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HOW COACHES USE THEIR KNOWLEDGE TO DEVELOP SMALL-SIDED SOCCER GAMES: A CASE STUDY

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ABSTRACT

The method employed by coaches when designing small-sided soccer games has had limited attention from the scientific community. Therefore, the aim of this study was to undertake a case study where one expert coach was interviewed and tasked with designing and justifying four different small-sided games (SSG) for different physiological effects. Using these games, players were tested and the real-time heart rate responses of the players were compared with the coach's estimation. Both qualitative methodology and quantitative methodology were developed to differentiate the games in terms of the effort produced. The coach's estimation was compared with the actual real-time effects produced by the players' efforts. It was possible to identify that, as predicted by the coach during the design of the games, the management of task constraints such as goals/targets and specific zones of action had statistical effects on the players' efforts as measured by heart rate monitors. The case study revealed how the soccer-specific coach organises his knowledge and experience to develop small-sided games. Possibilities for future study that would identify the fundamental decisions that differentiate novice and experienced coaches were revealed.

Key words: Coach knowledge; Small-sided games; Soccer; Qualitative and quantitative methods.

INTRODUCTION

Knowledge and a deeper understanding of a specific subject matter are essential to any professional activity. Knowledge of a specific issue can result from a range and depth of understanding different concepts and conceptions (Abraham *et al*., 2006). The concepts can be defined by their formality on categorisation boards and by procedural and declarative knowledge (Abraham & Collins, 1998). On the other hand, the conceptions represent a personal interpretation of the concepts applied in a given context that means something to the coach (Abraham *et al*., 2006). Therefore, the knowledge of coaches not only depends on their concepts, but also on integration between the concepts and the experience gained in the field through the application of these concepts.

In the area of sport, previous studies suggest that a large part of training knowledge and its associated practice are based on the coaches' experience and personal interpretations of those experiences (Cushion *et al*., 2003). Nevertheless, this does not mean that all experienced

coaches are competent (Bell, 1997), but to become one it is important to have a high level of experience (Lyle, 2002). The quality practise time promoted by experience and the evolution of training methods is a deciding factor for success in this profession (Cushion *et al*., 2003). In this sense, it is very important to have a flexible body of knowledge that produces mental schemes based on what coaches perceive, perform and evaluate from their own practice (Ritzer, 1996).

One variable of the most important ones that needs to be taken into account by team sports coaches is the development of ecological tasks (drills). How does this process happen? Few studies have developed a cross-methodological process to understand how this process occurs (Light & Robert, 2010). An understanding of how coaches think, project and prescribe their drills are essential for the success of the intervention, requires investigation.

There are several variables that soccer coaches can use to develop a drill (Hill-Haas *et al*., 2011). When the main goal is to develop physical, technical and tactical performance indicators simultaneously, it is important to have a deeper understanding of how these variables interact with one another to achieve the fundamental objectives (Clemente *et al*., 2012). In small-sided games (SSG), the variables used regularly include the number of players, field dimensions, specific rules, touch limitations, and type of targets or encouragements provided to induce different responses in players' performance (Aguiar *et al*., 2012). These variables have been studied in recent years; however, the process of how coaches use them to achieve their goals has not been investigated, despite its importance. The way in which coaches project the drills for specific goals is very important for the improvement of training courses or curricular programmes.

RESEARCH AIM

This study aims to analyse how a specific coach organises his drills to achieve the specific goals set by the research team. As a case study, it was proposed that an expert coach develop four different tasks (SSG) to achieve specific physiological and kinematical responses from the players. During the design of the drills, the coaches were interviewed to identify their thoughts about their personal criteria when organising drills to achieve specific goals. Afterwards the coaches were asked to anticipate the efforts experienced by players during their SSG. This study used a methodological approach. It is expected that a relation between the coaches' estimation and the actual heart rate (HR) responses of the players during the SSG will be found.

METHODOLOGY

Participants

Six soccer players (13±1.1 years old) with a minimum of 3 years of soccer experience participated in this study. After an initial phase of coach selection, which was defined by the criteria of a minimum of 5 years of experience, using SSG in his training process, possession of a minimum academic qualification of a master's degree in Sports Science or Physical Education, one coach was selected from the 10 analysed. One soccer coach with 6 years of experience was selected to have his planning soccer drills analysed. All data collected

complies with the American Psychology Association (APA) ethical standards for treatment of human or animal subjects.

Research design

This case study used a series of interviews conducted over a 2-week period in August 2013. The study was then organised into 2 data-collecting phases.

During the first phase, the coach was interviewed with regard to his own perspective of small-sided soccer games. Data was generated through a series of one-to-one, semi-structured interviews guided by the following core research questions: How can you use SSG to develop your players and how do you think such games can be developed? The interviews were conducted by the authors with an initial interview of 30 minutes, followed by 3 subsequent interviews of approximately 20 minutes each.

During the last 3 interviews, the coach was asked to develop a set of 4 different small-sided soccer games that would gradually increase the HR responses of the soccer players (measured by heart rate monitors). A maximum of 15 players participated and were asked to begin at 80% HRmax and attempt to finish closer to 90% HRmax. The coach designed all games during interviews and no further instructions were provided. The coach selected his own task constraints to achieve the main goal. After the SSG had been designed, the coach was asked to define the mean of effort (in %-HRmax) for each game.

At the completion of the first study phase, the coach developed his SSG for soccer training. He was asked not to develop such games before the analysis phase in order to avoid the previous knowledge retention by the players. The four SSG as designed by the coach were applied to 6 players. Four games of 3 minutes each were performed, followed by 3 minutes of passive recovery. The coach also defined those orientations. Six heart rate monitors (Polar RC3 GPS with Heart Rate Sensor) were used to measure the players' level of activity.

Data analysis

The quantitative analysis was used to compare the anticipation of players' physiological responses as predicted by the coach compared to the specific physiological responses of players in a practice context. The qualitative analysis (interview) was used to establish how the coaches organised their drills based on the specific objectives set by the researchers.

Interview analysis

The method of qualitative analysis involved systematically gathering enough information about a person, social setting, event or group to allow the researcher to understand effectively how the person operates or functions (Berg, 2007). The themes were coded manually from the transcribed interviews. The main concepts from all interviews were selected in order to compare the consistency of thinking. Three overall themes were identified: (1) the coach's perception of using SSG; (2) the most pertinent task constraints to develop SSG; (3) the knowledge and experience of the HR effects of such task constraints.

Statistical analysis

The quantitative analysis entailed the following. To determine statistical differences between the four SSG a one-way ANOVA was applied. In order to analyse the differences between the variables, the Games-Howell test was used as a post hoc test. Generally, this test is more effective than the other alternatives for case studies similar to this one. The estimation of the effect size (the proportion of the variance in the dependent variables that can be explained by the independent variables), was established according to Pallant (2011). Apart from the effect size, the power of the corresponding test was also presented. The analysis of the power of the test is a fundamental procedure to validate the conclusions reached in the inferential analysis (Pallant, 2011). This analysis was performed using IBM SPSS Statistics for a significance level of 5%. In order to determine the relationship between the coach's estimation of effort with the real effort of the players, the Pearson r-test was applied with both of these values. This analysis was also performed using IBM SPSS Statistics for a significance level of 5%.

RESULTS

How the coach used his knowledge

The following section presents and discusses the ways the coach thinks about and organises SSG. The first analysis provided information about how the coach viewed an opportunity to use SSG in training.

