- en 17-jaar ewekansig geselekteer. Die geselekteerde steekproef het uit 1800 leerders bestaan. Daar is op die bogenoemde ouderdomme besluit aangesien Van Deventer in 1999 'n soortgelyke studie onder leerders binne dié ouderdomsgroep in die Wes-Kaap uitgevoer het. Die resultate van die huidige studie is met die resultate van die 1999-studie vergelyk om te bepaal of, en hoe, die leefstylpatrone van vandag se adolessente van dié van 10 jaar gelede verskil.

Dertig (30) skole het elk 60 vraelyste ontvang. Van die 30 skole, het 22 gereageer en 830 respondente het hul vraelyste terugbesorg. Die adolessente wat aan die studie deelgeneem het, was soos volg saamgestel: 335 Wit (56%); en 242 Bruin (40%). Slegs 19 Swart (19.3%), 2 Indiër (2.0%) en 5 ander (1%) het gereageer. Twee honderd sewe-en-twintig (227) adolessente het nie aangedui aan watter rasgroep hulle behoort nie en vier adolessente het nie hulle geslag aangedui nie. As gevolg van die lae terugvoersyfer van Swart en Indiër adolessente is die meerderheid adolessente se spreektaal Afrikaans (93%), met slegs 5% Engels- en 2% Xhosa-sprekendes. Wat geslag betref, het 53% adolessente meisies en 47% adolessente seuns aan die studie deelgeneem.

Vraelyste

Die leerdervraelys is bekom uit 'n studie wat deur Van Deventer in 1999 uitgevoer is. Die vraelys is vir die huidige studie aangepas. Die geldigheid en betroubaarheid daarvan is reeds in 'n lootstudie bewys wat deur Van Deventer in 1997 uitgevoer is.

Verwerking van data

Die data is in rekenaarformaat gekodeer en statisties verwerk. *Statsoft Statistica Weergawe 10* (Statsoft, 2011) is vir dataverwerking gebruik. Opsommende statistieke is gerapporteer deur middel van frekwensietabelle en gepaardgaande persentasies. Kruistabulasie en die Chi-kwadraattoets is gebruik om „belangrike" en „nie-belangrike" response tussen groepe (soos ras en geslag) te vergelyk. Die vergelyking van ordinale skale tussen groepe is met die nie-parametriese Mann-Whitney-toets gedoen. 'n Betekenispeil van $p<0.05$ is gebruik om beduidende verwantskappe te beoordeel.

RESULTATE EN BESPREKING

Leefstylverskille volgens ras

'n Lys van 22 vryetydsaktiwiteite is aan die adolessente voorgehou waarvolgens hulle die belangrikheid van hierdie aktiwiteite moes aandui. Die lys het aktiwiteite wat nie-fisiek van

aard (lees, musiek luister, televisie kyk, rekenaarspeletjies speel en SMS'e stuur), asook aktiwiteite wat fisiek van aard was bevat (deelname aan klub- en skoolsport, partytjie hou en dans en fisieke stokperdjies).

TABEL 1: **BELANGRIKHEID VAN VRYETYDSAKTIWITEITE VOLGENS RAS**

Vryetyds-aktiwiteite	Wit O		Bruin O		Wit B		Bruin B		Totale Groep	
	%	(n)	%	(n)	%	(n)	%	(n)	O	B
Huiswerk doen	13.13	(44)	8.68	(21)	*86.87	(291)	*91.32	(221)	65	512
Stokperdjies	17.91	(60)	17.36	(42)	82.09	(275)	82.64	(200)	102	475
Kuier saam met vriende	9.25	(31)	20.66	(50)	*90.75	(304)	*79.34	(192)	81	496
Luister na musiek	20.60	(69)	18.18	(44)	79.40	(266)	81.82	(198)	113	464
Skoolsport	27.45	(92)	35.12	(85)	*72.54	(243)	*64.88	(157)	177	400
Werk vir geld	31.94	(107)	35.54	(86)	68.06	(228)	64.46	(156)	193	384
Kuier saam met kêrel of meisie	26.27	(88)	43.39	(105)	*73.73	(247)	*56.61	(137)	193	384
Speel op selfoon	37.01	(124)	38.84	(94)	62.99	(211)	61.16	(148)	218	359
Boek lees	40.90	(137)	33.47	(81)	*59.10	(198)	*66.53	(161)	218	359
Huishoudelike take	40.90	(137)	34.30	(83)	59.10	(198)	65.70	(159)	220	357
Partytjie en dans	39.70	(133)	51.65	(125)	*60.30	(202)	*48.35	(117)	258	319

O= Onbelangrik B= Belangrik * = $p \leq 0.05$

TABEL 2: **GEREELDE DEELNAME AAN VRYETYDSAKTIWITEITE VOLGENS RAS**

Vryetyds-aktiwiteite	Wit N		Bruin N		Wit G		Bruin G		Totale Groep	
	%	(n)	%	(n)	%	(n)	%	(n)	N	G
Luister na musiek	33.13	(111)	34.30	(83)	66.87	(224)	65.70	(159)	194	383
Huiswerk doen	36.12	(121)	33.47	(81)	63.88	(214)	66.53	(161)	202	375
Kuier saam met vriende	37.61	(126)	51.24	(124)	*62.39	(209)	*48.76	(118)	250	327
Speel op selfoon	47.46	(159)	42.56	(103)	*52.54	(176)	*57.44	(139)	262	315
Stokperdjies	50.75	(170)	51.24	(124)	49.25	(155)	48.76	(118)	294	273
Skoolsport	43.88	(147)	62.40	(151)	*56.12	(188)	*37.60	(91)	298	279

Kuier saam met kêrel of meisie	59.10	(198)	62.81	(152)	40.90	(137)	37.19	(90)	350	227
Huishoudelike take	69.85	(234)	57.85	(140)	*30.15	(101)	*42.15	(102)	374	203
Televisie en DVD¨s kyk	71.64	(240)	57.02	(138)	*28.36	(95)	*42.98	(104)	378	199
Partytjie en dans	64.18	(215)	74.79	(181)	*35.62	(120)	*25.21	(61)	396	181

N= Nooit G= Gereeld * = $p \leq 0.05$

Die lys in Tabel 1 en Tabel 2 is in rangorde van belangrikheid gerangskik. Dit is bepaal deur die grootste getal adolessente wat die gelyste aktiwiteite as belangrik geag het. Slegs die eerste 10 aktiwiteite word lys, met enkele verwysings na ander aktiwiteite wat betekenisvol verskil het. Dit is duidelik dat beide groepe die doen van huiswerk as hul belangrikste daaglikse aktiwiteit geag het. Dit word gevolg deur die beoefening van stokperdjies, kuier saam met vriende, luister na musiek, deelname aan skoolsport, werk vir geld, kuier saam met 'n kêrel of meisie, speel op selfoon, boeklees en huishoudelike take (Tabel 1).

Wat die belangrikheid van sosialisering (kuier saam met vriende) betref, het Wit adolessente dit veel belangriker as Bruin adolessente geag. Alhoewel dit 'n 3de plek in die totale groep beklee het, het Wit adolessente (90.75%) sosialisering as die belangrikste vryetyds-aktiwiteit beskou. Wit adolessente het die samesyn met 'n kêrel of meisie (73.73%) en partytjie hou en dans (60.30%) belangriker as Bruin adolessente geag (Tabel 1). Van Deventer (1999) het in sy studie dieselfde tendens gevind.

Volgens die data het Bruin adolessente die doen van huiswerk (91.32%), huishoudelike take (65.70%) en boek lees (66.53%) veel belangriker as Wit adolessente geag (Tabel 1). Die studie van Van Deventer (1999) toon dat Bruin adolessente ook huishoudelike take en boeklees belangriker as Wit adolessente geag het, maar dat Wit adolessente weer die doen van huiswerk belangriker as die Bruin en Swart adolessente geag het. Die Wit adolessente het

skoolsport (72.54%) belangriker as die Bruin adolessente (64.88%) geag wat met die bevindinge van Van Deventer (1999) ooreenstem.

Dit is duidelik dat die Wit adolessente (62.39%) meer tyd saam met hulle vriende as die Bruin adolessente (48.76%) van dieselfde ouderdom deurgebring het. Die belangrikheid wat die Wit adolessente (Tabel 1) aan sosialisering geheg het, word bevestig deurdat die Wit adolessente (35.62%) in die werklikheid meer as die Bruin adolessente (25.21%) partytjie gehou en gedans het. Die data toon dat die Bruin adolessente (42.15%) meer gereeld huishoudelike take as die Wit adolessente (30.15%) verrig het (Tabel 2). Dieselfde verskynsel (dat Bruin adolessente huishoudelike take belangriker ag en dit meer gereeld doen) is deur Van Deventer (1999) gerapporteer. Van Deventer (1999) se data is wel teenstrydigheid met die bevinding in die huidige studie. Hy het gevind dat Bruin adolessente baie meer partytjie gehou en gedans het.

Adolessente het skoolsport as belangrik geag, maar Tabel 2 toon dat slegs 56.12% van die Wit en 37.60% van die Bruin adolessente gereeld daaraan deelgeneem het. Die moontlikheid bestaan dat voorheen benadeelde Bruin skole steeds onder 'n gebrek aan opgeleide personeel,

fasiliteite en toerusting gebuk gaan en dus min of geen aandag aan sport en fisieke aktiwiteite skenk nie (Van Deventer, 1999; Hardman & Marshall, 2005). Nog 'n moontlike rede vir die lae deelname aan skool- en klubsport onder Wit en Bruin adolessente is 'n gebrek aan vervoer, veral in landelike gebiede (Van Deventer, 2004). Dit is ook welbekend dat klubsport vir skoolgaande kinders in Suid-Afrika nie so gevorderd soos byvoorbeeld in Europa is nie. Hierdie gebrekkige deelname aan fisieke aktiwiteite en skoolsport word bevestig deur die aanhang van sedentêre aktiwiteite onder Bruin adolessente. Bruin adolessente (42.98%) het aangedui dat hul meer gereeld televisie en DVD"s kyk as Wit adolessente (28.36%) (Tabel 2). Van Deventer (1999) het ook gevind dat Wit adolessente aktiewer as Bruin adolessente was.

TABEL 3: **BLOOTSTELLING AAN BEWEGINGSVORME VOLGENS RAS**

Bewegingsvorme	**Wit Ja** % (n)	**Bruin Ja** % (n)	**Wit Soms** % (n)	**Bruin Soms** % (n)	**Wit Nee** % (n)	**Bruin Nee** % (n)	**Tot. Ja** n	**Tot. Soms** n	**Tot. Nee** n
Fisieke fiksheid	80.72 (268)	76.60 (180)	15.96 (53)	21.28 (50)	3.31 (11)	2.13 (5)	448	103	16
Spele	67.17 (223)	73.84 (175)	27.41 (91)	22.78) (54)	5.42 (18)	3.38 (8)	398	145	26
Buitelug rekr.-aktiwiteite	54.85 (181)	58.72 (138)	27.88 (92)	25.53 (60)	17.27 (57)	15.74 (37)	319	152	94
Water-aktiwiteite	24.77 (82)	27.66 (65)	16.01 (53)	22.55 (53)	59.21 (196)	49.79 (117)	147	106	313
Gimnastiek	17.17 (57)	24.36 (57)	31.02 (103)	31.62 (74)	51.81 (172)	44.02 (103)	114	177	275

Tabel 3 toon dat adolessente gedurende Lewensoriëntering-periodes gereeld aan fisieke fiksheid, spele en buitelug rekreasie-aktiwiteite blootgestel was en minder gereeld aan gimnastiek en wateraktiwiteite. Die data korreleer met Van Deventer (1999) wat dieselfde resultate gevind het. Moontlike redes wat voorgehou kan word is dat baie skole nie 'n gimnasium of swembad het nie en dit dus onmoontlik is om die aktiwiteite aan te bied (Van Deventer, 1999). Die moontlikheid bestaan ook dat ongekwalifiseerde Lewensoriëntering-onderwysers eerder fisieke aktiwiteite en spele aanbied aangesien dit 'n makliker uitweg is.

Die huidige studie toon dat Lewensoriëntering aan Wit (90.71%) en Bruin adolessente (96.51%) se verwagtinge voldoen het. Jacobs (2011) is van mening dat Wit adolessente se positiewe gesindheid teenoor die vak toegeskryf kan word aan die lae status wat dit geniet. Hulle beskou dit as 'n „af" periode waarin huiswerk voltooi kan word. Jacobs (2011) het ook gevind dat Wit adolessente die inhoud van Lewensoriëntering as algemene kennis beskou aangesien inligting aangaande sommige onderwerpe reeds by die huis ingewin word. Bruin en Swart adolessente, veral uit lae sosio-ekonomiese omgewings, toon weer 'n positiewe gesindheid teenoor Lewensoriëntering aangesien nuwe inligting tydens die aanbieding van die vak bekom word (Jacobs, 2011).

Leefstylverskille volgens geslag

TABEL 4: **BELANGRIKHEID VAN VRYETYDSAKTIWITEITE VOLGENS GESLAG**

Vryetyds-aktiwiteite	Seuns O		Meisies O		Seuns B		Meisies B		Totale Groep	
	%	(n)	%	(n)	%	(n)	%	(n)	O	B
Huiswerk doen	15.98	(66)	8.42	(39)	*84.02	(347)	*91.58	(424)	105	771
Kuier saam met vriende	15.50	(64)	16.41	(76)	84.50	(349)	83.59	(387)	140	736
Stokperdjie	18.89	(78)	17.06	(79)	81.11	(335)	82.94	(384)	157	719
Luister na musiek	23.97	(99)	17.49	(81)	*76.03	(314)	*82.51	(382)	180	692
Skoolsport	31.23	(129)	33.05	(153)	68.77	(284)	66.95	(310)	282	594
Werk vir geld	32.20	(133)	35.64	(165)	67.80	(280)	64.36	(298)	298	578
Kuier saam met kêrel of meisie	34.35	(146)	36.29	(168)	64.65	(267)	63.71	(295)	313	562
Huishoudelike take	45.28	(187)	33.26	(154)	*54.72	(226)	*66.74	(309)	341	535
Speel op selfoon	44.79	(185)	34.99	(162)	*55.21	(228)	*65.01	(301)	347	529
Boek lees	57.63	(238)	26.57	(123)	*42.37	(175)	*73.43	(340)	361	515

O= Onbelangrik B= Belangrik * = $p \leq 0.05$

Die lys in Tabel 4 en 5 is in rangorde van belangrikheid gerangskik. Dit is bepaal deur die grootste getal adolessente seuns en meisies wat die genoemde aktiwiteite as belangrik geag het. Slegs die eerste 10 aktiwiteite is gelys, met enkele verwysings na aktiwiteite wat betekenisvol verskil het.

Dit blyk duidelik dat die adolessente meisies huiswerk doen (91.58%), boek lees (73.43%) en musiek luister (82.51%) belangriker as die seuns geag het (Tabel 4). Van Deventer (1999) het ook gevind dat adolessente meisies huiswerk doen, boek lees en musiek luister belangriker geag het en ook meer gereeld daaraan deelgeneem het as adolessente seuns. Die afleiding wat hieruit gemaak kan word is dat adolessente meisies sedentêre aktiwiteite bo fisieke aktiwiteite verkies. Adolessente meisies het ook getoon dat hul huishoudelike take (66.74%) belangriker as adolessente seuns (54.72%) ag (Tabel 4). Die tendens kan moontlik aan geslagsrolverskille tussen seuns en meisies toegeskryf word. Meisies word van jongs af al die belangrikheid van hul rol as vrou in die huishouding aangeleer het (Van Deventer, 1999). In Van Deventer (1999) se studie het adolessente meisies huishoudelike take minder belangrik as in die huidige studie geag. Dit kan moontlik aan veranderende sosio-ekonomiese toestande toegeskryf word.

TABEL 5: **GEREELDE DEELNAME AAN VRYETYDSAKTIWITEITE VOLGENS GESLAG**

Vryetyds-aktiwiteite	Seuns N		Meisies G		Seuns N		Meisies G		Totale Groep	
	%	(n)	%	(n)	%	(n)	%	(n)	N	G
Luister na musiek	38.50	(159)	31.97	(148)	*61.50	(254)	*68.03	(315)	307	569
Huiswerk doen	43.58	(180)	28.08	(130)	*56.42	(233)	*71.92	(333)	310	566
Kuier saam met vriende	44.07	(182)	47.95	(222)	55.93	(231)	52.05	(241)	404	472
Speel op selfoon	51.57	(213)	46.00	(213)	*48.43	(200)	*54.0	(250)	426	450
Stokperdjie	46.97	(194)	56.37	(261)	*53.03	(219)	*43.63	(202)	455	421
Skoolsport	47.70	(197)	56.59	(262)	*52.30	(216)	*43.41	(201)	459	417
Kuier saam met kêrel of meisie	62.23	(257)	66.31	(307)	37.77	(156)	33.69	(156)	564	312
Huishoudelike take	67.31	(278)	62.85	(291)	32.69	(135)	37.15	(172)	569	307
Televisie en DVD"s kyk	63.20	(261)	68.47	(317)	36.80	(152)	31.53	(146)	578	298
Partytjie en dans	68.28	(282)	69.76	(323)	31.72	(131)	30.24	(140)	605	271

N=Nooit G=Gereeld *= $p \leq 0.05$

Data in Tabel 5 toon dat die adolessente meisies sedentêre aktiwiteite soos huiswerk doen (71.92%), musiek luister (68.03%) en speel op selfoon (54.0%) bo fisieke aktiwiteit verkies het en meer gereeld daaraan deelgeneem het. Die adolessente seuns, aan die ander kant, het meer gereeld aan skoolsport (52.30%) en stokperdjies (53.03%) as adolessente meisies deelgeneem. Bogenoemde bevindinge word deur Van Deventer (1999) en Fourie (2011) beaam. Dit blyk dis dat adolessente seuns meer gereeld aan sport en fisieke aktiwiteit deelneem, terwyl adolessente meisies eerder sedentêre aktiwiteite verkies.