> *Well, from my first contact with small-sided games, I have never stopped thinking about their importance. Actually, the importance of such games is very high. All games are always valuable for players and for us (coaches). We can develop many things at the same time, from physical responses to technical and tactical actions – we can develop everything in a single moment. Moreover, it is also possible to develop the social elements such as co-working and team spirit.*

It was also possible to explore the reasons why the coach regarded SSG in a particular way. Previous experiences and some cultural influences were determinants for his thinking on SSG.

> *From very early on, I had some coaches that developed my thinking about the importance of practising the game 'in' the game. I mean, if you are a soccer player, you need to have soccer training and not athletic training or other sports not related to the unique dynamics of soccer. When I started my coaching, I read many books about different methods to achieve the same goal. Thus, if I can use the game to achieve the main goal, why can't I develop that? Moreover, through their results, our national coaches showed me that it is possible to be successful using these kinds of games at a professional level.*

Following the interview with regard to the personal importance of SSG, the coach introduced some important topics. These topics concerned the reactions and feelings about the importance of such games for the players.

> *When I come to a new team with players who have never experienced a training methodology based on small-sided games, I sensed an initial distrust of the real benefits of such games and their ability to develop mainly the players' physical capabilities. Nevertheless, after the pre-season training and during the initial games of the season, it is possible for them to compare their*

fitness with that of their opponents. It is at this point that my players realise that small-sided games have effects similar to traditional training based on running activities and other physical activities without game play and many times without the ball. Moreover, players increase their commitment to training sessions because these are always different and always have what the players love - a game of soccer! They enjoy all the training sessions!

After the first interview concerning the importance of SSG to the coach, during the following sessions the coach was asked to develop 4 different games in which, while ensuring the same shape of the game and field dimensions he had selected initially, the games should induce different HR responses. To achieve the target of 80% HRmax up until 90% HRmax using a maximum number of 6 players, the coach selected the game shape 1v1 plus 1 in a field dimension of 15x15m. His reasons were as follows:

Well, for such efforts I need to organise a game with a small number of players. When I develop a task with a great number of players, the possibility of all players working at the same time decreases. In games with a small number of players, the individual participation will increase for sure. I will select a game shape with only 1v1 and 1 neutral player. Why I use a neutral player? I do it to increase the success for the attacker and to increase the effort during the defensive phase. Regarding the playfield dimensions, I think 15x15m should be enough to ensure an interesting running activity and not push my players too much. When they experience higher values of fatigue, their soccer contribution will decrease.

After the shape of the game and the field dimensions had been selected, the coach was asked to organise 4 games using the task constraints he wanted. He was provided with a computer containing specific software to develop the drills. The coach created the design in the presence of the researchers. The coach selected the following games (Figure 1).

For each game, the coach was asked to comment on his options and to describe each small-sided game and his reasoning and decision-making process:

For the first task [(1)] I will choose to use the goals and one spatial limitation for the neutral player. In this game, the neutral player can just use the middle zone, reducing his intervention in the game. Thus, his physiological responses will be reduced. The goals are used to impose a small space to shoot at. However, with a target, the players do not need to run too much because they have the opportunity to shoot from far away, thus reducing their activity and the effort of the task. They will work at an effort of 80% HRmax or less.

In order to increase the effort a little, I will remove the middle area [in game (2)]. Now the neutral player can use all the space, increasing his participation and increasing the task's complexity. The defender should now have to worry

about the man with the ball and the man without it. As for the effort, I think that will increase to something around 85% HRmax.

(1) (2)

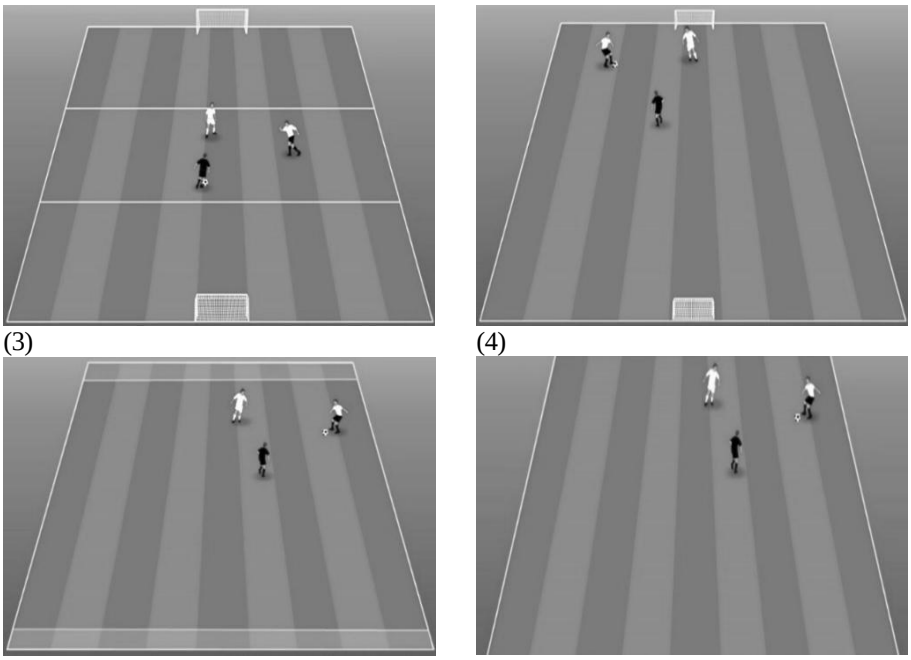

FIGURE 1. **FOUR DIFFERENT SMALL-SIDED SOCCER GAMES DESIGNED BY THE COACH DURING INTERVIEWS**

For the 2 initial games, the coach used the goals. He then opted to remove the goals and reorganise the game. He explained his choice:

> *I chose to remove the goals because I needed to increase the effort. Thus, if players have a target, they will protect the target in the middle of the field. Without a central target, it is harder to protect their defensive zone because it is bigger than a single goal, thus this will increase their activity on the field and increase the effort.*

The last 2 games were developed to achieve higher efforts. The explanations were as follows:

> *I will replace the goal with a defensive line that will be the target in this task [game (3)]. I believe players will achieve efforts of around 85-88% HRmax. I bet on 87% HRmax! This effort increases the opportunity to explore the whole goal line of the field, thus increasing the running activities. For example, the player with the ball should get through the defensive line using ball control. The neutral player cannot score. Thus, the constraint to get over the finishing line will increase the effort because they need to run more to reach the end of the field.*

> *Well, I need to achieve 90% HRmax, right? Therefore, it is simple! I will remove any kind of target [game (4)]. Usually, the games without a target increase the effort because you can play in any part of the field, thus increasing the running activities and the efforts. For this game, the players should keep possession of the ball for the maximum time possible. The neutral player can*

only play with the player with the ball. When one player loses the ball, the other player should try to keep the ball by playing with the neutral player. I believe they will achieve values closer to 90% HRmax. I can bet on this!

After the coach described the main categories of thinking, it was possible to compare his theoretical notions with the actual effects on the players. The quantitative analysis had 2 kinds of tests: an analysis of variance to differentiate the heart rate responses for different games; and a comparison between the heart rate estimated by the coach and the real efforts revealed by the players.

Heart rate experienced by players in different SSG

After the SSG had been defined by the coach they were applied on the field. The descriptive results from those games are given in Table 1.