TABEL 6: **BLOOTSTELLING AAN BEWEGINGSVORME VOLGENS GESLAG**

Bewegingsvorme	Seuns Ja % (n)	Meisies Ja % (n)	Seuns Soms % (n)	Meisies Soms % (n)	Seuns Nee % (n)	Meisies Nee % (n)	Tot. Ja n	Tot. Soms n	Tot. Nee n
Fisieke fiksheid	73.48 (291)	84.21 (384)	21.72 (86)	13.06 (62)	4.80 (19)	2.19 (29)	675	148	48
Spele	64.14 (254)	74.45 (338)	29.29 (116)	19.82 (90)	6.57 (26)	5.73 (26)	592	206	52
Buitelug rekr.-aktiwiteite	51.01 (202)	59.69 (268)	31.82 (126)	21.16 (95)	17.17 (68)	19.15 (86)	470	221	154
Water-aktiwiteite	29.29 (116)	22.22 (100)	21.46 (85)	16.89 (76)	49.24 (195)	60.89 (274)	216	161	469

Gimnastiek	23.29 (92)	21.78 (98)	33.67 (133)	24.89 (112)	43.04 (170)	53.33 (240)	190	245	194

Die huidige studie toon dat adolessente seuns en meisies gedurende Lewensoriëntering-periodes hoofsaaklik aan fisieke fiksheid, spele en buitelug rekreasie-aktiwiteite blootgestel was (Tabel 6). Van Deventer (1999) se navorsing toon dieselfde verskynsel. Dit kan moontlik aan 'n gebrek aan fasiliteite, toerusting en opgeleide personeel toegeskryf word. Die adolessente seuns (89.19%) en meisies (90.93%) het aangetoon dat Lewensoriëntering aan hulle verwagtinge voldoen het.

AANBEVELINGS

Algemene aanbevelings

- Die onderhawige studie is 'n opvolgstudie op 'n studie wat Van Deventer in 1999 uitgevoer het. Dit dien as rigtingwyser vir verdere navorsing. 'n Opvolgstudie elke 10 jaar is ideaal om die veranderinge in leefstylpatrone onder adolessente te monitor en aan te spreek.

Aanbevelings vir ras

1. Dit wil voorkom asof die sosio-ekonomiese status van adolessente 'n groot rol in hul sportdeelname speel. Beide Wit en Bruin adolessente se deelname aan sportaktiwiteite is laag. Volgens die data neem Wit adolessente egter meer gereeld aan skoolsport deel. Verdere navorsing ten opsigte van kulturele verskille in sportdeelname word dus aanbeveel.
2. Die laer sportdeelname van Bruin adolessente kan moontlik aan 'n tekort aan toerusting, fasiliteite en opgeleide onderwysers by hul skole, toegeskryf word. Die Nasionale Departement van Basiese Onderwys, die Wes-Kaapse Onderwysdepartement en die skole moet na moontlike oplossings kyk om die probleem aan te spreek.
3. Verdere navorsing word as gevolg van die lae terugvoersyfer van Swart adolessente aanbeveel sodat hul leefstylpatrone ook bepaal en aanbevelings daarvolgens gemaak kan word.

Aanbevelings vir geslag

1. Geslagsverskille is duidelik sigbaar in die huidige studie aangesien adolessente seuns aktiewer as adolessente meisies is. Adolessente meisies verkies sedentêre aktiwiteite soos om musiek te luister en boek te lees. Yoncalik (2011) is van mening dat die fokus van fisieke aktiwiteite en Liggaamlike Opvoeding by skole moontlik tot die verskynsel kan bydra. Yoncalik (2011) het gevind dat meisies meer van dans, gimnastiek, joga en aangepasde sportsoorte hou, terwyl seuns spansporte soos sokker en krieket verkies. In die huidige studie is daar gevind dat adolessente meisies die meeste aan fisieke aktiwiteite en spele by skole blootgestel word. Verdere navorsing word aanbeveel om te bepaal aan watter aktiwiteite adolessente seuns en meisies by skole blootgestel wil word. Dit is belangrik sodat die aanhang van sedentêre leefstylgewoontes onder adolessente meisies aangespreek kan word.

2. Die Kurrikulum en Assesseringsbeleid Verklaring (Finale Konsep) moet aangepas word sodat die belange van beide seuns en meisies in ag geneem word.

Aanbevelings vir Liggaamlike Opvoeding

1. Om bogenoemde te vermag word aanbeveel dat Liggaamlike Opvoeding se status as 'n alleenstaande skoolvak herstel word. Indien Liggaamlike Opvoeding saam met ander leeruitkomstes in 'n vak verskuil word, sal die vak nooit tot sy reg kom nie en sal leerders nie die voordele daarvan ervaar en uitleef nie.
2. Die vak moet aangebied word deur opgeleide Liggaamlike Opvoeding-leerkragte. Indien dit nie gebeur nie, sal Liggaamlike Opvoeding nie tot sy reg kom nie.
3. Lewensoriëntering moet ten minste drie keer per week vir 60 minute aangebied word om die nodige impak op adolessente se leefstylpatrone en gesondheid te hê (Hardman & Marshall, 2005).

Met die vooruitsig van voorgesette navorsing, sou dit van belang wees om 'n poging aan te wend wat sal verseker dat steekproewe verteenwoordigend van alle adolessente en etniese groepe in Suid-Afrika moet wees. Aangesien hierdie studie beperk is tot slegs Wes-Kaapse

skole, sou dit verder van groot waarde vir besluite deur Nasionale Opvoeding wees, as soortgelyke opnames in die ander provinsies onderneem word.

GEVOLTREKKINGS

Daar is tot die gevolgtrekking gekom dat beide Wit en Bruin adolessente sport as onbelangrik geag het en ongereeld daaraan deelgeneem het. Adolessente seuns het sport belangriker geag en meer gereeld daaraan deelgeneem. Adolessente meisies het sedentêre aktiwiteite, soos lees en na musiek luister, belangriker as adolessente seuns geag. Wit adolessente het meer as Bruin adolessente gesosialiseer, terwyl Bruin adolessente huishoudelike take belangriker as Wit adolessente geag het.

SUMMARY

Adolescent lifestyle patterns: A survey in selected high schools of the Western Cape Education Department

Adolescence is the period amid childhood and adulthood. This phase starts between the ages of 11 and 13 years and ends between 17 and 21 years. Adolescence was seen as a phase of development and growth characterised by excellent health. This is not the case in the 21st century. The health of adolescents are being influenced by technology such as computers and television, crime, poor eating habits, the absence of Physical Education at schools, urbanisation, overpopulation and less available space for children to play. These aspects lead to a sedentary lifestyle, which may impact their health in the form of hypokinetic diseases.

The aim of this study was to determine the lifestyle patterns of adolescents in selected Western Cape high schools. The objectives of this study were to determine the lifestyle patterns of different ethnic groups, those of boys and girls and to compare the lifestyle patterns with those of adolescents from 10 years ago. A questionnaire was used for data

collection. Data from the questionnaire was coded and statistically analysed with the *Statsoft Statistica Version 10* program.

The high schools (N=30) and the learners (N=60) were randomly selected to participate in the study. The 60 learners consisted of 15 boys and 15 girls in each of the Grade 9 and 11 groups of the selected schools and were between the ages of 15 and 17 years. A total of 1800 learners were selected to participate in the study. The final sample consisted of 830 participants.

The results of this study revealed that both the White and Coloured and boys and girls, found doing their homework as the most important activity. Neither White nor Coloured adolescents found school sport important nor did they partake in sporting activities on a regular basis. Adolescent boys, on the other hand, were found to be much more active in sporting activities than adolescent girls. Adolescent girls preferred sedentary activities like listening to music and reading books. Both White and Coloured adolescents and boys and girls, found their health to be excellent despite the fact that research has been reported the opposite to be true. White adolescents also found socialising more important than Coloured adolescents. Coloured adolescent, on the other hand found, the doing of household chores more important.

This study was a follow-up to the study conducted by Van Deventer in 1999. It serves as a basis for further research and it is recommended that follow-up studies should be conducted every 10 years to determine changes in the lifestyle patterns of adolescents so that it can be addressed. Further research is recommended because of the absence low response rate of the Black learners. It is important to determine their lifestyle patterns so that recommendations in this regard can be made.

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BIRTH ORDER AND SPORT PARTICIPATION

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ABSTRACT

The purpose of this study was to determine the relationship between birth order and sport participation in terms of the inherent dangers associated with different sport codes. Data collected from 1310 sport science students over a period of more than 15 years failed to support the popular birth-order hypothesis.

Key words: Birth order; Ordinal position; Dangerous sports; Sport socialisation.

INTRODUCTION

Much of the appeal of studying birth order (ordinal position) stems from the common belief that children, occupying different positions in the sibling order, experience different socialisation environments (Ebihara *et al*., 1983; Daniels & Plomin, 1985). The child's interactions with parents and siblings are mediated by ordinal position (Soetevent & Kooreman, 2005). For example, first-borns tend to receive more parental attention with regard to support and control (Lewis & Kreitzberg, 1979). Later-born children, on the other hand, experience more interaction at sibling level, receive less attention from parents and tend to have a tougher time asserting themselves in a family set up (Seff *et al*., 1992). These tendencies are affected by factors, such as the family size, the gender composition of the siblings and the spacing between ordinal positions (Blake *et al*., 1991).

One of the areas of interest with regard to birth order is that of risk-taking behaviour and participation in dangerous sports (Seff *et al*., 1992). Despite some contrary findings (Eisenman, 1987; Seff *et al*., 1992), empirical evidence suggests that first-born children are under-represented in dangerous sports. According to Longstreth (1970), first-borns tend to experience greater fear and tend to avoid situations that can lead to physical harm. Flowers and Brown (2002) found that first-born athletes recorded significantly higher cognitive and

somatic state-anxiety as compared to later-born athletes. In a survey of 166 male university students, Yiannakas (1976) found that first-borns avoided sport where the probability of physical injury was high. Casher (1977) in a study of 127 university athletes concluded that the proportion of participants in dangerous sports increased with ordinal position. No evidence of research on the relationship between birth order and sport participation in South Africa could be found.

RESEARCH HYPOTHESES

The main hypothesis of this investigation was that there is a relationship between birth-order and participation in dangerous sports.

METHOD

Sample

Data were collected from physical education/sport science students (N=1310) from Stellenbosch University (South Africa) over a period of more than 15 years.

Data collection

The information pertaining to this survey formed part of the customary biographical data collection from students at the beginning of a semester course in sport psychology. In addition to biographical information, students were requested to state their favourite sport in which they were participating at the time of the survey. They also had to provide information about the number of siblings and their ordinal position within their families.

Ethical issues

Over the major part of the duration of the data collection there were no formal official procedures at the university regarding the ethical issues of research. However, such issues were considered in the present study. The author who was the lecturer for this particular sport psychology course collected the data personally. The students were not informed of the purpose of the study (to determine whether there is a relationship between birth order and sport participation). As some respondents may have perceived the requested information to be of a sensitive and personal nature (family size), it was stressed that participation in the survey was voluntary and that the information of individuals would be treated confidentially. Not a single student withheld the requested information.

Danger index

No objective formulation of the criteria used to define "dangerous" sports could be found in the literature on this topic. For the purpose of the current study a *danger index* was constructed for 57 sport codes. A total of 192 final-year and post-graduate sport science students were asked to rate each of the sport codes by answering the question: "How dangerous are the following sports?" The following guideline was provided:"*Dangerous* refers to the potential physical harm or injury that the participant may experience when competing".

Responses were recorded on a 7-point Likert scale ranging from (1) *Safe* to (7) *Dangerous.*

Albeit a crude form of classification, it does utilise the opinions of a fairly large sample of students in the field of sport and therefore the survey does not rely exclusively on the intuitive perception of a few individuals.

RESULTS

Family composition

The respondents in the sample came from fairly large families ranging from 1 to 8 siblings. The median family size was 3 siblings (Mean=2.75). Only 5% of the respondents were the only child in the family. Eighty-five per cent (85%) of the respondents were from 2- or 3-sibling families. The percentage of first-born siblings in the sample was 38.5%. A fair proportion (51%) of the male respondents grew up with an older brother in the family. In the case of female respondents, 19% had older brothers. This phenomenon could have had an effect on their sport socialisation.

Sport preferences

The sample of sport science students at this particular university participated in a variety (57) of sport codes of which rugby was the most popular (Table 1).

TABLE 1: **TEN MOST PREFERED SPORTS OF SAMPLE OF SPORT SCIENCE STUDENTS**

Sport	n	%
Rugby	239	18.2
Field hockey	204	15.6
Track and field	148	11.3
Netball	113	8.6
Cricket	80	6.1
Competitive swimming	71	5.4
Tennis	56	4.3
Water polo	48	3.7
Gymnastics	46	3.5
“Cross country running”	35	2.7

Danger index

TABLE 2: **TEN MOST DANGEROUS SPORTS** [a]

Sport	Mean	SD
Rugby	5.70	0.95
Para gliding	5.60	1.36
Rock climbing	5.59	1.18
Surf life saving	5.27	1.34
Mountain biking	5.24	1.15
Wrestling	4.98	1.17
Scuba diving	4.95	1.55
Kick boxing	4.82	1.49
Pole vaulting	4.77	1.24
Field hockey	4.69	1.23

[a] Rated on a 7-point scale

TABLE 3: **TEN SAFEST SPORTS** [a]

Sport	Mean	SD
Table tennis	1.53	0.86
Golf	1.59	0.85
Drum majorettes	1.71	1.11
Badminton	1.77	0.75
Tennis	1.48	0.79
Synchronised swimming	1.92	1.03
Competitive swimming	1.96	1.03
Competitive dancing	1.99	1.04
Shooting	2.37	1.56
"Cross country running"	2.39	1.04

[a] Rated on a 7-point scale

Tables 2 presents the 10 most dangerous sports and Table 3 covers the 10 safest sports. Rugby was rated as the most dangerous sport [5.7 on the 7-point Likert scale]. Table tennis was considered the safest sport with a rating of 1.18. As not a single subject in the sample participated in boxing, it was unfortunately omitted from the questionnaire. It is assumed that it would normally feature in the top 10 most dangerous sports.

Relationship between sport danger index and birth order

No significant correlation (Spearman r=0.01; p=0.68) was found between birth order and the sport danger index. The data were subjected to an additional statistical approach. The subjects

were divided into 2 groups: those who participated in the top 10 dangerous sports (n=489) and those who participated in the 10 less dangerous sports (n=332).

The mean ordinal order for the dangerous group was 1.9 and for the less dangerous group 1.8. The statistical analysis, F (1, 819) p=0.31 and Mann-Whitney U, p=0.32, again failed to support the birth-order/sport-preference relationship. This finding is contrary to general belief and expectations, as well as other findings of empirical research. This prompted further analysis of the data of some sport codes.

Closer inspection of the respondents who played rugby (perceived as the most dangerous sport) indicated that 46% of the players were first born. In the case of the safer sports such as tennis and competitive swimming the percentage of first-born participants was 58% and 51% respectively. These findings will be discussed later, but at this stage it can be concluded that this does not support the generally accepted belief about the relationship between birth order and sport-preference.

DISCUSSION

Family composition

The respondents came from fairly large families. Only one out of every 20 of the sport science students was the only child in the family. It is assumed that larger families or the availability of playmates would have a positive effect on a child's participation in games and sport. The presence of an older brother in the family (51% for males and 19% for females) could have had an influence on the sport socialisation of the sample of sport science students. The fairly large percentage (38.5%) of first-born siblings in the sample is somewhat unexpected, especially if one assumes that ordinal family position (later-born) makes serious sportspersons different from their non-participant peers.

Sport preferences of sport science students

The respondents participated in a variety (57) of sport codes. It would have been interesting to determine if the participation patterns changed over the years with changes in the demographics of the university and other societal changes. Unfortunately no provision (date of completion of the questionnaire) was made for this type of analysis when the research was initiated.

Relationship between sport danger index and birth order

The data provided no support for the belief in the relationship between birth order and sport participation. This prompted further analysis of the data of some sport codes. Closer inspection of the respondents who played rugby (perceived as the most dangerous sport) indicated that a large percentage (46%) were first-born players. This finding does not support the generally accepted hypothesis that the more dangerous sports are the domain of later-born participants. The latter could not be regarded as over-represented in the group of rugby players in the current sample.