TABLE 1. **DESCRIPTIVE STATISTICS FOR %-HRMAX OF PLAYERS DURING FOUR DIFFERENT SMALL-SIDED GAMES**

%-HRmax	Mean	Std. Dev.	% Coefficient of Variation
Task 1	81.924	14.271	17.420
Task 2	81.785	12.806	15.658
Task 3	85.811	10.332	12.040
Task 4	86.106	9.966	11.574
Total	83.906	12.147	14.477

Task 4 shows the highest %-HRmax (86% HRmax). Task 2 shows the lowest %-HRmax and generally the heart rate responses increased gradually until the last task. The only exception is between Task 1 and 2, where Task 2 had a lower effort than the first. This can be seen in the mean differences shown in Table 2.

The analysis of the %-HRmax between the different SSG showed statistically significant differences with small effect ($F_{(3,431679)}$= 42.398; p-value= 0.001; η^2= 0.029; Power= 1.00). More specifically, the post hoc tests showed that Task 1 was statistically different from Tasks 2 (p-value= 0.001) and 3 (p-value= 0.001), showing significantly lower values for %-HRmax. The efforts achieved in Task 2 were also statistically lower compared to Tasks 3 (p-value= 0.001) and 4 (p-value= 0.001). No significant differences were observed between either Tasks 1 and 2 or between Tasks 3 and 4.

TABLE 2. **MEAN DIFFERENCE BETWEEN %-HRMAX VALUES ACHIEVED IN SMALL-SIDED GAMES**

Task	Tas k 1	Task 2	Task 3	Task 4
Task 1		0.13873	– 3.88690*	– 4.18151*
Task 2		–	– 4.02563*	– 4.32025*

Task 3	–	–	– 0.29461

* Mean differences are significant at the p<0.001 level.

The relation between the coach's anticipation and the real heart rate responses experienced by players was investigated using the Pearson r-test. The mean values can be seen in Figure 2.

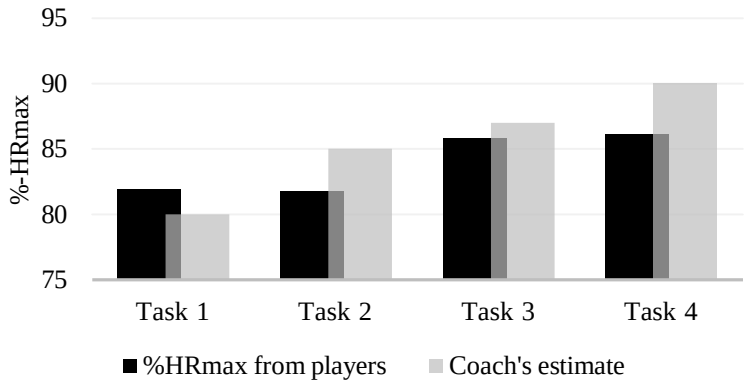

FIGURE 2. **MEAN OF %-HRMAX OF PLAYERS AND ESTIMATE FOR EACH TASK BY THE COACH**

Generally, the coach's estimates are an over estimation, except in Task 1. The Pearson r-test that established the relationship between the actual %-HRmax of the players with the coach's estimate, showed a very large and positive correlation between both factors (r= 0.827). The values were not linear, based on the significance value of p-value= 0.173.

DISCUSSION

This study aimed to analyse how a coach plans and develops SSG and the criteria he uses to define them. Moreover, it was intended to identify whether the coach's perception is in line with players' HR responses during soccer sessions. Both goals are extremely important to identify how coaches organise their planning sessions and to understand the mechanisms that support the options provided by SSG in a soccer-training context.

During the interview, it was possible to compare the coach's comments with existing literature. One of the main themes that the coach highlighted was the players' motivation for training when SSG are developed. This proved to be in agreement with previous studies developed in sessions using ecological methods (Ryan & Deci, 2000). Some studies on SSG have shown that, despite great psychological flow levels, the effort is not stressful for players due to the games' dynamics, and players report that SSG are rewarding and enjoyable activities (Krustrup *et al*., 2010).

It is not only the psychological and social effects of SSG that can be reported as benefits. During the interview, the coach also reported SSG as being holistic games that develop

physical, technical, tactical and social variables at the same time. This kind of analysis can be corroborated by previous research that looked at the effects of SSG regarding HR responses and technical/tactical actions (Hill-Haas *et al*., 2011; Aguiar *et al*., 2012; Clemente *et al*., 2012). In a more general way, it is possible to confirm that no statistical differences were found between SSG and traditional training based on running regimes on the HR effects in a training programme (Sassi *et al*., 2004; Dellal *et al*., 2008). Moreover, SSG allow technical and tactical actions to develop, thus contributing more to soccer training (Clemente *et al*., 2012).

Based on specific initial instructions to develop SSG requiring efforts between 80% HRmax and 90% HRmax, the soccer coach opted to develop drills for a specific game shape of 1v1 plus 1. This option seems in line with existing guidelines defined for SSG (Little, 2009), with the shape of the game being the first decision to make.

The fundamental task constraints the coach opted to use were the different goals/targets, specific zones of action and different rules. He argued that to increase the effort it was necessary to remove the goals, until a situation without any target was reached. These options, as expected by the coach, resulted in increasing the %-HRmax closer to 90%. He surmised that, without targets, players could explore the entire field's space, thus increasing the running activities and variability of actions. Moreover, he was sure that SSG with goals decreased the effort experienced by players. This expectation was confirmed by the results of the practice.

The analysis of variance showed statistical differences between Tasks 1 and 2 (using goals) and Tasks 3 and 4 (using the line and without the line or target). During activities with goals, it was possible to observe values closer to 82% HRmax in both Tasks 1 and 2. For their part, Tasks 3 and 4 showed values around 86% HRmax. Such results are in line with previous studies that compared tasks with goals and without goals (Duarte *et al*., 2010; Casamichana *et al*., 2011). In actuality, the activities without goals increase the variability of the heartbeat, thus increasing the effort and reducing the opportunities for recovery in the game. In the presence of goals, the movements are more standardised in direction to one central point, and therefore, the movements performed by both players (attacker and defender) are more predictable.

The coach was also asked to predict the effort for each game developed. By using this information and the values achieved in the game by the players, it was possible to identify a very large and positive correlation value. The coach was able to anticipate the players' responses with relative accuracy during the games. It was also observed that in 3 of the 4 games the coach overestimated the players' heart rate responses. This could be due to the fact that there was no specific regular measurement of the players' fitness, and therefore, their responses varied over different seasons' moments, mainly reducing HR rest and increasing the VO_{2max} (McMillan *et al*., 2005). Thus, specific methods to measure the players' fitness (such as heart rate monitors), are very important to ensure a quality of stimulation and to regulate the training process, thereby helping the coach to be more efficient with regard to the players' stimulation (Impellizzeri *et al*., 2004).

CONCLUSION

In this case study, it was possible to assess how a coach organises his thoughts with regard to the development of SSG. The coach's experience with SSG seems to be essential in order to develop this kind of training regime. However, these results cannot be generalised for other coaches without further research. It would be interesting to compare different expert coaches with different kinds of academic backgrounds in future to identify whether such decisions are the same or whether they are indeed different. It would also be interesting to compare expert and novice coaches regarding their designing of SSG and the estimation of the effort. It can be assumed that the criteria employed by each to develop games would certainly be different, thus providing pertinent information for the potential reorganisation of the academic curriculum and coaching programmes. It could prove to be beneficial to both academic qualification and coaching programmes to increase the time spent in practice, thereby promoting the attainment of real-time experiences that could potentially define the most important variables (task constraints) when designing and promoting SSG.