In the case of the safer sports the birth-order/sport-preference relationship would predict an over-representation of first-born participants. The percentages first born participants in this

group of tennis players (58%) and competitive swimmers (51%) are not large enough to be regarded as an over-representation of first-borns in safer sports.

The lack of evidence supporting the popular belief in the relationship between birth order and sport participation may be the result of the nature of the sample used in this research. It is possible that the sample of sport science students is not representative of the larger population.

CONCLUSION

Considerable attention has been given to the socialisation of children into sport. Apart from personal attributes, the influence of others (parents and siblings) plays a role in this process (Ebihara *et al*., 1983). The interaction patterns in the family as the primary socialising agency are reflected in the secondary social systems, for example, sport (Frey & Eitzen, 1991). This supports the findings of others on this topic (Longstreth, 1970; Yiannakas, 1976; Casher,

1977; Rees *et al*., 2008).

The effect of birth order is not a simple issue. In addition to other factors in the family, it is assumed that there are some complicated networks at different birth-order positions that influence socialisation into sport for both sexes (Ebihara *et al*., 1983). For example, if the gap between siblings is large, a later-born child might demonstrate the characteristics of a first-born sibling. Gender considerations add to the complexity of birth-order interactions. For example, if the first child is a girl followed by a later-born boy, the latter may exhibit the traits of a first-born male.

It could be surmised that in some instances participation in specific sports is mediated by socio-cultural factors that override the influence of birth order. This might have been the case with the nature of the current sample. Birth order continues to be a frustrating variable in the study of socialisation (Seff *et al*., 1992). Kluger (2007) observes in *Time* that the vocal detractors of birth-order research, question the findings of the science less than the methods that lead to nothing more than "interesting junk". However, he continues:

> "Millenniums of families would swear by the power of birth order to shape the adults we eventually become. Science may yet overturn the whole theory, but for now, the smart money says otherwise" (p. 34).

A more pessimistic view is that the birth-order effect is a myth. After an extensive review of literature and conducting their own empirical research with a large sample of 6215 Swiss males, Ernst and Angst (1983) concluded that birth-order research is futile.

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PERCEPTIONS OF GENDER EQUALITY AND ATTITUDES TOWARD EQUAL OPPORTUNITY IN SCHOOL SPORT AMONG BOTSWANA ADOLESCENTS

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ABSTRACT

The aim of this study was to explain consciousness of gender inequality in school sport and predict pro-equality attitudes among 1580 respondents (934 girls and 646 boys) from 45 Botswana secondary schools. Results of separate multiple regression models indicate that girls' sport participation is negatively correlated with pro-equality attitudes and boys' grade level is negatively related to perception of gender inequality. Pro-equality attitudes could not be predicted from the students' grade level, regardless of gender. The coefficient on sport participation in relation to pro-equality attitudes among boys is expectedly negative but not statistically insignificant (p=0.084). The implications of these preliminary findings for policy and programmes include the need to monitor and redress gender disparities in the school sport space.

Key words: Gender differences; School sport; Attitudes; Equal opportunity.

INTRODUCTION

In Botswana as elsewhere, the school sport system is not only value-laden; it is also political in the sense that it reflects specific norms, interests and relations of power. Politics is intrinsic to any sport enterprise within and outside the educational system, since the choice of goals, structures, processes and programmes (what should be or *not* be on the sport agenda) entails ideological contestations and relations of power, even among youngsters. Consequently, the

commonsensical notion that the school sport terrain is neutral, innocent, apolitical and insulated from the dominant social relations is misleading (Messner & Sabo, 1990; Stoll & Beller, 2000). Socially constructed differences such as gender enhance or constrict people‟s chances in the sport arena (Theberge, 2000; Harry 2001; Yiannakis & Melnick, 2001). It is for this reason that discussions of sport production and reproduction in the school system must entail considerations of power relations and gender-specific patterns of experiences, orientations and outcomes among student groups. Such considerations enable a critical appraisal of how issues of social justice in relation to gender and other statuses are perceived, received, contested or resisted in the school sport context.

Policy developments in physical education and sport in Botswana over the past decade reflect the Government‟s commitment to improving access, participation and athletic success of school children and youth and, ultimately reduce social inequities in the playground. For instance, Botswana‟s social policies such as The Revised National Policy on Education (Republic of Botswana, 1994), the Long Term Vision for Botswana (Presidential Task Group, 1997) and the National Sport and Recreation Policy for Botswana (Ministry of Labour and Home Affairs, 2001) reflect faith in the power of sport not only to boost health and productivity (by counteracting unwholesome leisure, addictions, AIDS, obesity and attendant illnesses), but also to instil the ethos of tolerance, unity, inclusion, decorum, productivity, competitiveness, equity and morality.

Initiatives to realise the policy objectives of access and equity in sport for the country‟s socially diverse youth include elective physical education at the secondary school level and the establishment of specific sport competitions for the tertiary, secondary and primary educational institutions. However, there has been limited research on the extent to which social or gender relations within the school sport system are congruent with the democratic ideals of inclusion, access and equity.

In recent times, it has become clear that school sport resources and opportunities are not equal within and across Botswana districts and regions. At the time of writing, the Botswana Government was grappling not only with teachers‟ gripes over non-compensation for extra-curricular responsibilities, but also a widespread dissatisfaction over the perennial issues of inadequate sport and recreational facilities and the shortage of sport personnel in the primary, junior and senior secondary schools (Department of Sport and Recreation, 2001).

The dominant discourse about sport in Botswana schools has become narrowed to qualification, selection and preparation of youngsters for international sport engagements by means of age-graded competitions and schools of sports excellence. It has largely ignored the types of issues most crucial to access and equity in sport, namely broad aims, comprehensive and inclusive programmes, choices, opportunities, equal representation, adequate resources and infrastructure, quality physical education, participant empowerment, regular evaluation and proactive structural reform (Shehu & Mokgwathi, 2007).

Shehu (2009) and Motsumi (2011) examined the ways gender impacts on pupil-pupil and teacher-pupil interactions in physical education classes in Botswana, highlighting a number of contextual issues. For instance, young people‟s gendered positions in terms of physical literacy and level or rate of physical activity are affected by interventions and expectations of

teachers. Besides, experiences of subordination, such as male dominance in squad leadership and monopoly of the playing field and equipment, can constrain their female counterparts. The topical issues of bullying/harassment and objectification underscore the need to address the intersections of structural positions, perspectives and pedagogies more systematically (Evans, 1986; Birrell & Cole, 1994).

The strategic issue of engendering equal sport opportunities has given rise to extensive literature aimed at putting on the global cultural and curricula agenda of the issues of access, participation, representation and subjectivity in sport in relation to the wider social relations that inform and shape inequalities in society. For example, women‟s relative under-

representation at the elite and managerial levels of male-dominated invasion and combat sports, such as soccer, rugby, boxing and basketball have been linked to patriarchal ordering of social space, gender relations and cultural formations (Birrell, 1987; Scraton, 1990; Burnett, 2001). It has been noted that factors of sport participation cannot be assumed to predict for both males and females given the ways structural positions and traditional sex roles define and shape access to sport opportunities, privileges and resources (Lenskyi, 1986; Fasting, 1987; Penney, 2002; Shehu, 2010). Political, economic and normative analyses (Ingham & Loy, 1993; Capel & Piotrowski, 2000; Coakley, 2009) have explored the highly charged issues of equal opportunity, occupational structures and income from sport and demonstrate that woman are disadvantaged relative to men. Moreover, sport sociologists analysing the history and culture of sport (Costa & Guthrie, 1994; Hargreaves, 1994; Birrell, 2000; Messner, 2011) have shown how gender discrimination is legitimised and made to appear natural.

Several researchers have integrated the situated sporting experiences of students into explanations of how school and college sport structures and processes are gendered, gendering and often benefit boys and men disproportionately (Messner, 1990; Messner & Sabo, 1990; Miller *et al*., 2007). In particular, it has been demonstrated that school sport has a special status in relation to systemic educational inequalities as one of the structures that create social distinctions and hierarchies through qualifying tests, tracking, role expectations and natural meritocracy (Polley, 1998; Landers & Fine, 2001; May, 2008). School sport as a central part of school culture can hardly avoid operating in ways that are congruent with the groundwork laid by the surrounding educational and ideological processes (Connell, 2003; Thorne, 2003). Inequalities produced by the construction and production of school sport are often obscured by the way the entire school valorises winning athletes and teams so as to condition the students to believe that when the school team wins everyone is a winner, and therefore, nobody is marginalised (Folley, 1990; Stoll & Beller, 2000).

Given that studies conducted in the global North reveal that the intersection of gender and sport experiences have implications for inclusion and exclusion, the gendered sport situations in Botswana schools cannot be regarded as unproblematic. Theoretical and empirical explorations of intra-gender and inter-gender differences in young people‟s perceptions, values and experiences with regard to sport are no less important in a developing country like Botswana. Such explorations are crucial for deconstructing practices that entrench subordination in micro- and macro-sport settings and for constructing conditions that are sensitive and responsive to the gender subtext of youth sport development. Accordingly, this study aimed at examining Botswana secondary school students‟ consciousness of gender in

their school sport programmes and their *pro-equality attitudes*, that is the extent to which respondents will support or oppose measures to equalise sport opportunities for girls and boys

Specifically, the study sought to: (1) determine if there are significant differences in the mean scores on the indices of perceptions of gender inequality in school sport and pro-equality attitudes between girls and boys; (2) test the significance of two separate regression models for girls‟ and boys‟ data in which perceptions of gender inequality in school sport were regressed on grade level and sport participation; (3) determine the significance of perceptions of gender inequality in school sport, grade level and sport participation as predictors of pro-

equality attitudes; and (4) evaluate these regression models in light of the *underdog thesis, threat hypothesis, enlightenment thesis,* and *reproduction thesis.*

ASSUMPTIONS OF THE STUDY

Several assumptions were fundamental to this study. Firstly, that gender, like other social statuses, explains what one notices or does not notice in given situations (Rosenblum & Travis, 2000). Indeed, social psychological studies have demonstrated that life experiences and circumstances are central to how socio-structural conditions are perceived (Iyengar & McGuire, 1993). Thus being a boy or a girl affects how a student experiences access, participation, equity, constraints and privileges in a sporting context. Secondly, following Davis and Robinson (1991), it is assumed that "consciousness of inequality includes self-awareness of subordinate groups, as well as awareness of inequality on the part of those who are not disadvantaged" (Davis & Robinson, 1991:72*).* Thirdly, it draws on theories derived from research on men and women‟s awareness of gender inequality in home, higher education and workplace (Robinson, 1983; Plutzer, 1988; Davis & Robinson, 1991; Quinn, 2003), on the assumption that these theories have epistemological relevance for the domain of school sport. Fourthly, it is assumed that using a parsimonious model with few variables and items will provide preliminary snapshots of the factors that shape perceptions of gender inequality in school sport and pro-equality attitudes among secondary school students. Fifthly, it is assumed that understanding the antecedents of students‟ support for equity in school sport is crucial for sport managers, coaches and school authorities, as the success and sustainability of any inclusive sport policy depends on the active support of the students.

Given the variety of personal and socio-cultural variables that mediate perceptions of gender inequality and pro-equality attitudes, the researchers did not assume any cause-effect relationships between the dependent and independent variables explored in this study. These assumptions underscore the challenge of conducting a preliminary study on the perceptions of gender inequality and pro-equality attitudes among school sport participants, which is a topic that is relatively under-researched and absent from the sport studies literature.

THEORETICAL FRAMEWORK

This study draws on the *underdog thesis, threat hypothesis, enlightenment thesis,* and *reproduction thesis* to explain consciousness of gender inequality and predict attitudes toward policy actions that favour greater gender equality. According to the underdog thesis, those who are most subordinated by the existing institutional arrangements will be more aware of inequality than those who are privileged, and the former are more likely to favour greater

equality than those who benefit more from the status quo (Robinson & Bell, 1978; Kluegel & Smith, 1986). Previous studies have shown that sport has long been culturally defined as a masculine activity meant to privilege males and the highly skilled (Messner & Sabo, 1990; Hargreaves, 1994; Burnett, 2001; Coakley, 2009).

The threat hypothesis holds that increasing gender equality or advances of minorities and marginalised groups will represent a threat to the dominant group‟s identity, privileged status and cultural power (Blalock, 1967; Zuo & Tang, 2000; Pridemore & Freilich, 2005). Consequently, the dominant group is likely to resent and resist equality as the subordinate

group pushes for it. Thus, the threat hypothesis is not only salient in political economic terms, but also in athletic and recreational terms. School sport is not only cultural and structural; it is also relational. It confers statuses and privileges. Its construction, regulation and management are based on assumptions and expectations about rules, roles and power differentials between social statuses. In this regard, boys will be less likely than girls to support gender equity in school sport because girls‟ increased empowerment will be perceived as a threat to the boys‟ dominant status in school sport structures.

The enlightenment thesis holds that more years of education and exposure to diverse learning experiences broaden the mind, enabling the individual to develop concern for human values, social welfare, gender equality and removal of structural causes of social problems (Astin, 1993). In other words, education, in broad and graduated terms, contributes to the development of an individual who is critically aware of social issues, such as gender inequality and is willing to support interventions to combat it (Hyman & Wright, 1979). In this context, the varied educative and interactive experiences that are included in the curriculum at various grade levels increasingly strengthen students‟ cognitive abilities and beliefs about equity. Given that this theory assumes that education correlates with opposition to social inequalities (Pascarella & Terenzini, 1991), the researchers tested the hypothesis that students‟ grade level will influence perception of gender inequality in school sport and support for interventions to combat it.

Contrary to the enlightenment thesis, the social reproduction thesis posits that school-based education, in the context of wider social relations, not only creates hierarchies of knowledge, competencies and values, but also promotes an unquestioning attitude towards the existing social structures (Bowles & Gintis, 1976; Bourdieu & Passeron, 1977; Giroux, 1981). A point that is especially relevant here is the role of hegemony in the creation of hierarchies and gender regimes, which are mutable and contestable (Gramsci, 1985; Connell, 1987). Studies have shown that, like other school structures, school sport subculture reproduces inequality by promoting hierarchies and the ideology that access, participation and success are due to prowess (Donnelly & Young, 1988; Foley, 1990). This theory views the school system as socialising pupils to accept social inequalities through selection, classification, examination, promotion, certification and recognition (Messner, 2003; Coakley, 2009). Students thus come to regard privileges, dominance and power as legitimate rewards for individual effort rather than due to discrimination or subordination. In this sense, student-athletes will be more likely to perceive gender inequality in school sport, but will be least supportive of equal sport opportunities.

METHODOLOGY

Sample

The quantitative data reported in this study are based on a survey conducted in 45 purposively selected secondary schools. Participants were 1580 students out of the initial stratified random sample of 1700. The response rate was 93%. Of the 1580 participants, 934 (59%) were girls and 646 (41%) were boys. In terms of grade level, 1434 (91%) were from 40 junior secondary schools (JSS) and 146 (9%) were drawn from 5 senior secondary schools (SSS). At the time of this study, Botswana had 207 junior secondary schools and 28 senior secondary

schools. The participating institutions represented 19 and 18% of the school populations respectively. Primary school leavers in Botswana go to a 3-year junior secondary school and those who complete the junior secondary school proceed to a 2-year senior secondary school, which is the main pathway to the university. About 58% of the girls and 63% of the boys were on their school sport teams. Forty percent (40%) of the respondents (394 girls & 241 boys) were non-athletes. The mean age for girls was 15.1 years (SD=1.21) and that of boys was 15.6 years (SD=1.33). The mean age of the participants was 15.3 years (SD=1.28).

Procedure

Permission to conduct the study was granted by the respective school authorities and class teachers. Questionnaires were administered to students in their classrooms after obtaining their informed consent and assuring them that their responses will be treated with anonymity and confidentiality. Students completed the questionnaire in less than 15 minutes. The researchers and/or the research assistants were on hand to explain the items and provide clarifications where required.

Data and measures

Based on the insights from the aforementioned theories regarding the influence of education, involvement and social status on equity predisposition, this study used gender, grade level and sport participation as predictors of students‟ perception of gender inequality in secondary school sport. These variables were coded as 0 or 1 for gender (1 for girls), sport participants (1 for student athletes) and grade level (1 for senior secondary). In addition to these 3 independent variables, perceptions of gender inequality index were added as a 4th explanatory variable to determine the link between each variable and students‟ disposition towards equalisation of sport opportunities for girls and boys. The 2 dependent variables were indices of students‟ perceptions of gender inequality in school sport and attitudes towards equal sport opportunities for both sexes.

Perceptions of Gender Inequality in School Sport (GISS) Scale

The items in the GISS scale stem from the observations by previous researchers (Capel & Piotrowski, 2000; Connell, 2003; Dar & Resh, 2003) that girls and women in sport are usually disadvantaged in 3 policy areas: educative (access to good quality sport instruction and practice opportunities); competitive (access to substantive sport competitions); and redistributive (access to standard sport facilities and equipment and/or rewards). Consequently, the GISS scale was designed to compare how girls and boys fare in these 3 policy arenas (see Notes).

Attitudes towards Gender Equality in School Sport (GESS) Scale

The GESS scale was developed to assess the degree to which students regard extension of greater sport opportunities to boys than girls as un-egalitarian and discriminatory. The 3 items in the GESS scale contain reference to the 3 policy arenas embedded in the GISS scale. The 2 scales were pilot-tested with 40 secondary school students (20 boys and 20 girls) to ensure the items and instructions were clear and measured what they were intended to measure. Inter-item correlations and exploratory factor analyses of the items in the 2-scales were

conducted. Data were analysed using multiple regressions to predict GISS and GESS indices from the selected independent variables. Preliminary analyses for normality, linearity, multicollinearity and homoscedasticity were conducted and results indicated that the assumption for multiple repressions was not violated. All results were tested for significance at an alpha level of 0.05.

RESULTS AND DISCUSSION

Item analysis

The GISS and GESS scales demonstrated considerable internal consistency with Cronbach‟s coefficients of 0.88 and 0.75 respectively. Inter-item correlations for GISS ranged from 0.63 to 0.81 and 0.43 to 0.56 for GESS. Results of exploratory factor analyses using varimax rotations resulted in 2 clear structures with each item loading strongly on only 1 component. Table 1 shows the correlations of the items in each scale, their Cronbach‟s alphas and the factor scores of each measure with an Eigenvalue greater than 1. All correlations in Table 1 are significant at $p<0.01$.

TABLE 1: **CORRELATION MATRIX OF THE ITEMS FOR GISS & GESS SCALES AND CRONBACH'S ALPHA**

Scales & item dimensions	Cronbach's Alpha	Correlation (p<0.01)			Factor scores
GISS	0.88	SL	SC	SF	
Sport Learning (SL)		–	0.63	0.68	0.85
Sport Competitions (SC)			–	0.81	0.91
Sport Facilities (SF)				–	0.93
GESS	0.75				
Sport Learning (SL)		–	0.56	0.43	0.81
Sport Competitions (SC)			–	0.51	0.85
Sport Facilities (SF)				–	0.78

Descriptive statistics

The overall means and standard deviations on the 2 scales for the total sample and by respondents‟ gender are presented in Table 2. The t-test results revealed that girls, in general, perceived significantly higher levels of gender inequality in their school sport programmes ($t(1578)=3.37$, $p<0.01$), and are less likely than boys to support inequitable sport policies ($t(1578)=4.91$, $p<0.01$). These findings support Hypotheses 1 and 2 and previous studies on gendered perceptions of power differentials in the larger sporting contexts (Choi, 1999;

Messner, 2005), due to social constraints and normative conceptions of sport performance.

TABLE 2: **DESCRIPTIVE STATISTICS FOR GISS & GESS SCALES RESULTS**

	Total sample (N=1580)		**Girls** (n=934)		**Boys** (n=646)	
Index	Mean	SD	Mean	SD	Mean	SD
GISS	10.34	2.69	10.54	2.52	10.06	2.91
GESS	11.32	2.81	11.61	2.80	10.91	2.79

Bivariate analyses

On the one hand, the bivariate analyses for boys‟ and girls‟ data reported in Tables 3 revealed that grade level, sport participation and perception of gender inequality were negatively correlated with pro-equality attitudes among girls.

TABLE 3: **GENDER CORRELATION MATRIX BETWEEN INDEPENDENT AND DEPENDENT VARIABLE**

	Girls (correlations)				**Boys** (correlations)			
Variables	PI	GL	SP	PII	PI	GL	SP	PII
Pro-equality Index (PI)	–	-0.057 *	-0.064 *	-0.079 **	–	-0.021	-0.072 *	0.103 **
Grade Level (GL)		–	-0.044	-0.030		–	0.014	-0.148 ***
Sport Participation (SP)			–	-0.038			–	-0.042
Perceptions of Inequality Index (PII)				–				–

*p<0.05 ** p<0.01 *** p<0.001

On the other hand, sport participation was negatively correlated with pro-equality attitudes among boys. However, their perception of gender inequality was positively correlated with pro-equality attitudes, but negatively correlated with grade level. This confirms studies showing that, like other school structures, school sport subculture reproduces inequality by promoting ideology that access, participation and success are due to prowess tied to gender order (Walker & Barton, 1983; Messner, 2003).

Standard multiple regression

Tables 4 and 5 present separate standard multiple regression equations for girls and boys. The independent variables of grade level and sport participation were simultaneously entered into the equations, and each was evaluated in terms of its predictive power in relation to the dependent variables (Pallant, 2007). The data for girls and boys were desegregated because it was expected that gender would be salient for students‟ sport experiences at different levels of education and sport (Hall, 1988; Duda, 1991), given the social conditions and expectations that shape participation.

As Table 4 indicates, grade level (entered as 2 dummies instead of a single education variable) was not a significant predictor of girls‟ perception of gender inequality in school

sport as predicted by the enlightenment thesis and reproduction thesis. Among boys, the coefficient for grade level was significantly negative as senior secondary male students were less likely to be conscious of unequal sport opportunities in their school, as predicted by the reproduction thesis. This is because the culture of schooling, its meritocratic ideology, as well as gender role expectations can make inequalities appear natural (Giroux, 1981).

TABLE 4: **STANDARD MULTIPLE REGRESSION COEFFICIENTS FOR PERCEPTION OF GENDER INEQUALITY ON GRADE LEVEL AND SPORT PARTICIPATION BY GENDER**

Independent variables	**Girls** F (2, 931) = 1.17, p=0.31					**Boys** F (3, 642) = 7.79, p<0.001				
	B	SE	β	t	p	B	SE	β	t	p
Grade level	0.322	0.339	0.032	0.981	0.328	-1.261	0.332	0.148	-3.80	0.001 *
Sport participation	-0.203	0.167	-0.040	-1.22	0.225	-2.42	.234	-.040	-1.03	.302
Constant	10.30					11.64				
R^2	0.002					0.024				

*p<0.05

Between both gender groups, sport participation had no significant bearing on perceptions of gender inequality, although the negative coefficients would suggest that non-athletes perceive more gender inequality in school sport than student athletes. Contrary to the enlightenment thesis that education leads the individual to support equal opportunities, this data suggest that grade level was not a significant predictor of pro-equality attitudes among the students. One implication of this finding is that a higher level of education might be needed to confirm the enlightenment thesis.

TABLE 5: **STANDARD MULTIPLE REGRESSION COEFFICIENTS FOR PRO-EQUALITY ATTITUDES ON GRADE LEVEL, SPORT PARTICIPATION AND PERCEPTIONS OF GENDER INEQUALITY BY GENDER GROUPS**

Independent variables	**Girls** F (3, 930) = 4.18, p<0.001					**Boys** F (3, 642) = 3.30, p<0.05				
	B	SE	β	t	p	B	SE	β	t	p
Grade level	-0.595	0.376	-0.052	-1.58	0.114	-0.048	0.323	0.006	-0.15	0.882
Sport participation	-0.366	0.185	-0.064	-1.98	0.049 *	-0.390	0.226	-0.068	-1.73	0.084
Perceptions	-0.089	0.036	-0.080	-2.44	0.015 *	0.95	0.038	0.099	2.50	0.013 *
Constant	13.39					10.26				
R^2	0.013					0.123				

*p<0.05

The results in Table 5 illustrate that sport participation was negatively related to pro-equality attitudes among girls as expected. Although the coefficient for boys in this regard was not significant, it was also in the negative direction in accordance with the reproduction thesis that emphasis on striving and performance lessens support for equity in sport participation,

compensation and access to equipment and facilities (Shields, 2008).

The estimates in Table 5 demonstrate that perceptions of gender inequality constituted a significant predictor of pro-equality attitudes among the students. After accounting for the influence of grade level and sport participation, perceptions of the gender inequality index

was positively related to pro-equality attitudes among the boys. The reverse was noted among the girls. Girls who were relatively more aware of gender inequality in their school sport and had dramatically lower pro-equality scores than the rest. This finding may well imply that the underdog thesis applies only when the girls are non-athletes.

It may be that the significant negative relationship between sport participation and pro-equality attitudes among the girls is indicative of disagreements regarding the extent of specific inequalities and what should be done about them. Understanding why perceptions of greater gender inequality may not result in significant support for equal sport opportunities is crucial to effective cognitive interventions to engender equity, access and respect in school sport settings (Kay, 1995).

Viewing the overall mean scores in Table 2, most students seemed to acknowledge some kinds of gender inequality in their school sport system and were somewhat against the maintenance of inequitable status quo. However, the standard deviations would seem to suggest the students in this study would have different views about ways to balance different values and trade-offs about how school sport should be regulated in relation to the gendered social identity of students. Results from the preliminary t-tests generally indicate that girls were more likely than boys to perceive gender inequality in school sport and less likely than boys to support sport programmes or policies designed to privilege boys at the expense of girls. This group differences suggest that perceptions of school sport activities and equity policies are shaped by the gendered orientation and structured expectations that girls and boys bring to sport contexts, and to the process of deciding on the kind of policy options that will bring about specific sport benefits or equity (Reynold, 1997).

Further studies are needed to examine the meanings, expectations and values that school girls and school boys associate with school sport, how they construct their notion of equal or unequal sport opportunities and how these vary by students‟ ethnicity, class, religion, race, gender and other social positions (Lee, 1983). As Lentinnon *et al*. (2006) have noted, perception of social injustice and sensitivity to gender inequalities are related to self-concept, school effects, as well as gender stereotyping of sporting activities. This requires cognitive and structural interventions to change perceptions, attitudes and material disadvantages.

Standard multiple regressions were used to predict factors that influence perceptions of gender inequality and pro-equality attitudes in the context of school sport. Age was not included in the models because the differentials were close to zero. Results of separate analyses for girls and boys presented in Table 4 suggest that perceptions of gender inequality in school sport were negatively correlated with boy‟s grade level. The coefficient for girls on this variable was positive but statistically insignificant. This finding indicates that there were within-group variations in perceptions of unequal sport opportunities among secondary school students influenced in part by gender.

In the second model, pro-equality attitudes could not be predicted from the students‟ grade level. The coefficients for this variable were, however, negative. This finding suggests the need to look beyond grade levels to fully understand what shapes propensity to support or oppose equal sport opportunities. The coefficient on sport participation in relation to pro-equality attitudes was negative for girls but insignificant for boys. Thus, girls on school sport

teams responded according to the reproduction thesis, indicating that the underdog thesis is confounded in part by gender, as well as athletic status, such as differing athletic skills and differential participation in sporting activity. Perhaps the student-athletes among the girls, given their privileged roles and/or greater athletic skills, were more opposed to attempts to dismantle a school sport policy regime based on efforts, performance, selection and competitiveness, as predicted by the reproduction thesis (Bourdieu & Passeron, 1977).

Contrary to the threat hypothesis, girls‟ pro-equality index was negatively and significantly correlated with perceptions of unequal sport opportunities. The positive link between perceptions and pro-equality attitudes noted among boys might be due to a sense of fair play and a commitment to ideals of gender parity. Perhaps, the boys also saw gender equity in sport as a two-way street that facilitates the removal of barriers that *both* girls and boys face in having a fair access to school sport resources (Anderson, 1999).

On the whole, boys‟ overall R^2 were higher than those of girls in the sample, suggesting that „boyness‟ contributed much to the estimates in the models. This indicates that gender can be expected to matter when it comes to students‟ constitutive interests in sport matter, considering that girls and boys are constrained by different social norms regarding competitive physical activities (Harrison *et al*., 1999).

CONCLUSION AND IMPLICATIONS FOR POLICY

In this preliminary study, perceptions of gender inequality in school sport and support for equal sport opportunities among a cross-section of Botswana secondary school students were examined. Under the logic of the reproduction thesis, the relations between students at different grade and sport skills levels may increase the individual‟s resistance to substantive equal opportunities. Results of the multiple regression equations in this study indicate that the impact of girls‟ sport participation on pro-equality attitudes is negative and boys‟ grade level is negatively related to perception of gender inequality. After taking the students‟ grade level and sport participation into consideration, findings did not support the threat hypothesis. A key conclusion from the study is that support for equal sport opportunities in the school system depends on an awareness of gender disparities and norms of competition and hierarchy.

One implication of this study for school sport policy in Botswana is the need to carry out periodic gender analyses and attend to situations where egalitarian sport arrangements are needed. The outcomes of such a gender analysis will give school authorities and sport administrators the much-needed data for reframing and addressing equality issues within the context of school and collegiate sport programmes in Botswana. It will also have salutary effects on any politics of privilege that are played out in out-of-school sport programmes organised by the Botswana Sports Council affiliates.

In particular, Women and Sport Botswana (WASBO), Botswana Primary Schools Sports Association (BOPSSA) and Botswana Integrated Sports Association (BISA) have a critical role to play in deepening students‟ understanding of gender equality issues and mobilising sport to serve the needs of socially diverse students in government schools in the context of forging „a moral and tolerant nation‟ (Presidential Task Group, 1997). A pedagogical or

didactic pathway to addressing gender bias or sexist attitudes among students is to create ample space and time for group discussions on the impact/outcomes of equitable sport programmes with the teachers or coaches acting as authoritative rather than authoritarian facilitators. Such peer group discussions will enable students to voice their views, values and beliefs about sport and gender equality, discover new facts in the desired direction, identify with the ideas generated by the group and hence accept pro-equality attitudes as the group norm.

The official rhetoric in Botswana, as elsewhere in Africa, is to democratise sport and promote equality of opportunity for all students in the sport sphere. On this ethical ground, comparative studies are needed to further understand the complex socio-demographic factors influencing students‟ perceptions of relational inequalities in school sport, what egalitarian school sport policy comprises from the perspectives of students and school authorities, the contradictions at the heart of these perspectives, and how the individually lived experiences of structural limitations and unequal relations in school sport contexts are contested by students.

Notes

The ***GISS Scale*** contained three items:

a) Are opportunities to learn how to play sport in your school better or worse for girls than for boys?;
b) How about chances for girls to participate in school sport competitions– are these chances better or worse than the chances for boys?; and
c) Are opportunities for girls to use the school sports facilities better or worse than the opportunities for boys to use these facilities?

The items were scored on a 5-point scale (1=Much better for girls; 2=Better for girls; 3=About the same; 4=Worse for girls; 5=Much worse for girls).

The ***GESS Scale*** requested students to rate the degree to which they favour the following policies:

1. Opportunities to learn how to play sport should be higher for boys than for girls;
2. Opportunities to participate in school sport competitions should be increased for boys rather than for girls; and
3. Compared to girls, boys should have more opportunities to use the school sport facilities.

The three items were scored on a 5-point scale (1= Strongly in favour; 2= In favour; 3= Neither for nor against; 4= Against; 5= Strongly against).

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LOCATING OPPORTUNITIES FOR OUTDOOR ACTION AND ADVENTURE RECREATION AND TOURISM IN THE WESTERN CAPE: A GIS APPLICATION

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ABSTRACT

This paper indicates how modern spatial computing technology can be used for developing spatial policy for, and planning of outdoor action and adventure recreation and tourism (OAART). An application was performed in the Western Cape Province of South Africa. The research overviews spatial recreation and tourism development policy, marketing and express outdoor recreationist and tourist preferences that translate into spatial suitability indicators or attraction features captured in a spatial resource database. Special attention was given to the conceptual foundations of attraction and what can be captured in spatial format as mapped variables. The methodological approach of spatial multiple criteria evaluation (MCE) by weighted linear combination of spatial factor layers as images in a geographical information system (GIS) are explained. The outcome in map format demonstrates the execution of the technique for the Western Cape. The fine-scale spatial result was compared with the coarser regional indicators of the marketing-based spatial development framework proposed to guide official recreation and tourism planning. The results are useful for entrepreneurial and regulatory planning and may be replicated in different spatial locations provided a supporting database exists.

Key words: Geographical Information System (GIS); Multiple Criteria Evaluation (MCE); Action and adventure recreation; Nature tourism; Spatial planning; Western Cape Province.

INTRODUCTION

As societies develop, economies mature and people globally become more affluent, live longer and have more spare time, while outdoor recreation and tourism become increasingly important activities. Conceptually, a confluence between outdoor, nature-based action recreation and similar types of tourism has become evident. Issues like policy formulation, activity promotion and resource development, especially at strategic regional and local spatial resolutions, resonate strongly. Spatial planning by authorities and entrepreneurs has consumer needs, demands and trends in tourism and recreation preferences as its drivers. Hence, Bell *et al*. (2007) prioritise research needs in this field, firstly as monitoring and assessing resource demands (recreation behaviour, activity preferences, new technologies), impacts (climate change, natural and social vulnerability), site-specific resource pressures (resource

characteristics, visitor numbers, carrying capacity, conflicting uses) and, secondly as planning for new developments and alternatives (sustainable usage, strategies for regions and communities, building efficient resource databases, new technologies to support decision making).