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GROEIPATRONE BY SEUNS TYDENS MID-ADOLESSENSIE: 'N LONGITUDINALE STUDIE VAN ANTROPOMETRIESE VERANDERINGE

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ABSTRACT

This study analysed the growth profiles stature, mass, arm span, sitting height and sitting-height-ratio of boys during the growth spurt within the mid-adolescent phase. A convenience sample of 73 Grade 8-10 boys (13.58-15.57 years) participated.

Measurements were repeated three times annually, four months apart and sitting height ratio was calculated (sitting height/stature X 100). Protocols of the International Standards for Anthropometric Assessment (ISAK) and the Canadian Sports for Life were applied. Repeated measures over time ANOVA with a Bonferonni post hoc correction was use to analyse the data. The most significant increases (p=0.000) in stature, mass, arm span and sitting height occurred between 13.58 and 14.58 years while sitting-height-ratio showed the greatest change (p=0.002) between 14.58 and 15.57 years. Stature, mass and arm span exhibited parallel development up to 15 years after which further development levelled off, while no levelling off occurred in mass increase. The boys in this study entered the growth spurt in height on average prior to 13.58 years, but significant anthropometrical, motor and physical changes still occurred during their first year of high school (Grade 8), where high individual variability in growth changes were still evident.

Key words: Anthropometric measures; Maturation; Boys; Mid-adolescence; Growth spurt; Longitudinal study.

INLEIDING

'n Sentrale tema in biologiese antropologie, is menslike variasie, die aard en verspreiding van die variasie sowel as die betekenisvolheid van dié variasies (Malina *et al*., 1988). Cole (2003) dui aan dat bioloë wat menslike ontwikkeling bestudeer, deeglik daarvan bewus is dat die mensdom se liggaamsgrootte oor die laaste een en 'n half eeu heelwat groter geword het. Kim *et al*. (2008) rapporteer in die verband dat sekulêre groei, wat die verkryging van groter liggaamsdimensies as in vorige generasies beskryf (Malina *et al*., 2004), verhoog het onder kinders en adolessente vanaf 1965-2005. Groei dui op die vergroting van die liggaam as geheel sowel as in verskillende liggaamsdele, wat daartoe bydra dat 'n persoon langer en swaarder word namate die groeiproses vorder (Malina *et al*., 2004). Balyi en Way (2005) dui verder aan dat groei en ontwikkeling 'n natuurlike en kontinue proses is, terwyl die tempo van veroudering meer individueel van aard is. Alhoewel groei hoofsaaklik 'n kontinue proses is,

kom daar tydperke van versnelde groei voor wat die adolessente fase insluit en by seuns op ongeveer 13-16 jarige ouderdom plaasvind (Tomonary, 2012; Gerber *et al*., 2014).

Adolessensie, wat puberteit insluit (die ontwikkelingstydperk wat die aanvang van geslagtelike rypingseienskappe verteenwoordig vanaf 13-15 jaar), verwys na die oorgangsfase van die kinderjare na volwasse wording. Tydens hierdie tydperk ondergaan adolessente verskeie fisieke en fisiologiese veranderinge (Dahl, 2004), waar die mees beduidende veranderinge ten opsigte van antropometriese groei tydens die mid-adolessente fase plaasvind (Rogol *et al*., 2002; Gallahue *et al*., 2012). Versnelde somatiese groei en veranderinge in liggaamsamestelling kom hoofsaaklik tydens 'n tydperk van versnelde anatomiese veranderinge by seuns tussen die ouderdom van 10 tot 14 jaar voor, wat as die groeiversnellingsfase (GVF) bekend staan (Bitar *et al*., 2000; Rogol *et al*., 2002; Gallahue *et al*., 2012).

Volgens Hennenberg en Louw (1998) word studies wat op groei fokus, veral by kinders en adolessente, hoofsaaklik om twee redes uitgevoer, naamlik om die invloed van die omgewing waarin die populasie grootword te bepaal, en om kennis te verkry met betrekking tot die algemene/sekulêre patrone van fisieke ontwikkeling en die eienskappe wat daarmee gepaard

gaan. Antropometriese inligting rakende groeitendense kan gebruik word om menslike grootte, proporsie en veroudering van 'n spesifieke groep, streek of bevolking te beoordeel (Balyi & Way, 2005). Gevolglik kan dié inligting rakende groei gebruik word om die vlak van strukturele volwassenheid by sportmanne te monitor om sodoende oefen-, kompetisie- en rehabilitasieprogramme volgens ontwikkelingsouderdom en nie volgens kronologiese ouderdom, te ontwikkel nie (Balyi & Way, 2005). Inligting van hierdie aard kan gevolglik bydra om 'n individu in objektiewe fokus te plaas ten opsigte van sy strukturele status op enige gegewe tyd, sodat voorsiening vir die kwantifisering van differensiële groei gemaak kan word (Balyi & Way, 2005).

Verskeie antropometriese metings of 'n kombinasie daarvan word ook vir kliniese doeleindes in die evaluering van groei en groei-abnormaliteite (abnormale kort of lang liggaamslengte) gebruik soos byvoorbeeld 'n ongewone kort statuur (Mumtaz *et al*., 2009). Verwante inligting van groei kan ook gebruik word tydens die identifisering van natuurlike talent of vermoëns (Pearson *et al*., 2006) om so toekomstige suksesvolle atlete te identifiseer en te monitor. Baxter-Jones en Helms (1996) rapporteer dat die meeste talent-identifiseringsprogramme 'n aanvang neem tydens die begin en voltooiing van die puberteitfase. Gevolglik behoort die effek van groei en ontwikkeling tydens puberteit in talentidentifisering (TID) en ontwikkelingsprogramme in ag geneem te word.

Volgens die LTAD („Long Term Athlete Development") model val seuns tussen 12 en 16 jarige ouderdom in die fase van fisieke gereedmaking vir sport (Balyi & Hamilton, 2004). Kennis met betrekking tot die aard en omvang van groei in hierdie tydperk kan gevolglik bydra tot die optimale benutting van dié ontwikkelingstydperk om seuns ten volle voor te berei vir kompeterende sportdeelname. Inligting oor groeitendense maak gevolglik voorsiening vir die kwantifisering van differensiële groei en oefeningsinvloede (Balyi & Way, 2005). Gerber *et al*. (2014) bevestig in die verband klein tot matige interverwantskappe tussen veranderinge in antropometriese groei en in fisieke en motoriese vaardigheids-ontwikkeling by seuns tydens mid-adolessensie. Interverwantskappe het hoofsaaklik tussen veranderinge in lengte, armspan en sithoogte, en veranderinge in krag, spoed, ratsheid en hand-oog koördinasie voorgekom (Gerber *et al*., 2014).

Navorsing rakende groei en ontwikkeling word meestal verkry uit dwarsdeursnit-studies en beskikbaarheid-steekproewe (Matton *et al*., 2007). Groeikurwes kan egter nie hieruit ontwikkel word nie en dit is selde veralgemeenbaar tot die groter populasie, derhalwe word longitudinale studies van groeikurwes benodig om die groeipatrone van kinders en adolessente te monitor om sodoende hulle volwasse groeistatus te bepaal (Balyi & Way, 2005).