This paper draws direct and important parallels between the fields of outdoor recreation and nature-based tourism. Tourism, as major generator of revenue and employment opportunity, receives prominent attention from government policy development and implementation, as well as entrepreneurial investment, while recreation is often treated separately in the public domain and as being less directly valuable to society. Yet, the same resource base is exploited by both activity sectors in largely the same manner and for similar reasons. Should the simple definition of recreation as „active, enjoyable leisure activity" (Kent, 2006; Ndulini, 2009) be embraced, the parallel with „nature based tourism" (activities that take place in a nature area and are directly or indirectly dependent on or enhanced by the natural environment) (Tangeland & Aas, 2011:823), is self-evident, in spite of the fact that definitions have been much refined for specific analytical or management purposes (Hammitt, 2004; Mnguni, 2010; Tangeland, 2011).

In this paper, outdoor, nature-based recreation and nature tourism and derivatives of both are synonymous and called „outdoor action and adventure recreation and tourism" (for the sake of brevity referred to as OAART throughout) to avoid confusion. OAART represents an efficient means to extract economic value from localised tangible and intangible environmental resources of cultural and natural origin and hence demands proper planning at strategic spatial and localised entrepreneurial levels.

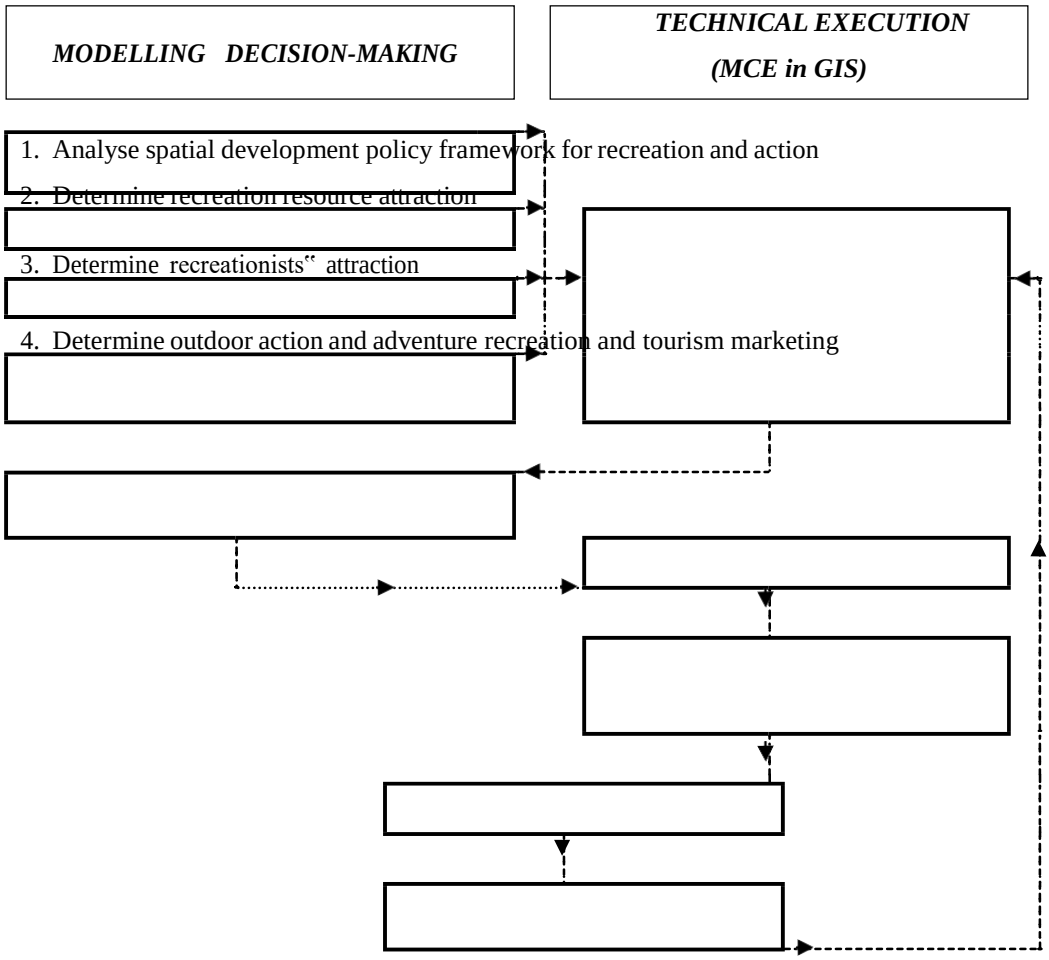
The Western Cape is a premier tourism destination with its development potential strongly linked to a rich natural and cultural resource base, well-developed tourism infrastructure and its Big Six attractions (Table Mountain, Cape Point, Kirstenbosch, Groot Constantia, Victoria and Alfred Waterfront, Robben Island). Yet, provincial space is unevenly endowed with natural and human resources ranging from lush coastal plains and mountain valleys studded with large urban concentrations to bleak, dry and desolate inland plains. The geographic complexity and diversity of situated resources (Olson, 2010), as products of their biophysical properties and the political, social and economic framework, in which they are produced, provide the province with an extraordinarily rich resource base for current and future development of OAART.

Successful OAART at any locality must satisfy visitor experiences, enhance the quality of life of local populations and protect the local natural, built and cultural resource bases. Such an approach recognises the importance of a sound spatial framework for planning and developing a sustainable OAART industry in local and national space (Boers & Cottrell, 2007; Marcouiller *et al*., 2009; Kanga *et al*., 2011) so that regions become destinations on their own. Yet, evidence shows scant theoretical and practical concern for the incorporation of spatial planning principles in the design of development policy and for the direction of development funding to follow resource evaluation and targeted investment. This paper addresses this dilemma through a practical application of spatial information technology.

RESEARCH APPROACH, PLAN AND METHODS

The paper aims to show how modern spatial computing technology can operationalise the

tourism development policy in the Western Cape Province of South Africa. An overview of provincial policy, the tourism marketing framework, the OAART resource base and the methodological approach of spatial multiple criteria evaluation (MCE) and its application in a geographical information system (GIS) for the Western Cape are provided. This prototype application, it is argued, is replicable for similar spatial units elsewhere in South Africa or indeed internationally.



5. Operationalise spatial criteria
   - Define spatial variables (n=27)
   - Map spatial variables in GIS
   - Convert maps to standardised images (n=13; potential values =1-5)

6. Set differential weighting of spatial factors

7. Run MCE in GIS

8. Output: Map of outdoor action and adventure recreation and tourism potential

9. Analyse spatial patterns

10. Iteratively reset model as required

FIGURE 1: **RESEARCH STEPS OF MCE MODEL BUILDING**

The paper explains the spatial MCE approach in the ten sequential research steps shown in Figure 1, namely interpret spatial development policies, determine spatial attraction factors from various perspectives, select spatial variables, map them, apply digital conversion and standardisation and factor weighting, followed by MCE application and interpretation of the spatial outcome, and finally iterative revision if required. Later sections in the paper elaborate on these steps as they were performed.

The empirical content of the paper is based on research conducted for Cape Town Routes Unlimited (CTRU) to identify spatial tourism gaps for development and market opportunities in the Western Cape Province (Van der Merwe *et al*., 2008). OAART emerged as a major development opportunity among nine identified tourism market segments. A panel of experts passed judgement on the indexing method for OAART potential measurement, market segmentation and recreationists‟ product preferences. The destination definitions were translated to spatial operational format for the OAART product and a spatial database of phenomena and features indicative of the product‟s potential (natural outdoor resources and human-made plant) was portrayed as indicators of potential. Twenty-seven relevant criteria were selected from 80 available mapped variables, as a spatial data inventory of determinants for OAART opportunity and infrastructure in the Western Cape. These were employed in an application of a spatial MCE model in GIS for generating a map of OAART development potential at a spatial resolution of 1km^2 as product.

PRINCIPLES AND PROCESSES OF MULTICRITERIA EVALUATION IN GIS

Ideally, human decision-making should weigh multiple influencing factors to reach objective, balanced and logical conclusions. This principle is realised in spatial decision-making through overlaying spatial variables (mapped phenomena) and analysing their superimposed, combined and cumulative influence. The proven cumulative or clustering effect in the

attraction value of proximate recreational resources (Weidenfeld *et al.,* 2010) is harnessed in this manner. The realisation has only recently dawned that this represents the combination of the spatial manifestations of classical complex human and natural systems (Proctor & Qureshi, 2005; Kiper, 2011) that collapses different landscapes into a categorisation scheme (Olson, 2010), together with related resources. In the geoinformatics age, the method has been greatly refined and simplified in the form of MCE for application in GIS (Ascough *et al*., 2002). This modelling methodology requires the application in a raster modelling format (as opposed to the vector format of geographical feature data captured as points, lines or polygons in GIS). The method combines criterion values (in each individual raster image cell) mathematically in a MCE module to form single potential images via the weighted linear combination formula:

$P = \Sigma W_i X_i$, where W_i = Weight of factor i, and X_i = Criterion score/cell value of factor i.

The application entailed the implementation of a stepped sequential process (Van der Merwe, 1997) is shown in Figure 1. In essence it requires that two parallel, cooperative processes be performed: the one (Steps 1-4, 6 in the diagram) is a decision-making process involving all relevant decision-making stakeholders, the other (Steps 5, 7, 8) involves the technical gathering and manipulation of spatial data and the running of the software by the GIS

specialist. In this application workshop, input largely captured the former set, while data gathering, generation of distance parameters, manipulation of each variable to signify importance in the potential rating, the weighting of these variables for combination, and the eventual programmatic generation of an OAART product potential image (Step 8), were performed by a team of scientists. Because differently calibrated program runs generate different results (Heywood *et al*., 1994; Boroushaki & Malczewski, 2008), an iterative process allows revisiting the steps until results meet policy requirements. While sensitivity analysis may be required to affirm particular model outputs, the argued scientific integrity of expert calibration is deemed sufficient to guarantee valid results.

PRINCIPLE OF PROPAGATION OF SPATIAL FEATURE INFLUENCES IN GIS

The criteria used in an MCE analysis are based on spatial relationships or situation characteristics. Situation factors measure the exposure that each raster cell has to resources or land uses that generate spatial externalities for the activity being sited (Cromley & Huffman, 2006). During Step 2, distances from target features to each cell in the factor image are calculated in a standard GIS procedure. This allows the logical object-based influence or potential-generating effect of features in the landscape (Aplin & Smith, 2011) to extend beyond the immediate physical presence or footprint in that landscape. By allowing individual layers of resource elements to propagate their relative influence over tourism-potential space, both the numerical value of a feature type (denoting intensity of the phenomenon‟s occurrence at a place) and the nature of the location it refers to must be factored in. This means that „influence distance‟ is made dependent on the relative intensity (size, quality, rating) value of the target feature (Chhetri & Arrowsmith, 2008; Kanga *et al*., 2011).

When feature values denote mere presence or absence (Boolean values), the feature class exercises a linear distance effect radiating in constantly diminishing degree away from the

feature. However, when features or various members thereof (line features like roads) are rated along a value range (ordinal or scale variables) the distance effect for higher-valued features or parts thereof must extend farther according to the segment value; examples being roads of different classes, or facilities with different quality or size ratings. The rate of influence decay of a feature with distance from that feature need not be constant (a linear function), but may be a logarithmic or similar function. However, this presupposes some empirical knowledge or measurement to calibrate the function. In this application all propagation of distance influence was linearly calculated and classified into equal-interval, potential-generating class values.

MCE application in GIS for spatial decision support is described as "…perhaps the most fundamental of decision support operations in geographical information systems" (Jiang & Eastman, 2000:173). Geographers and scientists from related disciplines, various geographical regions and developmental realms of the world, initially concentrated their MCE applications on determining the location suitability of various phenomena based on multiple qualifying criteria, especially regarding the natural environment (the author encountered many examples in the literature not directly relevant here).

Improving the human condition, expressed as activity preference and specifically in tourism applications, is the field where the most relevant and innovative applications for this study occur. Examples are comparing areas‟ options for recreation and tourism activities (Proctor & Drechsler, 2003; Kumari *et al.,* 2010; Kiper, 2011) or districts‟ tourism performance (Smith, 1987; Kanga *et al*., 2011) of which the latter is now available in web-driven format (De Montis & Nijkamp, 2006). Such examples are evidence that MCE application is growing in sophistication and its usefulness is being widely recognised. Yet, its application for determining recreation and tourism potential for various products in the same geographical area, as attempted here, is a fresh and innovative approach.

ALLOCATING RECREATION AND TOURISM DEVELOPMENT SPACE IN THE WESTERN CAPE

Designating potential centres for recreation and tourism in provincial space is determined by government policy and by understanding the preference of market participants. The consultants, KPMG, have developed an integrated tourism development framework (ITDF) according to the initial policy foundation provided by the provincial White Paper on tourism (DEAT, 2001; 2002). This framework reviewed tourism potential (through the assessment of tourism product, plant and infrastructure, supply patterns, possible portfolios and theme routes) and matched these with the demand from primary and secondary international and domestic markets servicing the destination. This approach facilitated the identification of a formal, coarse-resolution hierarchy of spatial tourism development foci like gateways, distribution points, routes and destinations (DEAT, 2002). The plan identified 11 nodes and corridors (tourism development areas [TDAs]) worthy of further development and which offer a basis for comparison with the results of this research.

The scope of OAART as drivers for local and regional economic development across South Africa is maximised through appropriate policy interventions designed to support the competitive niches in local tourism economies. Therefore, the Western Cape is informed by the wider international experience (Baum, 1998; Butler& Waldbrook, 2003; Rogerson, 2004,

2007) in planning the development of OAART, especially the territorially based product (Che *et al*., 2005). The Western Cape province is endeavouring to grow its tourism product portfolio farther afield from the Cape Town metropolitan area and the highly developed southern coastal region. This raises the pivotal questions: To where should government and industry direct tourism development in the Western Cape province and, spatially and product sector-wise, where can and should OAART help to sustainably diversify the total product development load? Understanding the tourism landscape means knowing where the strength of a product is located and what the existing and future market requirements are according to recreationists‟ preferences.

The spatial resource base for OAART is not a monotypical phenomenon since it encompasses a variety of participant, educational and spectator experiences (Tangeland, 2011). These include OAART activities (fishing, swimming, canoeing, kayaking, rafting, boating, kiting, surfing, hiking, canyoning, mountain climbing, bouldering, caving, cycling, horse riding, bird watching, wildlife viewing, nature and action photography, fauna and flora study) and

hospitality services (farm stays, country-style accommodation, restaurants sourcing local produce).

Market intelligence regarding preferences was gained through empirical surveys of OAART practitioner preferences in the Western Cape (Linde, 2001; Speirs, 2003; Donaldson, 2007) and standard statistical sources (DEAT, DTI, SAT, 2005; South African Tourism (SAT), 2007a, 2007b; South African Tourism Strategic Research Unit (SATSRU), 2007; WTTC & Accenture, 2007). These sources confirmed the prominent position of the Western Cape in the international tourism market and among its competitor destinations for natural beauty, wildlife and culture (DEAT, 2002, 2007). In the minds of consumers globally, South Africa‟s profile as a destination attraction is much the same as it was two decades ago, namely an adventure and wildlife destination with striking natural beauty (South African Tourism [SAT], 2007a).

The tourism growth strategy (SAT, 2007a) identified three segments of varying strategic significance, namely established, emerging and untapped markets. Opportunities exist for growing several of these segments in OAART and these have already been identified. Particular interest should be directed at the active sections of these segments to match the dominant nature-based products typical of the Western Cape. In summary, consumer preferences or linking-recreational-product-to-market analyses show most product development takes place around the natural resource base, the cultural product, family product and affordable attractions (SAT, 2007a).

A workshop attended by a select group of tourism experts (Vander Merwe *et al*., 2008) reached consensus on product guidance. It confirmed, *inter alia*, that innovative tourism experiences need to replace stale products; resources have an uneven spatial spread across the province; sustainable business ventures should ensure better visitor experiences and overall competitive edge of destinations; sustainability and ecological stability should be enhanced; local opportunities outside traditional tourist centres must help to reduce tourism‟s ecological footprint; spatial databases must be as exhaustive as possible; and tourism-resource potential is measurable in spatial map overlays. The workshop determined that rural OAART is a priority focus product among nine for the Western Cape. It also concurred with SAT (2007a)

that the development of new destinations for tourism, in areas beyond the traditional tourism routes and nodes, must be pursued if OAART is to have a significant effect on poverty and unemployment, which is another aim of this research.

CALCULATION OF REGIONAL PRODUCT POTENTIAL

Product-market match aims to balance supply of tourism products, particularly attractions and services, with targeted quality OAART destination plans in regional context (Che *et al*., 2005; Puustinen *et al*., 2009; Kiper, 2011) to encourage visitation. Statistically-defined recreation and tourist segments usually originate from designated areas, fall into specified age and gender groups, have specified education and income levels and they have preferences for what they wish to do, see and eat (Kelly, 1998). The MCE method requires the selection of spatial variables (called factors or criteria) as location attributes in provincial space to determine potential attraction. This section introduces the principles on which such variable

selection is founded and concludes with a listing and discussion of the variables used in this research.