Verskeie studies is reeds wêreldwyd uitgevoer rakende groei by adolessente seuns (Tanner & Whitehouse, 1976; Armstrong & McManus, 2000; Kemper *et al*., 2004; Lee *et al*., 2005; Kim *et al*. 2008). Tanner en Whitehouse (1976) het groeistandaarde vir lengte en massa en tempo van lengte- en massa-toename ontwikkel vir seuns wat veralgemeen kan word na verskeie populasies. Groeinorme wat deur Armstrong en McManus (2000) gerapporteer word stem ooreen met dié van Tanner en Whitehouse (1976) waar hulle gevind het dat seuns in lengte met ongeveer 7-9-7cm per jaar tydens die GVF toeneem. Lee *et al*. (2005) rapporteer verder dat versnelling van piek-sithoogte en piek-armlengte op 13.5-jarige ouderdom plaasvind met piekverhogings van onderskeidelik 4.6cm/jaar en 8.4cm/jaar.

In Suid-Afrika is studies ook uitgevoer (Hennenberg & Louw, 1998; Richter *et al*., 2007; Pienaar & Viljoen, 2010; Van den Berg & Pienaar, 2010), wat inligting oor groei na vore bring maar die studies fokus nie noodwendig op die adolessensie tydperk, of op seuns nie en is meestal gebaseer op dwarsdeursnit-studies. Richter *et al*. (2007) bevestig ook verhoogde groei by Suid-Afrikaanse kinders in vergelyking met kinders wat in die sewentigerjare gebore is en dat blanke kinders swaarder en langer is in vergelyking met swart kinders. Pienaar en Viljoen (2010) rapporteer verder uniekhede in die groeikurwes van seuns van verskillende etniese groepe vanaf 10-15 jarige ouderdom rakende antropometriese, fisieke en motoriese groei.

Dit blyk dat navorsing wat in die vroeër jare gedoen is, se geldigheid vir huidige populasies bevraagteken kan word weens sekulêre groei wat onder andere oor die laaste dekade plaasgevind het (Cole, 2003). Gevolglik word resente studies benodig, veral in die Suid-Afrikaanse konteks waar sport-talentidentifisering en ontwikkeling heelwat aandag (Sport and Recreation South Africa, 2012) tydens die mid-adolessensie tydperk geniet, en veral met betrekking tot die spesifieke effek wat die groeiversnellingsfase op die antropometriese groei van seuns oor ŉ longitudinale tydperk uitoefen.

NAVORSINGSPROBLEEM

Die doel van hierdie studie was om die omvang van groei in lengte, massa, sithoogte en armspan by seuns oor ŉ drie-jaar tydperk te bepaal, ten einde ŉ antropometriese profiel van die groei van seuns tydens die mid-adolessensie tydperk saam te stel.

METODOLOGIE

Proefpersone

ŉ Beskikbaarheid-steekproef bestaande uit al die Graad 8 leerders van ŉ kwintiel-5 Hoërskool in Potchefstroom in die Noord-Wes Provinsie van Suid-Afrika is geselekteer om vir ŉ 3-jaar tydperk aan die longitudinale navorsingsprojek oor groei („Growth during Mid-Adolescence" (GdMA)) deel te neem. Alhoewel slegs die leerders van een skool met koshuisfasiliteite in die navorsing gebruik is, was die leerders afkomstig vanuit 46 verskillende laerskole. In 2010 is 182 proefpersone (87 seuns, 95 meisies) met ŉ gemiddelde ouderdom van 13.58 jaar gemeet, terwyl die finale groep in 2012, op wie volledige opvolgmetings uitgevoer is, uit 152 leerders bestaan het, waarvan 79 dogters en 73 seuns was. Die groei en ontwikkeling van seuns was die fokus van hierdie studie en daarom is slegs die seuns se data vir die doeleindes van hierdie studie gebruik. Die rasse samestelling van die groep seuns was 95.4% blank, 2.3% swart en 2.3% kleurling.

Etiese klaring

Etiese goedkeuring is by die Etiekkomitee van die Noordwes-Universiteit (NWU) Potchefstroomkampus (Etiese nommer NWU-00142-11-A1) vir die uitvoering van die studie verkry. Die skoolhoof, ouers sowel as die leerders, het toestemming tot deelname aan die studie verleen.

Navorsingsontwerp

Die studie is oor 'n tydperk van 3 jaar uitgevoer met die eerste metings wat op alle Graad 8 leerders in Februarie 2010 uitgevoer is, en die laaste metings in November 2012 op dieselfde leerders. Die groep is elke jaar (2010, 2011, 2012) aan die begin van Februarie van elke jaar aan die volledige toetsprotokol van die studie onderwerp (liggaamsamestelling, fisieke en motoriese fiksheidstoetse), met opvolgtoetse vir slegs die groeimetings (lengte, massa, armspan en sithoogte) wat op 'n 4-maandelikse basis (Junie en Oktober) van elke jaar herhaal is sodat 9 groeimetings oor die 3-jaar tydperk beskikbaar was.

Vir die antropometriese metings, fisieke en motoriese komponente, is die Australiese "Sport Search Program" protokol gebruik (Australian Sport Commission, 1996). Die protokol word in Australië vir algemene sport-talentidentifisering by leerders van 12 jaar en ouer gebruik. Die toetsprotokol behels 10 toetse wat uit 4 antropometriese- (lengte, massa, sithoogte en armspan) en 6 fisieke en motoriese toetse bestaan. Tydens die metings is die proefpersone in kleiner groepe verdeel. Die antropometriese veranderlikes is binnehuis in afgeskorte areas gemeet deur van die standaard voorskrifte, soos deur ISAK voorgeskryf (International Standards for Anthropometric assessment), gebruik te maak (Marfell-Jones *et al*., 2011).

Navorsers met 'n nagraadse kwalifikasie in Menslike Bewegingskunde en 'n Vlak Twee Kinantropometriese sertifikaat het die antropometriese metings uitgevoer. As deel van die etiese verantwoordelikheid van navorsing het elke leerder jaarliks 'n verslag van sy resultate ontvang. Die resultate is uitgedruk in gemiddelde waardes en na persentielskale verwerk, wat met 'n verduideliking gepaard gegaan het sodat die inligting deur die leerder self geïnterpreteer kon word.

Data-insameling

Antropometrie

Die antropometriese metings vir lengte en massa is geneem deur middel van 'n standaard metingsprosedure soos deur die Australiese protokol voorgeskryf (Australian Sports Commission, 1996). Die armspan- en sit-hoogtemetings is geneem deur gebruik te maak van protokolle soos deur "The Canadian Sport for Life" (CS4L) voorgeskryf (Simmons, 2000 in Balyi & Way, 2005). Sithoogte as persentasie van totale liggaamslengte (sithoogte-ratio), is bereken deur van die volgende formule gebruik te maak, Sithoogte/Lengte x 100.

Lengte

Lengte is bepaal deur gebruik te maak van 'n stadiometer. Die leerder staan met sy rug teen die stadiometer en met die voete teenmekaar. Die hakke, boude, bo-rug en die agterkant van die kop van die leerder moet kontak maak met die stadiometer. Die kop word deur die toetsafnemer in die Frankfort posisie gehou en die meting word geneem wanneer die leerder diep inasem en die meting word tot die naaste 0.1cm genoteer. Twee metings is geneem waarvan 'n gemiddeld uitgewerk is en genoteer is (ISAK) (Marfell-Jones *et al*., 2011).

Massa

Massa is bepaal deur van 'n gekalibreerde elektroniese skaal (ADE, M302000) gebruik te maak en die meting is tot die naaste 0.1kg genoteer. Die leerder staan regop met sy gewig eweredig oor die skaal versprei en sy arms langs sy sye terwyl hy reguit vorentoe kyk. Die meting is sonder skoene en met so min as moontlik klere aan, geneem (ISAK) (Marfell-Jones

et al., 2011).

Armspan

Armspan is gemeet met behulp van 'n maatband wat horisontaal teen 'n muur op ongeveer skouerhoogte van die leerder, geheg is. Die beginpunt van die maatband moet in 'n hoek van 'n muur begin. Die leerder staan regop en so na as moontlik teen die muur, met die voete teenmekaar en met die maag wat in die rigting van die muur wys. Die arms word horisontaal met die skouers in hierdie posisie teen die muur uitgestrek, met die kop wat na die linkerkant gedraai word, terwyl die meting tot die naaste 0.1cm geneem word (Simmons, 2000 in Balyi & Way, 2005).

Sit-hoogte

Sit-hoogte is geneem met die leerder wat plat op die stadiometer sit met sy rug teen die stadiometer en die knieë wat ongeveer 90 grade gebuig is. Tydens die meting moes die leerder se kop in die Frankfort posisie wees waarna die meting geneem is, terwyl die leerder diep inasem. Die stadiometer se arm word tot op die leerder se kop afgeskuif en dan tot die naaste 0.1cm genoteer (Simmons, 2000 in Balyi & Way, 2005).

Sit-hoogte ratio

Sithoogte-ratio is bereken deur die volgende formule te gebruik: Sithoogte/Lengte x 100.

Dataverwerking

Die data is verwerk deur "Statistica for Windows 2012", Statsoft-rekenaarprogrampakket. Die metode van dataverwerking is deur die statistiese konsultasie dienste van die NWU aanbeveel. Vir beskrywingsdoeleindes is die metings aan die hand van rekenkundige gemiddeldes (Gem.), standaardafwykings (SA) en minimum en maksimum waardes ontleed (StatSoft, 2012). 'n Herhaalde meting oor tyd variansie analise (ANOVA) is uitgevoer om verskille oor die 3-jaar tydperk in die groep oor die 9 metingsgeleenthede by elke veranderlike te ontleed. 'n Post hoc Bonferonni aanpassing is gebruik om betekenisvolle verskille tussen metings oor tyd te bepaal, waar $p<0.05$ 'n statistiese betekenisvolle verskil aandui.

RESULTATE

Die resultate van die groep sal hoofsaaklik as 'n geheel bespreek word met enkele verwysings na resultate wat variasie in groei tydens hierdie tydperk aandui. In Tabel 1 word die aantal proefpersone, die gemiddelde ouderdom van die groep aan die begin van elke jaar en die aantal metings wat vir elke jaar van toepassing was, gerapporteer. Tydens die verloop van die studie het 14 proefpersone vanaf jaar 1 (n=87) tot jaar 3 uitgeval, hoofsaaklik as gevolg van verskuiwing van skole, wat tot gevolg gehad het dat volledige metings op 73 proefpersone oor die 3-jaar tydperk uitgevoer is.

TABEL 1. **INLIGTING VAN GROEP EN METING OOR DRIE JAAR**

Veranderlikes	**Jaar 1 (Gr. 8)**	**Jaar 2 (Gr. 9)**	**Jaar 3 (Gr. 10)**
N	87	80	73

Ouderdom Gemid±SA	13.58±0.439	14.58±0.414	15.57±0.414
Toepassing van metings	T1-T3	T4-T6	T7-T9

TABEL 2. **BESKRYWENDE WAARDES VIR ANTROPOMETRIESE METINGS OOR DRIE-JAAR TYDPERK**

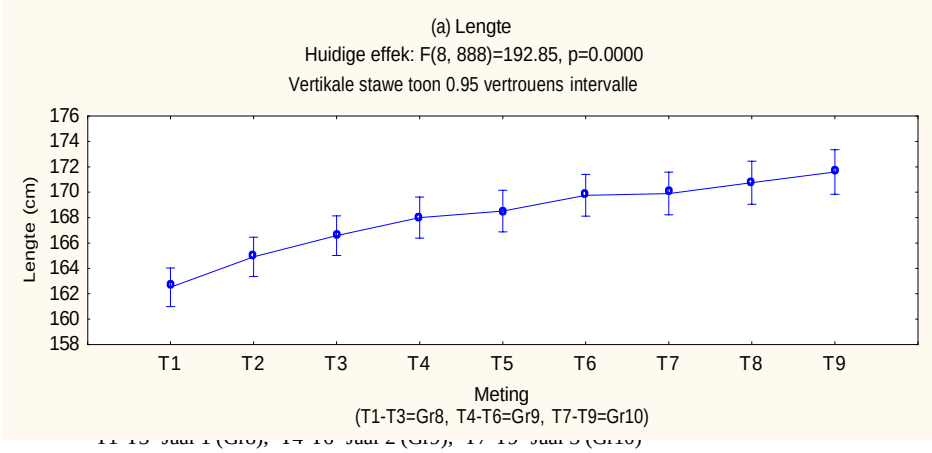
Metings & geleentheid	**Gem±SA**	**Minimum**	**Maksimum**
Lengte			
T1	163.85±8.84	147.80	186.10
T2	166.56±8.97	152.10	187.10
T3	169.00±8.16	154.20	187.60
T4	171.92±7.77	155.20	187.90
T5	173.25±7.62	155.50	189.50
T6	174.65±7.09	157.40	191.00
T7	175.27±7.07	157.80	192.60
T8	176.48±6.75	158.80	193.60
T9	177.72±6.76	158.80	195.20

(vervolg)

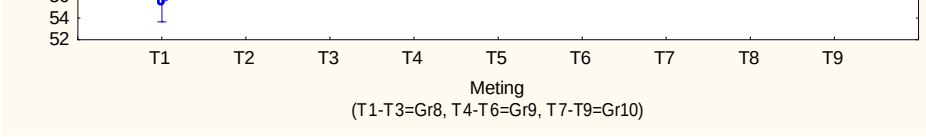
TABEL 2. **BESKRYWENDE WAARDES VIR ANTROPOMETRIESE METINGS OOR DRIE-JAAR TYDPERK *(vervolg)***

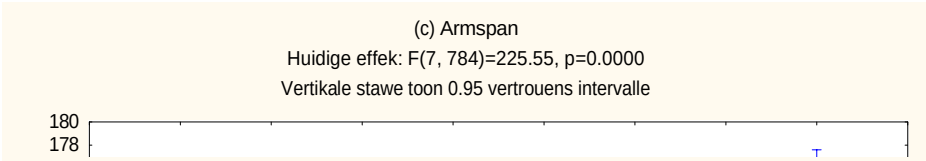
Metings & geleentheid	**Gem±SA**	**Minimum**	**Maksimum**
Massa			
T1	56.68±11.77	35.70	103.30
T2	59.74±11.90	37.20	101.10
T3	62.87±11.77	38.50	94.80
T4	65.23±12.28	41.60	101.40
T5	68.06 ±11.96	44.20	97.40
T6	68.99±11.92	45.20	99.80
T7	68.90±11.39	46.75	103.65
T8	72.18±11.08	50.40	106.90
T9	73.40±11.41	49.60	110.50
Armspan			
T1	166.60±9.59	147.40	188.00
T3	172.63±9.43	151.70	194.50
T4	176.58±9.05	153.70	197.50
T5	177.84±8.48	155.30	198.30
T6	179.74±7.96	156.90	199.90
T7	181.05±8.41	159.20	201.80
T8	181.70±8.22	159.50	202.60
T9	183.20±8.32	162.40	202.80
Sithoogte			
T1	82.28±4.92	73.20	97.60
T3	84.65±4.90	74.20	99.80