Principles for selecting spatial variables

The selection rests on the realistic assumption that the recreation and tourism potential of a spatial unit (place, location or area) is determined by three generic factors: the recreational activities or resources available at the site and in its vicinity; its accessibility; and the presence of support services. These manifest as resource factors that collate the contributing effects of the individual variables. Spatial factors are invariably considered to possess, and in recreation and tourism space, to express a specific sphere of influence (Clawson *et al*., 1960; Law, 1967; Cromley & Huffman, 2006), which encapsulates in space the measurement of the questions:

- From how far will recreationists be attracted to this destination?
- How far does the local attraction influence extend to enhance other local resources or products hereby implying a cumulative attraction effect?

The accessibility factor is expressed or interpreted as proximity to the potential incoming recreationist, so accounting for opportunity demand as a function of travel cost (Carpio *et al*., 2008). Each factor must be expressed as an attraction-factor value for its quality (a closer resource of higher quality attracts the tourist more strongly). In GIS, proximity is operationalised by calculating the distance from all locations in the experimental space to some target feature (the distance from each image grid cell to a road of a given class). The location value of any potential tourism attraction is also determined by the potential product demand for that location according to the concentration of populations of given economic classes in particular areas of provincial and national space, from where demand is generated. This niche nature-based product of the province is uniquely focussed on natural and infrastructure features to be used for action and adventure activities.

Selection of outdoor action, adventure recreation and tourism product variables

The variables selected for this product are listed in Table 1. Twenty-seven (27) individual factors were identified as criteria to measure potential for this product, mainly capturing

OAART opportunities, especially those that are water based (including sport). The variables cover a range of features with intrinsic (objectively measurable) and extrinsic (largely subjectively measurable) attributes (Priskin, 2001; Carter & Bramley, 2002). Six (6) compound indexed factors have been created to reduce the number of variables to 13. In this way some overlapping influences among variables were removed while the influence of individual variables remain prevalent (Kumari *et al.*, 2010) in the final analysis (albeit less influential) and application of the MCE procedure becomes less cumbersome. Combining lowly ranked variables (7 for Factor 5) maintains thematic coherence. Four main resource dimensions capture the variation in the natural and cultural landscape, spatial accessibility and service provision in provincial space quite exhaustively compared to similar research done elsewhere (Chhetri & Arrowsmith, 2008; Arabatzis & Grigoroudis, 2010; Hall, 2011).

Standardisation of measured potential

Step 5 of the MCE process is necessary because most of the spatial data sources were accessed in the original analogue (data lists) and vector formats (maps), and therefore, had to be converted to rasterised digital images.

This step required a crucial decision to be made on the resolution (cell size) of the raster images because it implies a generalisation of data from the exact vector location description to a grid cell sequence switch that automatically causes data generalisation. A fine-scale raster (<50m) implies cumbersome and computationally intensive image sizes and an unrealistic implied level of data accuracy. A coarse-scale raster (>5km) over generalises the data, causing data loss and generating output that has little functionality for decision support. Consequently, all raster images were standardised to a 1km x 1km cell size. This means that all data are approximated to the nearest one kilometre and that all results demarcate spatial units of $1km^2$. The generated image convincingly shows that this operational decision was appropriate and practical.

The variables listed in Table 1 were measured in the indicated variable units and data types. Since a variety of measurement units are used in the source maps (slope in degrees, height in metres, distance in kilometres) it was imperative that these raw values per input image be standardised (Onosemuode & Dare, 2010), because MCE application in GIS requires all image overlays to be combined virtually and thus be expressed in the same measurement unit. Many of these factor-image variables are indicative of the graduated presence or absence of a feature, but in most cases the distance (variable-kilometre influence buffers) or interpolated density of occurrence principles have been employed. Each variable in the list has demonstrable usefulness for measuring some form of OAART potential. A standard potential-rating scale for all values in the image cells was devised; such that they correlate positively with the potential they reflect (higher values indicate greater potential for the OAART product).

Although rating scales can be applied in a number of ways, this research applied the rating scale recommended in the literature to range from 1 (lowest potential) to 5 (highest potential). This range accords with human ability to comprehensibly and consistently judge differences between sequential values. Each factor image had its original (raw) cell values reclassified according to the potential scale of 1 (very low), 2 (low), 3 (medium), 4 (high) and 5 (very high). In many cases the researchers, acting as scientists, performed an expert-based evaluation to assign scale values to the raw image values. Most values for derived distance

images were statistically calculated according to quintile (mostly quintiles, five equal interval classes) or natural-breaks (Jenks, 1967) functions in the ArcMap software.

TABLE 1: **SPATIAL FACTORS FOR DETERMINING POTENTIAL OF OUTDOOR ACTION, ADVENTURE RECREATION AND TOURISM PRODUCTS**

Resource availability (quality) and measurement	**Data ***	**Attraction or opportunity relevance**	**Raw weight**
NATURAL ENVIRONMENTAL ASSETS			
1. Index of climbing activity potential			8
• Cliff line presence	B	Climbing potential, aesthetics	
• Slope (%)	S	Steep topography, action activity	
2. Index for presence of water bodies based on:			8
• Permanent water presence: distance from line-channels (m)	S	Running water: inland water action activity, aesthetics, tranquillity	
• Permanent water: distance from surface areas (m)	S	Dams, lakes, rivers: inland water activity, sport, aesthetics, tranquillity	
3. Absolute topographical height above sea-level (m)	S	Steep topography, action activity	6
4. Index for challenging coastal features based on:			6
• *Coastal morphology: distance from river estuaries (m)*	S	Coastal water activity, sport, aesthetics	
• *Coastal morphology: distance from sandy beach (m)*	S	Beach activity, sport, aesthetics	
• *Coastal morphology: distance from rocky shore (m)*	S	Rocky shore activity, sport, aesthetics	
5. Index for regional climatic character based on:			3
• *Mean monthly maximum temperature (°C, negative 5-1)*	S	General outdoor comfort	
• *Mean monthly minimum temperature (°C, negative 5-1)*	S	General outdoor comfort	
• *Mean relative humidity (%, negative 5-1)*	S	Outdoor action constraint, comfort	
• *Mean July temperature (°C, negative 5-1)*	S	Outdoor winter-activity opportunity, comfort	
• *Mean February temperature (°C, negative 5-1)*	S	Outdoor summer-activity comfort	
• *Mean annual rainfall (mm, negative 5-1)*	S	Outdoor-activity opportunity	
• *Mean number of days with frost (no, positive 1-5)*	S	Outdoor-activity comfort, duration	

TABLE 1 (cont.)

Resource availability (quality) and measurement	Data *	Attraction or opportunity relevance	Raw weight
CULTURAL HERITAGE RESOURCES			
6. Land cover (type)	N	Activity opportunity, diversity, interest	6
7. Nature conservation area: presence	B	Ecological activity and interest	6
8. Mountain passes and trails: presence	B	Hiking activity, cultural interest, aesthetics	5
TRANSPORTATION ACCESSIBILITY			
9. Index of road network access distances			3
• *Distance from national roads (km)*	S	National access ease: activity opportunity	
• *Distance from main gravel roads (km)*	S	Local access ease: activity opportunity	
10. Weighted distance from metropoles	S	National market demand and access	3
SUPPORT SERVICES AND PLANT			
11. Cell phone coverage	O	Communications connectivity	4
12. Distance to accommodation facilities *(density index)*	S	Travel support	4
13. Index of travel and security support services			1
• *Distance to nearest petrol service station (km)*	S	Travel support	
• *Distance to nearest dentist and doctors (km)*	S	Emergency or well-being support	
• *Distance to nearest pharmacy (km)*	S	Emergency or well-being support	
• *Distance to nearest police station (km)*	S	Emergency, safety and security support	
• *Distance to nearest restaurant (km)*	S	Travel and comfort support	

***** *Data type:N=Nominal; O=Ordinal; B=Boolean (0,1); S=Scale*
Data Sources: Chief Directorate Surveys and Mapping: 1:50 000 digital layers; Western Cape Towns Research project; Environmental Potential Atlas; Cape Nature; Centre for Geographical Analysis spatial database; South African Weather Bureau; Council for Scientific and Industrial Research; Multiple and compound indices; GIS-derived computations.

WEIGHTING OF OUTDOOR ACTION, ADVENTURE RECREATION AND TOURISM PRODUCT FACTORS

Combining potential-coded, georeferenced overlay themes in GIS requires standard combination procedures through overlaying and the use of standard mathematical operators like addition or multiplication. By implication, all variable images entered into the equation carry the same weight and contribute equally to the result. Clearly, such an approach contradicts the reality of normal decision-making where influencing factors contribute varying intensities to sway decisions (Priskin, 2001). So, Step 6 of the MCE process requires that the selected variables be differentially rated and weighted and weights assigned to participating factors as proportions summing to 1.0 (or as percentages summing to 100). The subsequent MCE process allowed for differential factor affects and cell values in the potential image still ranged between 1 and 5.

The weights were calculated according to the Saaty (1977) methodology on the basis of a reciprocal matrix in which each variable is compared to and scaled for importance relative to all other variables in the equation on a scale of 1-9 (positive and negative). The procedure calculates the weights automatically from the entered weight values and also performs a consistency check. The consistency value must be below 0.1. The weighting calculation was performed by the Canadian Conservation Institute online facility that allows the entering of values in a matrix or by a line-by-line method.

The weights derived from the method explained above generated the weight ranking of the 13 selected factors as listed in Table 2. It shows the high consistency obtained in the allocation process and no factor dominates disproportionately.

TABLE 2: **FACTOR WEIGHTS**

Factor	Weight (%)	Factor	Weight (%)
1. Climbing activity potential	19.9	11. Cell phone coverage	3.9
2. Index for presence of water bodies	19.9	12. Accommodation facilities	3.9
3. Absolute topographical height	9.3	5. Index regional climatic character	2.6
4. Challenging coastal features	9.3	9. Road network access	2.6
6. Land cover	9.3	10. Metropolitan access	2.6
7. Nature conservation area presence	9.3	13. Travel and security support service	1.4
8. Mountain passes and trails	6.0	*[Consistency ratio: 0.02]*	*(100.0)*

RESULTS: SPATIAL OUTCOME OF MCE APPLICATION IN GIS

The results of the MCE operation in GIS to generate a potential-rating image for the OAART product are shown in Figure 2. The map illustrates the highly nuanced and quite detailed (1-km^2 resolution) spatial pattern of potential allocation as it was determined by the selection and weighting of variable factors. The spatial pattern broadly shows the expected concentration of high potential along the high-mountain complexes, river corridors and along

the coast. Since it is a nature-based product, it is not surprising that the overall pattern largely highlights the less-developed and topography-endowed parts of the province. Yet, there are significant smaller peaks of opportunity in locations that call for focussed attention.

The spatial pattern appears complex because of the inclusion of fine-detail natural resources, such as water features and land cover. High-potential demarcations stream linearly along valleys from prominent topographical features, such as mountain-and-valley chains. As expected for the product, limited urban bias is detected here, as is often the case with similar projections for other tourism products.

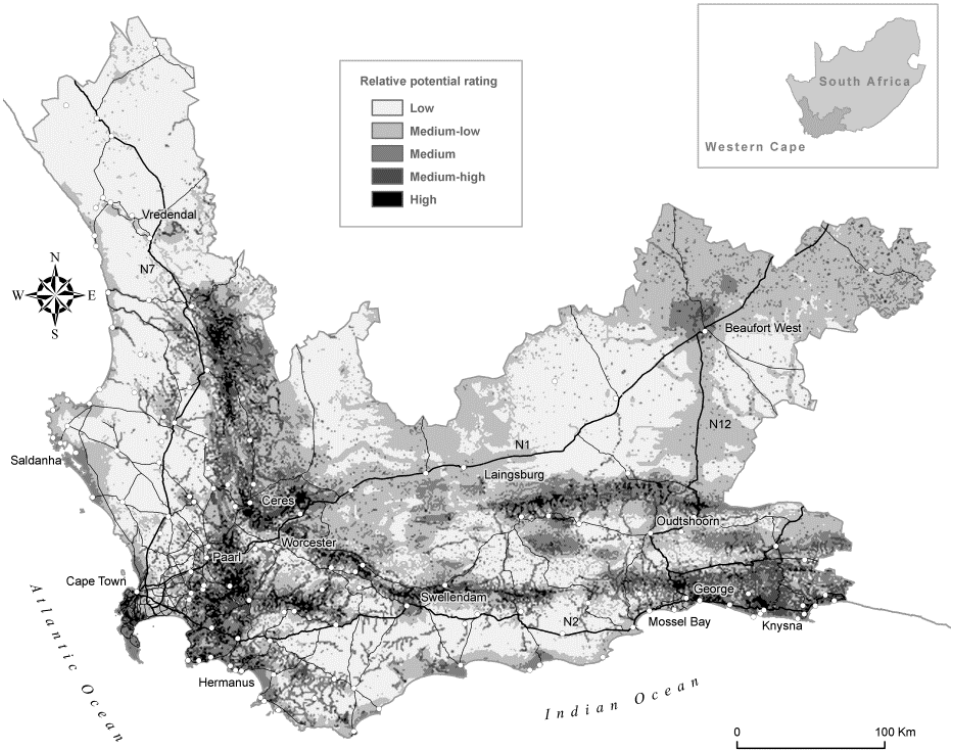


FIGURE 2:**POTENTIAL FOR OUTDOOR ACTION AND ADVENTURE RECREATION AND TOURISM PRODUCT DEVELOPMENT IN THE WESTERN CAPE**

Broadly, the Garden Route coastline and coastal bench show high prominence, with the south-western mountain-and-valley complex obtaining even higher prominence on the rating scale. The Cederberg, Swartberg, Langeberg and Boland mountain chains and eastern Little Karoo regions are clearly designated for this product. The regionally informed interpreter of these patterns can glean superb location insight from these detailed patterns. Noteworthy are the coastal-town corridors along the West Coast (peaking at Langebaan) and Southern Cape (with peaks around notable resort towns from Hermanus in the west through Cape Agulhas

and Stilbaai to Mossel Bay and farther east to Knysna); the rural valleys of Warm and Koue Bokkeveld, Slanghoek, Nuy, Villiersdorp, Grabouw, Baardskeerdersbos, McGregor, Buffeljags, Suurbraak, Koo, Op-de-Tradouw, Ladismith, Schoemanshoek and Klaarstroom; the wilderness mountain-and-valley maze of the Cederberg and the Nuweveld escarpment in the Beaufort West region. Overall, it is notable that the procedure gives significant potential

spatial allocations to the low-density, less-developed rural *platteland* and Karoo regions.

A comparison of these patterns of high-potential allocation with the 11 coarsely and intuitively identified and demarcated areas prioritised as tourism development zones by SAT (2007a) for the ITDF, namely: Cape Town Foreshore; Cape Flats; Stellenbosch-Paarl-Franschhoek; Langebaan-Velddrif; Overstrand; L‟Agulhas; George-Mossel Bay-Oudtshoorn; Eastern gateway (Plettenberg Bay-Knysna-Wilderness); Beaufort West; Cederberg gateway; and Route 62. These demonstrate the difference between the approaches. The coarser marketing-focussed approach allows for signal spatial indicators characterised by evocative names (like Route 62), known regions (Cederberg), administrative regionalisations (Overstrand), or town-specific notation (Beaufort West). Conversely, the fine-scale spatial directive and meaning of the more objective MCE approach analyses space more surgically to isolate development potential and opportunity. The ITDF was conceived to guide tourism development until 2012. It has given guidance to aligned spatial development programmes like provincial transport plans, provincial environmental and integrated development plans (IDPs), but the fine-scale indications of this research can guide more accurate entrepreneurial planning.

CONCLUSION AND RECOMMENDATIONS

This research gives strategic direction to developers and marketers of OAART in the Western Cape. The deliverable is an indicator of potential spatial recreationist product opportunities, spatially represented in map format at a resolution of 1km^2 and offered as a valuable planning and development tool and aid. It identifies, exposes and explains key elements of the natural, cultural, social and policy environments in which OAART operations and endeavours exist in the Western Cape. Through this „statistical picturing‟ (Olson, 2010), a resource-governance model is created that can assist private development of recreational resources. By offering information that describes fundamental aspects of the sector, and by supplying insights and recommendations for future initiatives, this research affords primary stakeholders and planning proponents‟ options to make informed decisions and to take knowledgeable action regarding the location of targeted development in space as demonstrated here for the Western Cape.

A focus on quality (responsible) tourism and recreation development and selective marketing to enhance experience and improve learning (Tangeland, 2011) is advocated as prerequisite for building and maintaining sustainable action and adventure product destinations in the Western Cape. The rural, eco-and OAART products must be given distinctive, innovative and spatially focussed product packaging, marketing and promotion. Growth in the Western Cape‟s OAART industry must not merely be about plant expansion, but rather about sustained investment behind clear choices how to differentiate the region into important target markets for the development of destinations (SAT, 2007a; Ecker *et al*., 2010). South Africa is

still mainly perceived as an adventure-filled wildlife destination with striking natural beauty. Our cultural assets are largely unclear in the consumer‟s mind and undifferentiated from the rest of the continent (SAT, 2007a). The recreation industry needs to redefine, upgrade and freshen products and services to deliver on the promises offered by marketing messages. The outcomes of this research can play a significant role in planning efforts to fill some of the product and service gaps. It contributes to the larger picture of OAART resource potential in

the province and can serve as a keystone of destination planning and reviewing the ITDF of the Western Cape province.

As in the USA (Das & Rainey, 2010), the paucity of relevant data relating to local recreation and tourism development hampers proper planning, including its location aspects. The constantly improving quality, level of detail and richness of spatial data afforded by the Spatial Data Infrastructure Act (Nr 54 of 2003) puts the possibilities for increased accuracy in informed decision support through spatial modelling of economic-sector development on a steep upward trajectory.

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OKULÊRE MOTORIESE BEHEER FUNKSIES EN VISUEEL-MOTORIESE INTEGRASIE STATUS VAN 'N GESELEKTEERDE GROEP 6- TOT 8-JARIGE LEERDERS MET ADHD

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ABSTRACT

The aim of the study was to determine, as ascertained by ocular motor control functions and visual-motor integration, what the nature and scope of visual-motor problems are in 6- to 8-year-old learners with ADHD. Fifty-seven learners (32 boys and 25 girls) were divided into an ADHD group (n=39, mean age 6.95 years) and a group without ADHD (n=18, mean age 7.11 years). The Sensory Input Systems Screening Test and Quick Neurological Screening Test II (QNST-II) were used to evaluate ocular motor control and the Beery Visual-Motor Integration Test (VMI 4th ed. was used to evaluate visual motor integration, motor coordination and visual perception. Two-way frequency tables were used to determine the relationship between ADHD and ocular motor control functions, while an independent t-test (p<0.05) was used to analyse group differences. Practical significance of differences between groups was established with effect sizes (d>0.5). The results confirmed more ocular motor control problems among learners with ADHD, especially in visual tracking and convergence-divergence. The visual perception (p<0.05; d=0.37) and motor coordination (p<0.05; d=0.49) of the groups differed significantly, where the group with ADHD obtained lower scores. The learners with ADHD experienced problems with ocular motor control, fine motor control and visual perception which should be rectified by intervention.

Key words: ADHD; Ocular motor control; Eye muscles; Visual-motor integration (VMI); Motor coordination; Visual perception.

INLEIDING

Aandaggebrek-hiperaktiwiteit-sindroom (ADHD) word gedefinieer as ‟n herhalende patroon van aandagafleibaarheid of hiperaktiwiteit met impulsiewe gedrag wat meer onvanpas, oormatig en herhalend is by leerders met dieselfde ontwikkelingsvlak (APA [American Psychiatric Association], 2000). Navorsers (APA, 2000; Faraone *et al*., 2000) rapporteer dat 3 tot 7% van alle leerders geaffekteer word deur ADHD, en ’n seun-tot-dogter ratio word tussen 2:1 en 9:1 gerapporteer (APA, 2000; Sherrill, 2004; Mahone *et al*., 2009), afhangende van die tipe ADHD (kombinasie tipe; predominante aandagafleibare en dominante hiperaktiewe-impulsiewe tipe). Simptome wat deur verskeie leerders openbaar word en wat as hiperaktief beskryf word, kan dikwels na leerverwante okulêre motoriese beheer probleme soos akkommodasie, visuele navolging, okulêre belyning, konvergensie-divergensie en fiksasie herlei word (Cheatum & Hammond, 2000).

Leerders met ADHD het ‟n groter geneigdheid om konsentrasie te verloor weens algemene afleidings (Loe *et al*., 2009). Sodanige leerders sal ook swakker vaar in visuele evaluasies, asook meer onnodige sakkadiese oog bewegings toon (Loe *et al*., 2009). ‟n Studie deur Borsting *et al*. (2005) toon dat leerders van skoolgaande ouderdom (8 tot 15 jaar) met simptomatiese akkommodasie-disfunksie of konvergensie-oneffektiwiteit, ‟n hoër frekwensie van ADHD-gedrag toon vergeleke met leerders in ‟n kontrole groep. Bala *et al*. (1981) het gevind dat hiperaktiewe seuns meer en groter sakkadiese bewegings maak en dat hulle ook meer wegkyk (oë wat dwaal) van die navolgingsrigting, as seuns sonder ADHD.

Swak okulêre motoriese beheer funksies beïnvloed vaardighede wat met visie te make het soos visueel-motoriese integrasie; visuele persepsie, diepte persepsie, motoriese koördinasie,

visuele figuuragtergrondontwikkeling en persepsie van vorm. Dit veroorsaak gevolglik agterstande in algehele liggaamskoördinasie- en perseptuele vaardighede soos balans en ruimtelike oriëntasie wat met ontwikkeling te make het (Lefebvre & Reid, 1998; Haywood & Getchell, 2009), sowel as in skryfvaardighede wat met fynmotoriese vaardighede te make het (Arter *et al*., 1996; Haywood & Getchell, 2009). Lane (2005) rapporteer dat leerders oor goed ontwikkelde okulêre en motoriese sisteme kan beskik, maar dat dit nie noodwendig is dat die twee sisteme goed geïntegreer is nie. Indien die sisteme nie goed geïntegreer is nie, kan dit tot visueel-motoriese integrasie probleme bydra (Beery & Buktenica, 1997; Lane, 2005).

Een van die oorsake van swak integrasie van die okulêre en motoriese sisteme is gesetel in die beheer van oogbeweging deur die okulêre spiere. Elke oog het drie pare oogspiere wat ekstern op elke oog geleë is, naamlik die rectus lateralis en medialis, rectus superior en inferior, asook die superior en inferior oblique wat bo, onder en aan die kante van die sklera vasgeheg is en bewegings van die oog beheer (Saladin, 2007). Indien daar uitvalle in enige van die okulêre motoriese beheer funksies voorkom, sal daar waarskynlik probleme ervaar word met akademiese- sowel as sportprestasie weens onvoldoende okulêre motoriese beheer (Desrochers, 1999; Orfield, 2001).

Uit die literatuur (George *et al*., 2005; Papavasiliou *et al*., 2007) blyk daar dus ŉ moontlike verband tussen okulêre motoriese beheer vaardighede en ADHD te wees. Alhoewel daar reeds studies in Suid-Afrika uitgevoer is wat op ADHD fokus, is geen navorsing gepubliseer oor moontlike verbande tussen ADHD, okulêre motoriese beheer en visueel-motoriese integrasie nie. Die verskeie verbande wat swak okulêre motoriese beheer met akademiese vordering en sportprestasie by die skoolbeginner toon, maak dit belangrik om te bepaal wat die omvang en aard van die probleem by jong leerders met ADHD is. Die doel van hierdie studie is gevolglik om die okulêre motoriese beheer- en visueel-motoriese integrasie status van ‟n geselekteerde groep 6- tot 8-jarige leerders met en sonder ADHD te bepaal, asook die moontlike effekte van ADHD op visueel-motoriese integrasie.

METODE VAN ONDERSOEK

Ondersoekgroep

Die studie is op ‟n beskikbaarheidsteekproef in Brakpan, Suid-Afrika, uitgevoer. Leerders met en sonder simptome van ADHD in Graad 1 en 2 is deur die onderwysers van 3 geselekteerde laerskole, pediaters en opvoedkundige sielkundiges geïdentifiseer. Die klasse

binne ‟n graad is ewekansig in elke skool geselekteer om aan die studie deel te neem. Die totale aantal proefpersone wat aan die studie deelgeneem het, was 57 leerders (32 seuns en 25 dogters) tussen die ouderdomme van 6- en 8-jaar wat in twee groepe verdeel is. Die 1 groep het uit leerders met ADHD-simptome (n=39) bestaan en die tweede groep is saamgestel uit leerders waarvan die simptome nie van so ‟n aard was dat hulle met ADHD (n=18) geklassifiseer is nie.

TABEL 1: **SAMESTELLING VAN ONDERSOEKGROEP VOLGENS GESLAG EN OUDERDOM**

Veranderlikes	Groep met ADHD			Groep sonder ADHD		
	Seuns n=24	**Meisies** n=15	**Totaal** N=39	**Seuns** n=8	**Meisies** n=10	**Totaal** N=18
Gemiddelde ouderdom (maande)	84.96	80.76	83.40	85.56	85.2	85.32
Gemiddelde ouderdom (jare)	7.08	6.73	6.95	7.13	7.1	7.11
Standaard afwyking (SA)	0.72	0.7	0.72	0.35	0.73	0.58

Meetinstrumente

Sensoriese Invoer Siftingsmeetinstrument en die "Quick Neurological Screening Test II" (QNST-II)

Die *Sensoriese Invoer Siftingsmeetinstrument* waarmee motoriese afwykings, gebaseer op neurologiese agterstande, geïdentifiseer kan word, is deur Pyfer (1988) ontwikkel en gepubliseer. Hierdie siftingsmeetinstrument is hoofsaaklik geskoei op die identifisering van leerders met probleme wat ‟n neurologiese oorsprong kan hê, wat as resultaat bewegingsafwykings by hulle kan veroorsaak. Die evalueringsbattery bestaan uit 6 hoofkomponente: reflekse; ekwilibrium reaksies; vestibulêre funksie; okulêre motoriese beheer funksies; bilaterale integrasie; en geassosieerde reaksies.

Vir die doeleindes van die studie is slegs die okulêre motoriese beheer funksies gebruik. Die okulêre motoriese beheer funksies komponent word in die volgende sub-toetse verdeel: fiksasie met beide (binokulêr) oë en linker- en regteroog afsonderlik (monokulêre werking); okulêre belyning (diepte persepsie); konvergensie-divergensie en visuele navolging (beide oë en linker- en regteroog afsonderlik). Proefpersone is individueel met die voorgeskrewe apparaat geëvalueer. Die QNST-II (Mutti *et al*., 1998) is ‟n kriterium gebaseerde meetinstrument wat visuele diskriminasie, visuele persepsie, fynmotoriese beheer, hand-oog-koördinasie, spiertonus, motoriese beplanning en opeenvolging, ruimtelike oriëntasie en bilaterale koördinasie meet. Hierdie meetinstrument is geskik vir persone van 5-jarige ouderdom tot volwassenheid (Mutti *et al*., 1998). Vir die doel van die studie is slegs van die subtoetse wat met visuele navolging te make het, gebruik gemaak naamlik, horisontale- en vertikale visuele navolging met beide oë.

Elke okulêre motoriese beheer funksie (oogspier funksie) is dan volgens simptome wat as visuele uitvalle beskou word, in 3 klasse verdeel naamlik: Klas 1 met geen visuele uitvalle; Klas 2 met 1 tot 3 visuele uitvalle; Klas 3 met meer as 3 visuele uitvalle of algemene manifestasies van visuele uitvalle. Die volgende uitvalle se voorkoms kan almal beskou word as die gevolg van oormatige stres op die visuele sisteem. Gevolglik het die proefpersoon slegs 1 punt behaal ongeag of meer as een van die simptome voorgekom het soos oë wat gevryf word, oë wat brand, oë wat geknip word, oë wat rooi is, asook oë wat traan/waterig is.

By kompenserende bewegings het dieselfde proefpersoon 1 punt vir elk ontvang indien een van die volgende simptome voorgekom het: kop draai na die linker- of regterkant; kop beweeg heen-en-weer of op-en-af terwyl ‟n voorwerp gevolg word; oë spring oor die

middellyn; en oë volg nie die voorwerp nie/verloor die voorwerp. Daarna is die punte bymekaar getel om die proefpersoon in ‟n sekere klas (geen; matig – 1 tot 3 uitvalle; ernstig – meer as 3 uitvalle) ten opsigte van visuele funksies te groepeer.

"Beery-Buktenica Developmental Test of Visual-Motor Integration" (VMI-4)

Die "*Beery-Buktenica Developmental Test of Visual-Motor Integration"* (VMI-4) (Beery & Buktenica, 1997) is ‟n meetinstrument wat bestaan uit ŉ visueel motoriese integrasie (VMI) gedeelte en 2 aanvullende toetse, naamlik vir visuele persepsie en motoriese koördinasie. Die VMI-4 bestaan uit ‟n ontwikkellingsopeenvolging van 27 geometriese vorme wat met potlood en papier gekopieer moet word. Die volledige toets kan individueel óf in groepsverband binne ongeveer 10 tot 15 minute voltooi word en is geskik vir gebruik vanaf voorskoolse ouderdom tot en met volwassenheid.

Die 2 aanvullende toetse, naamlik visuele persepsie en motoriese koördinasie, word afsonderlik geëvalueer en bepunt. Die kriteria vir die VMI-4 punte toekenning is soos volg: punte word toegeken volgens die hoeveelheid toetsitems wat die persoon korrek uitgevoer het. Die opdrag word gestaak sodra die persoon 3 toetsitems agtereenvolgend foutief uitgevoer het of met voltooiing van die afdeling. Die totaal punte word na ‟n standaardtelling verwerk waarvolgens die proefpersoon in 1 van 5 groepe geklassifiseer kan word, naamlik vanaf ver ondergemiddeld na ver bogemiddeld (40 tot 67 is ver onder gemiddeld; 68 tot 82 is onder gemiddeld; 83 tot 117 is gemiddeld; 118 tot 132 is bo gemiddeld; 133 tot160 is ver bo gemiddeld). Die visueel-motoriese integrasie en die aanvullende visuele persepsie en motoriese koördinasie toetse het elk ‟n algehele betroubaarheid van r=0.92, r=0.91, en r=0.89 onderskeidelik (Beery & Buktenica, 1997).

"*Disruptive Behaviour Scale*" (Kontrolelys vir ADHD)

Die *Disruptive Behaviour Scale* is ŉ 18-item vraelys wat deur Bester (2006) saamgestel is en word gebruik om aan te dui of ŉ kind aandagafleibaar is of nie. Die 18-item vraelys is soortgelyk aan die *Modified Conner's Abbreviated Teacher* (Lowenberg & Lucas, 1999) skaal en die verkorte weergawe van die *Australian Disruptive Behaviour Scale* (Piek *et al*., 1999). Die onderwysers sowel as ouers moes afsonderlike vraelyste voltooi en aandui watter stelling huidig of in die laaste 6 maande die mees toepaslikste ten opsigte van die kind was, deur „nooit‟ tot „baie gereeld‟ in die aangewese kolom te antwoord.

Items 1-9 (A) van die vraelys is gerig op ADHD-A (aandagafleibaarheid) simptome en items 10-18 (B) op ADHD-HI (hiperaktiwiteit-impulsiwiteit) simptome, terwyl items 1 tot18 is op die ADHD-K (kombinasie tipe) gerig. Puntetoekenning word soos volg gemaak: 0= „nooit‟; 1= „nou en dan‟; 2= „soms‟; 3= „gereeld‟; 4= „baie gereeld‟. Hoe hoër die totaal wat die kind behaal, hoe meer kenmerke van ADHD kom voor. Daar is ook ‟n addisionele kolom waarin die ouers/onderwysers moet aandui of die gedrag as problematies ervaar word deur, „Ja‟ of „Nee‟ te merk. Wanneer die totaal van A of B bo 24 en by meer as twee funksionele plekke voorkom (soos die skool en die huis) het die kind voldoende hoeveelheid simptome om ADHD te kan diagnoseer (48 en meer). Daar moet egter ook meer as 6 „Ja‟ antwoorde afgemerk wees in groep A of B. Die interpretasie van die resultate van die *Disruptive Behaviour Scale* is deur opgeleide Kinderkinetici onder leiding van ŉ voorligtingsielkundige gedoen.

METODOLOGIE

Navorsingsprosedure

Etiese goedkeuring (O6M04) is verkry by die Etiekkomitee van die Noordwes-Universiteit, Potchefstroomkampus. Die 18-item ADHD kontrolelys (Bester, 2006), wat die eienskappe en simptome van leerders met ADHD-simptome aandui, is aan die 3 betrokke laerskole verskaf. Die onderwyser is versoek om potensiële proefpersone te identifiseer en die vraelys te voltooi, sowel as aan dié leerders se ouers te voorsien vir voltooiing. Ingeligte toestemming is van die ouers van elke proefpersoon verkry. Leerders wie se ouers toestemming daartoe verleen het dat hulle aan die studie mag deelneem, is geëvalueer ten opsigte motoriese-okulêre motoriese beheer funksies, sowel as met betrekking tot visueel-motoriese integrasie.

Al die leerders wat geïdentifiseer is met die ADHD-vraelys, is in een groep geplaas (n=38) terwyl ‟n tweede groep (n=18) bestaan het uit leerders wat nie genoegsame simptome getoon het om met ADHD geklassifiseer te word nie. Hierdie leerders is geselekteer uit ‟n groep leerders wat die onderwysers geïdentifiseer het as leerders sonder konsentrasie probleme. Basislynmetings is tydens skoolure in die eerste kwartaal van 2009 afgeneem.