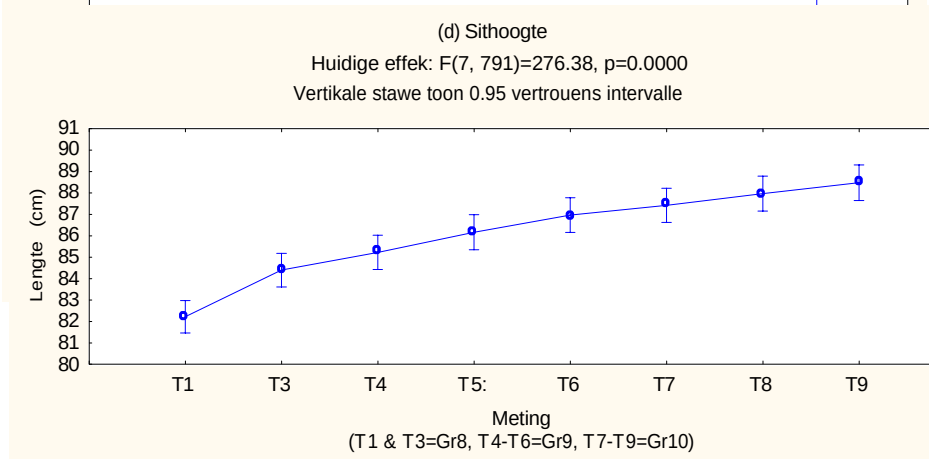
T4	86.11±4.84	76.00	99.85
T5	87.24±4.84	77.10	105.00
T6	88.58±4.52	77.90	100.00

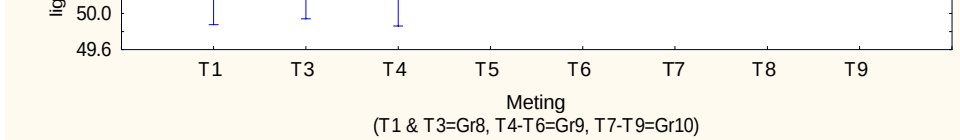


Gewig (kg)


54
52
T1
T2
T3
T4
T5
T6
T7
T8
T9
Meting
(T1-T3=Gr8, T4-T6=Gr9, T7-T9=Gr10)


(c) Armspan
Huidige effek: F(7, 784)=225.55, p=0.0000
Vertikale stawe toon 0.95 vertrouens intervalle
180
178


(d) Sithoogte
Huidige effek: F(7, 791)=276.38, p=0.0000
Vertikale stawe toon 0.95 vertrouens intervalle
Lengte (cm)
91
90
89
88
87
86
85
84
83
82
81
80
T1
T3
T4
T5:
T6
T7
T8
T9
Meting
(T1 & T3=Gr8, T4-T6=Gr9, T7-T9=Gr10)



FIGUUR 1. **GROEIKURWES OOR NEGE TOETSGELEENTHEDE (d-e)**

In Tabel 2 word die resultate van lengte, massa, armspan, sithoogte en sithoogte-ratio metings van die groep oor die 3-jaar tydperk gerapporteer, alhoewel dit groei oor 'n tydperk van 2 jaar uitbeeld. Dit sluit in gemiddeldes, standaardafwykings, minimum en maksimum waardes, oor die verloop van drie jaar. Figuur 1 stel hierdie groeiprofiele grafies voor.

In Tabel 3.1 en 3.2 word die gemiddelde verskille tussen metings, sowel as die gemiddelde toename wat jaarliks plaasgevind het, asook die betekenisvolle toenames tussen die 9 metings oor die verloop van 3 jaar, gerapporteer. Tydens T2 is geen metings vir armspan, sithoogte en sithoogte-ratio weens praktiese probleme geneem nie. Om die rede word daar slegs verskille vanaf T1-T3 (kursief) tydens die eerste jaar vir hierdie veranderlikes in die Tabel 3.1 aangedui.

TABEL 3.1. **GEMIDDELDE VERANDERINGE EN VERSKILLE IN GROEI OOR NEGE MEETGELEENTHEDE**

Metings	**Verskil T1-T2**	**Verskil T2-T3**	**Verskil T3-T4**	**Verskil T4-T5**	**Verskil T5-T6**	**Verskil T6-T7**	**Verskil T7-T8**	**Verskil T8-T9**
Lengte (cm)	2.71*	2.44*	2.92*	1.33	1.4*	0.62	1.21	1.24
Massa (kg)	3.06*	3.13*	2.36*	2.83*	0.93	-0.09	3.28*	1.22*
Armspan (cm)	*6.03*		3.95*	1.26	1.9*	1.31*	0.65	1.5*
Sithoogte (cm)	*2.37*		1.46*	1.13*	1.34*	0.55	0.67	0.89*
Sithoogte-ratio (%)	*-0.13*		-0.02	0.28	0.37	0.14	0.03	0.13

TABEL 3.2. **GEMIDDELDE VERANDERINGE EN VERSKILLE IN GROEI PER JAAR EN TOENAMES OOR DRIE JAAR**

	Groei per jaar			**Totale groei**
Metings	**Gr. 8 Verskil T1-T4**	**Gr. 9 Verskil T4-T7**	**Gr. 10 Verskil T7-T9**	**Gr. 8-Gr. 10 T1-T9**
Lengte (cm)	8.07*	3.35*	2.45*	13.87*
Massa (kg)	8.73*	3.67*	4.50*	16.90*
Armspan (cm)	9.98*	4.47*	2.15*	16.60*
Sithoogte (cm)	3.83*	3.02*	1.56*	8.01*
Sithoogte-ratio (%)	-0.15	0.79*	0.16	0.95*

Die groep het 'n betekenisvolle gemiddelde *Lengte* toename van 13.87cm oor die 3-jaar tydperk (Tabel 3.2) getoon (p=0.000). Die grootste jaarlikse toename in lengtegroei het oor

die verloop van die eerste jaar (T1-T4) met 'n toename van 8.07cm (Tabel 3.2, Figuur 1; p=0.000) in die tydperk voorgekom. Die grootse toename in die tydperk tussen metings van 2.92cm het tussen T3 en T4 plaasgevind (Tabel 3.1). Addisionele, maar kleiner jaarlikse toenames van 3.35cm (T4-T7) en 2.45cm (T7-T9) is in jaar 2 en 3 afsonderlik gevind (Tabel 3.2; p=0.000). Tydens die eerste 2 jaar (T1-T6) was lengtetoename tussen metings statisties betekenisvol (p=0.000), uitsluitend vir die tydperk tussen T4 en T5 (p=0.655). Vanaf T6-T9 het geen statisties betekenisvolle lengtegroei meer voorgekom nie. Die gemiddelde ouderdom van die groep was ongeveer 14.2 jaar tussen T3 en T4, waartydens die grootse toename van 2.92cm in lengtegroei in 'n 4-maande tydperk voorgekom het. Minimum en maksimum waardes vir lengte toon verder 'n groot variasie in waardes vir die lengte van die groep tydens

die eerste toetsgeleentheid (T1), met 'n minimum waarde van 147.80cm en 'n maksimum waarde van 186.10cm (Tabel 2).