Statistiese prosedure

Vir die dataverwerking is die “Statistica for Windows” Statsoft rekenaarprogrampakket gebruik (StatSoft, 2011). Data is eerstens vir beskrywingsdoeleindes deur rekenkundige gemiddeldes ($\overline{X}$), minimum en maksimum waardes en standaardafwykings (SA) ontleed. Daar is van tweerigting frekwensie tabelle gebruik gemaak om die okulêre motoriese beheer te ontleed. Die Pearson Chi-kwadraat is gebruik om betekenisvolheid van verskille aan te dui en ‟n waarde van $p<0.05$ is hiervoor gebruik (Steyn, 2002). Die Phi-koeffisiënt toon ‟n „klein‟ praktiese betekenisvolheid by $w\geq0.1$, ‟n „matige‟ betekenisvolheid by $w\geq0.3$, en ‟n groot betekenisvolle effek by $w\geq0.5$ (Steyn, 2002). Onafhanklike t-toetsing en effekgroottes is verder gebruik om groepsverskille ten opsigte van die VMI resultate te ontleed, waar die volgende riglyne gebruik is om praktiese betekenisvolheid te bepaal: EG=0.2 (klein effek); EG=0.5 (medium effek); en EG=0.5 (groot effek) (Cohen, 1988).

RESULTATE

TABEL 2: **PERSENTASIE OKULÊRE MOTORIESE BEHEER UITVALLE BY LEERDERS MET EN SONDER ADHD**

		Klas 1		Klas 2		Klas 3			
Groep	N	n	%	n	%	n	%	p	w
Fiksasie beide oë									
1	39	28	80.00	7	20.00	0	0	0.93	0.01
2	18	15	78.95	4	21.05	0	0		
Fiksasie regter oog									
1	39	21	60.00	14	40.00	0	0	0.60	0.07
2	18	10	52.63	9	47.37	0	0		

Fiksasie linker oog									
1	39	17	48.57	18	51.43	0	0	0.93	0.01
2	18	9	47.37	10	52.63	0	0		
Navolging beide oë									
1	39	19	54.29	8	22.86	8	22.86	0.26	0.22
2	18	9	47.37	8	42.11	2	10.53		*
Navolging regter oog									
1	39	20	57.14	11	31.43	4	11.43	0.05	0.34
2	18	7	36.84	12	63.16	0	0	**	**
Navolging linker oog									
1	39	19	54.29	11	31.43	5	14.29	0.02	0.38
2	18	6	31.58	13	68.42	0	0	*	**
Navolging Horisontale QNST									
1	39	9	25.71	24	68.57	2	5.71	0.50	0.16
2	18	7	36.84	10	52.63	2	10.53		*
Navolging Vertikale QNST									
1	39	10	28.57	23	65.71	2	5.71	0.82	0.09
2	18	4	21.05	14	73.68	1	5.26		
Okulêre belyning regter oog									
1	39	28	80.00	7	20.00	0	0	0.99	0.013
2	18	15	78.95	4	21.05	0	0		
Okulêre belyning linker oog									
1	39	28	80.00	7	20.00	0	0	0.99	0.01
2	18	15	78.95	4	21.05	0	0		
Konvergensie-Divergensie									
1	39	6	17.14	28	80.00	1	2.86	0.72	0.11
2	18	4	21.05	15	78.95	0	0		*

p van Pearson Chi-kwadraat: p≤0.05** w van Phi Koeffisiënt: w=0.1* w=0.3** w=0.5***
Klas 1= Geen uitvalle Klas 2= Matige uitvalle Klas 3= Ernstige uitvalle
Groep 1= groep *met* ADHD Groep 2= groep *sonder* ADHD.

Tabel 2 dui die persentasie uitvalle met betrekking tot okulêre motoriese beheer aan wat in elke klas voorgekom het by die groep met ADHD-simptome (Groep 1), sowel as die groep sonder ADHD-simptome (Groep 2). Die 10% peil van praktiese betekenisvolheid is ook as ‟n betekenisvolle verskil beskou omdat daar weens die relatief klein groepe nie genoeg onderskeidingsvermoë op die 5% peil van statistiese betekenisvolheid voorgekom het nie.

Geen proefpersone is in die groep met of sonder ADHD in Klas 3 (ernstige uitvalle) geklassifiseer tydens fiksasie (beide oë, linker- en regteroog afsonderlik) en okulêre belyning (linker- en regteroog) nie. Navolging met die *regteroog* toon ‟n statistiese en praktiese betekenisvolle verskil (p=0.05; w=0.34) tussen die groepe, waar die groep met ADHD (Groep 1) ‟n groter persentasie (11.43%) leerders in Klas 3 gehad het in vergelyking met die groep sonder ADHD (Groep 2) (0%). Navolging met die *linkeroog* toon statisties sowel as prakties betekenisvol verskille (p=0.02; w=0.38), waar die groep sonder ADHD geen leerders in Klas 3 gehad het nie, maar wel ‟n groot persentasie in Klas 2 (63.16%), en die groep met ADHD kom die meerderheid van leerders in Klas 1 (54.29%) voor met van die leerders wat wel in Klas 3 geval het (14.29%). Tydens horisontale- en vertikale navolging is die meerderheid van

beide groepe in Klas 2 geklassifiseer, met geen statistiese betekenisvolle verskille nie, hoewel daar wel ‟n praktiese betekenisvolle verskil (w=0.16) met ‟n klein effek tussen die groepe tydens horisontale navolging gevind was.

Konvergensie-divergensie het geen statistiese betekenisvolheid met betrekking tot groepsverskille getoon nie, maar wel ‟n praktiese betekenisvolle verskil (w=0.11) met ‟n klein effek tussen die groepe. In hierdie toets het die meerderheid van die leerders in beide groepe in Klas 2 (80 en 78.95%) voorgekom, terwyl daar wel in die groep met ADHD (Groep 1), 1 leerder was wat in Klas 3 geklassifiseer is.

TABEL 3: **BETEKENISVOLLE VERSKILLE TUSSEN LEERDERS MET EN SONDER ADHD MET BETREKKING TOT VMI**

Veranderlikes	**Groep met ADHD** (n=38)		**Groep sonder ADHD** (n=18)		**Betekenisvolheid van verskille**			
	$\overline{X}$	**SA**	$\overline{X}$	**SA**	**t**	**gv**	**p**	**d**
VMI	92.71	12.99	92.78	17.17	0.01	54	0.99	0.003
VP	86.74	14.04	94.39	20.56	1.63	54	0.11	0.37*
MK	74.42	13.51	82.22	15.97	1.90	54	0.06	0.48*

gv=grade van vryheid; p≤0.05*; d≥0.2*; d≥0.5**; d≥0.8***;
VMI=Visueel-Motoriese Integrasie; VP=Visuele Persepsie; MK=Motoriese Koördinasie

Tabel 3 bied die resultate aan van ‟n onafhanklike t-toets wat op die visueel-motoriese integrasie resultate uitgevoer is om verskille tussen die groepe te ondersoek. ‟n Klein praktiese-betekenisvolle verskil in visuele persepsie (d=0.37) en motoriese koördinasie (d=0.49) is aangetref, waar Groep 1 (met ADHD) swakker gevaar het as Groep 2 (sonder ADHD), alhoewel daar geen statistiese betekenisvolle verskil tussen die groepe voorgekom het nie.

BESPREKING VAN RESULTATE

Die doel van hierdie studie was om die okulêre motoriese beheer- en visueel-motoriese integrasie status van ‟n geselekteerde groep 6- tot 8-jarige leerders met en sonder ADHD te bepaal, asook moontlike effekte van ADHD op visueel-motoriese integrasie.

Die resultate van die studie toon dat daar okulêre motoriese beheer uitvalle by die meerderheid van leerders voorgekom het ongeag of hulle met ADHD geklassifiseer was. Die grootste persentasie leerders het in Klas 2 voorgekom, veral met betrekking tot horisontale- (68.57%; 52.63%) en vertikale navolging (65.71%; 73.68%), asook konvergensie-divergensie (80%; 78.95%). Dit blyk egter dat ADHD leerders meer ernstige probleme (Klas 3) met visuele navolging ervaar as leerders sonder ADHD (beide oë: 22.86 teenoor 10.53%; regteroog: 11.43 teenoor 0%; linkeroog: 14.29 teenoor 0%). Dié resultate stem ooreen met die enkele navorsingsbevindinge wat in die verband gerapporteer is. Bala *et al.* (1981) se studie toon dat hiperaktiewe seuns meer en groter sakkadiese oogbewegings maak en dat hulle meer weggekyk het van die navolgingsrigting as seuns sonder ADHD. Granet *et al.* (2005) dui verder aan dat daar ‟n drie keer groter voorkoms van konvergensie-probleme by leerders met ADHD as by leerders sonder ADHD voorgekom het. Dit blyk dat fiksasie

probleme by leerders met ADHD in ander studies geïdentifiseer is (Armstrong & Munoz, 2003; Munoz *et al.,* 2003; Loe *et al.,* 2009) alhoewel geen sodanige uitvalle met hierdie studie bevestig is nie.

Die resultate met betrekking tot die verskille tussen die visueel-motoriese integrasie, visuele persepsie en motoriese koördinasie van leerders met en sonder ADHD, het prakties betekenisvolle verskille tydens visuele persepsie (d=0.37) en motoriese koördinasie (d=0.49) opgelewer waar die leerders met ADHD swakker gevaar het. Dit wil gevolglik lyk of daar 'n algemene tendens is dat leerders met ADHD swakker vaar tydens visueel-motoriese integrasie, visuele persepsie en motoriese koördinasie aktiwiteite as leerders sonder ADHD.

Die resultate stem ooreen met Schoemaker *et al*. (1994) se bevindinge wat daarop dui dat leerders met ADHD alle grafiese opdragte, stadiger en minder akkuraat uitvoer met 'n relatief harde druk op die pen as leerders sonder ADHD. Rommels *et al.* (2007) het gevind dat leerders met ADHD minder presies en stabiel was as die kontrole groepe in gerekenariseerde motoriesebeheer opdragte, terwyl Fliers *et al.* (2008) se navorsing op 'n swakker kwaliteit fynmotoriese vaardighede by een derde van leerders met ADHD dui, waar seuns en meisies ewe veel geaffekteer word. Schoemaker *et al*. (1994) rapporteer verder dat ongeveer 50% van leerders met ADHD probleme met motoriese koördinasie ervaar. Die studie se resultate stem ook ooreen met Kirby *et al*. (2007) se bevindinge wat aandui dat ADHD-leerders motoriese koördinasie probleme ervaar wat soortgelyk is aan dié van leerders met DCD (ontwikkelingskoördinasie-versteuring), veral ADHD-leerders met predominante aandag probleme sowel as die gekombineerde sub-tipe wat sukkel met fynmotoriese vaardighede. Die navorsers dui verder aan dat leerders met ADHD en die groep sonder ADHD geen betekenisvolle verskille ten opsigte van fynmotoriese vaardighede getoon het nie, maar dat hulle aansienlik beter gevaar het as leerders wat gekategoriseer is met ADHD en DCD (Kirby *et al*., 2007). Volgens Kirby *et al*. (2007) kan hierdie probleme nie aan konsentrasie toegeskryf word nie, maar eerder aan die probleme met motoriese verwante vermoëns (DCD gekombineer met ADHD).

Uitvalle wat voorgekom het tydens VP sowel as MK kan moontlik toegeskryf word aan die leerders met ADHD se aandag wat afgetrek was deur irrelevante inligting uit die omgewing. Resultate van Loe *et al.* (2009) dui in dié verband aan dat leerders met ADHD se aandag makliker afgelei word deur irrelevante inligting en dat hulle meer hulpmiddels benodig om take te kan voltooi, wat op agterstande in die handhawing van hul aandag dui. Leerders sal dus ook swakker vaar in visuele evaluasies, asook meer onnodige sakkadiese oogbewegings toon. Daar kan ook 'n moontlike verband wees tussen visuele navolging, konvergensie-divergensie en motoriese koördinasie wat hoofsaaklik handkontrole in die VMI meet. Navorsers wat simptome van visuele navolging en konvergensie-divergensie beskryf, bevestig die moontlike verbande deur simptome te noem soos probleme met midlynkruising, beweeg kop en nie oë nie, swak uitleg/plasing van werk op papier en verloor sy plek, wat swak motoriese koördinasie tot gevolg sal hê (Farrar *et al*., 2001; Lane, 2005).

Enkele studies toon wel teenstellende resultate soos dié van Kooistra *et al*. (2005), wat aandui dat leerders met ADHD oor die algemeen nie verskil van die kontrolegroepe met betrekking tot motoriese vaardighede nie, alhoewel hierdie navorsing visueel-motoriese verskille in vaardigheid aandui. Polderman *et al*. (2011) dui ook 'n lae korrelasie tussen ADHD en motoriese koördinasie aan, veral waar die leerders van die regterhand gebruik moes maak.

Studies wat op swak verbande dui, is egter in die minderheid.

GEVOLGTREKKING

Uit die resultate kan samevattend gerapporteer word dat leerders met ADHD meer visuele navolging en konvergensie-divergensie uitvalle, asook visuele persepsie en motoriese koördinasie uitvalle toon as leerders sonder ADHD. Hierdie uitvalle kan waarskynlik bydra tot leerverwante-, akademiese- en sportverwante probleme wat deur navorsers by leerders met ADHD, gerapporteer word (Desrochers, 1999; Orfield *et al*., 2001) en behoort gevolglik aandag te kry.

Hierdie studie het tekortkominge gehad wat aangespreek moet word en wat in ag geneem moet word tydens die veralgemening van die resultate. Dit wil daarom aanbeveel word dat daar in toekomstige studies verskillende subtipes van ADHD geïdentifiseer moet word en meer spesifiek binne sodanige studies na verbande binne elke subgroep afsonderlik gekyk word, aangesien groepe met predominante aandagafleibaarheid en die gekombineerde subtipe blyk om meer probleme te ervaar met fynmotoriese vaardighede. Sodanige studies sal ook moontlik duideliker verskille kan oplewer indien daar van groter groepe gebruik gemaak word, wat die resultate meer veralgemeenbaar kan maak.

SUMMARY

Ocular motor control function and visual-motor integration status of a selected group of 6- to 8-year-old learners with ADHD

According to the literature, effective ocular motor control, which is determined by the working of three pairs of eye muscles, is not only necessary for gross motor development, but also for academic improvement and achievement. A relationship is reported between visual-motor integration and ADHD. The visual system plays an important role in coordination (hand-eye, foot-eye, hand-foot-eye and overall body coordination), as well as perceptual skills, such as body awareness, balance and spatial orientation (Cheatum & Hammond, 2000; Pienaar, 2010).

The aim of the study was to determine what the nature and scope of ocular-motor problems are in 6- to 8-year-old learners with ADHD with regard to ocular motor control functions and visual-motor integration. Fifty-seven learners (32 boys and 25 girls) were divided into an ADHD group (n=38; Mean age 6.95 years, SD=0.72) and a group without ADHD (n=18; Mean age 7.11 years, SD=0.58). The *Sensory Input Systems Screening Test* and *Quick Neurological Screening Test II* (QNST-II) were used to evaluate the ocular motor control of the group, while the *Visual-Motor Integration Test 4* (VMI-4th ed.) was used to evaluate visual-motor integration, motor coordination (mainly hand control) and visual perception. Ocular motor control problems were categorised into three classes during the assessment (1= „no problems"; 2= „one to three general symptoms of strain on the eyes"; 3= „four or more serious ocular motor control problems").

The teachers and the parents of the learners completed *Bester's Disruptive Behaviour Scale* for ADHD and the results were used to identify learners with ADHD. The Statistica for Windows Program was used where two-way variance tables were used to determine the percentage of ocular motor control function problems in the groups with and without ADHD. The Pearson Chi-square was used to determine the practical significance of differences (value of $d>0.5$ significant). An independent t-test ($p<0.05$) was used to analyse group differences in visual motor integration, visual perception and motor coordination, while effect sizes were

used to establish practical significance of these differences.

The results indicated that no subjects were classified into Class 3 (4 or more problems) regarding fixation (both eyes, left- or right eyes) and ocular alignment control (left and right eye). Visual tracking with the right eye showed statistically significant differences between the groups ($p \leq 0.05$). The group with ADHD (Group 1) had a larger percentage (11.43%) of learners in the group with serious ocular motor control problems in comparison to the group of learners without ADHD (0%). Visual tracking with the left ($p=0.02$; $w=0.38$) and the right eye ($p=0.05$; $w=0.34$) showed statistical and practical significant differences between the groups, but with a small effect, where the group with ADHD had no learners in Class 3, although a higher percentage of the group were grouped in Class 2 (left eye=63.16%; right eye=68.42%). During horizontal- and vertical tracking, as well as convergence-divergence, the majority of both groups were classified in Class 2, with no statistical significant differences ($p=0.5$; $p=0.82$; $p=0.72$) between the groups. Overall, the results confirmed more ocular motor control problems among learners with ADHD, especially in visual tracking and convergence-divergence.

The results regarding differences between the ADHD and without ADHD group in visual-motor integration, visual perception and motor coordination, indicated practically significant differences in visual perception ($d=0.37$) and motor coordination ($d=0.49$) between the groups, where learners with ADHD showed poorer performance. It can be concluded that children with ADHD experience problems with regard to ocular motor control and visual-motor integration, which can hamper their academic and sport skills development. It is therefore recommended that these deficiencies should be addressed by appropriate intervention.

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