Massa het 'n soortgelyke ontwikkelingstendens as lengte getoon met die grootste en statisties betekenisvolle (p=0.000) jaarlikse toename tydens die eerste jaar (T1-T4) van 8.73kg (Tabel 3.2) en die grootste toename van 3.28kg vanaf T7-T8 (Tabel 3.1). Toename in massa toon 'n liniêre verhoging tot en met T5 waarna 'n afplatting vanaf T5-T7 waargeneem kan word (Figuur 1b). 'n Betekenisvolle toename van 3.28kg is weer waarneembaar tussen T7 en T8 waarna massatoename steeds betekenisvol was, maar afplat (Tabel 3.1). Massatoename was slegs tussen die tydperk vanaf T5-T7 nie statisties betekenisvol nie (Tabel 3.1).

Armspan het 'n gemiddelde betekenisvolle toename van 16.6cm oor die tydperk van 3 jaar getoon. Soortgelyk aan lengte, het armspan ook 'n betekenisvolle (p=0.00) en die grootste groeitoename van 9.98cm tydens die eerste jaar (T1-T4) getoon (Tabel 3.2, Figuur 1c). 'n Verdere betekenisvolle (p=0.00) toename het in die 2de jaar (T4-T7) plaasgevind (Tabel 3). In die derde jaar (T7-T9) is 'n stelselmatige afname in toename van armspan gevind waar daar slegs 'n 2.15cm toename voorgekom het. Toenames in armspan was statisties betekenisvol tussen metings uitsluitend tussen die tydperke T4-T5 en T7-T8 (Tabel 3.1).

Sithoogte het oor die 3-jaar tydperk betekenisvol en liniêr toegeneem (8.1cm oor die tydperk van drie jaar) (Figuur 1d), met geen groeiversnelling oor die verloop van drie jaar nie. Die grootste veranderinge het tydens die eerste jaar (T1-T4) plaasgevind met 'n statisties betekenisvolle verhoging van 3.83cm (Tabel 3.2; p=0.000). In die tweede jaar (T4-T7) is 'n effens kleiner, maar steeds betekenisvolle verhoging van 3.02cm waargeneem en in die derde jaar (T7-T9) 'n kleiner toename van 1.56cm (Tabel 3.2). Toename in sithoogte tussen metings in die periode tussen T6-T7 en T7-T8 (Tabel 3.1) was nie betekenisvol nie.

Sithoogte-ratio het tydens die eerste jaar (T1-T4) 'n afname van 0.15% getoon. Vanaf die tweede jaar (Gr. 9) het die ratio verhoog tot aan die einde van die studie (Gr. 10) (Tabel 3.2; Figuur 1e). Tydens die tweede jaar (T4-T7) het sithoogte-ratio betekenisvol verhoog met 0.79% (p=0.002) met 'n verdere nie-betekenisvolle verhoging van 0.16% tydens die laaste jaar (T7-T9) (Tabel 3.2). Alhoewel die totale verhoging van 0.95% oor die verloop van 3 jaar statisties betekenisvol was (p=0.000), is geen statisties betekenisvolle toenames tussen die herhaalde metings gevind nie (Tabel 3.1).

BESPREKING

Die doel van die studie was om betekenisvolle veranderinge in groei vir lengte, armspan, massa, sithoogte en sithoogte-ratio van adolessente seuns tydens mid-adolessensie oor 'n tydperk van drie jaar te bepaal en te beskryf. Hierdie tydperk sluit die Graad 8-10 tydperk van die hoërskoolfase in.

Lengte het jaarliks (T1-T4 [8.07cm], T4-T7 [3.35cm], T7-T9 [2.45cm]) statisties betekenisvol (p=0.000) toegeneem, sowel as oor die verloop van drie jaar met 'n totale betekenisvolle toename (p=0.000) van 13.87cm (T1-T9) in die tydperk vanaf Graad 8 – Graad 10. Die resultate bevestig dat hierdie seuns steeds in hulle groei-versnellingsfase (GVF) tydens hulle

Graad 8 jaar, op ongeveer 14- jarige ouderdom, was wat met Tanner en Whitehouse (1976) se bevindinge, dat seuns op ongeveer 14-jarige ouderdom (dit wil sê die Graad 8-jaar van huidige studie), die GKV bereik, ooreenstem. Verder toon dié navorsers dat seuns se lengtegroei vanaf ongeveer 14-jarige ouderdom 'n plato begin bereik wat ook met die resultate van die huidige studie ooreenstem waar die gemiddelde jaarlikse toenames geleidelik minder geword het.

Die grootste vier-maandelikse toenames in lengte groei (2.71cm, 2.44cm, 2.92cm, 1.33cm, 1.4cm) het tydens die eerste twee jaar (T1-T6) voorgekom en die grootste toename tussen T3 en T4 (2.92cm). Armstrong en McManus (2000) rapporteer dat seuns in die GVF onderskeidelik 7-9-7cm (23cm) tydens die drie jaar van dié fase groei. Verder toon Largo *et al*. (in Malina *et al*., 1988) dat seuns gemiddeld 6.7-12.4cm tydens PGV groei. In die verband toon die huidige studie se resultate, jaarlikse toenames van 8.07cm, 3.35cm en 2.15cm onderskeidelik oor die verloop van drie jaar, wat daarop dui dat 'n groot persentasie seuns reeds ver ten opsigte van die GVF gevorder het toe hulle in Graad 9 was.

Die bevinding word versterk deur die feit dat die eerste metings van die studie geneem is toe die groep reeds 'n gemiddelde ouderdom van 13.58 jaar gehad het. Daar het ook 'n groot variasie (39cm) tussen die minimum en maksimum waardes in die lengte van seuns in Graad 8 voorgekom. Die leerder wat die maksimum waarde van 186.1cm tydens T1 behaal het, het slegs 3.9cm verdere groei tot 190cm tydens T9 getoon. Hierdie leerder het gevolglik reeds sy PGV in lengte in Graad 8 behaal. Dit bevestig dat van die seuns in die groep reeds hulle PGV voor Graad 8 ondergaan het, teenoor van die leerders wat in Graad 8 in hul GVF was, soos blyk uit die gemiddelde lengte van die groep (163.85cm), in vergelyking met gerapporteerde minimum en maksimum waardes (Tabel 2) in Graad 8.

Massa het betekenisvol vanaf T1-T5 toegeneem waarna geringe toenames vir ongeveer agt maande (T5-T7) (p=0.000) voorgekom het. Hierna het 'n betekenisvolle toename van 3.28kg (p=0.000) tussen T7 en T8 voorgekom waarna daar nie-betekenisvolle toenames gevolg het. Die grootste toename tussen die vier-maandelikse metings het ook tydens die eerste jaar (T2-T3) plaasgevind (3.31kg; p=0.000). Die grootste jaarlikse toename van 8.73kg het tydens die eerste jaar (Graad 8) voorgekom.

Die resultate stem ooreen met Rogol *et al*. (2002) se studie wat gevind het dat piek-massa toename op ongeveer 14-jarige ouderdom plaasvind. In dié verband toon Malina *et al*. (1988) dat piek-massa toename ongeveer 0.2-0.4 jaar na PGV plaasvind. In die huidige studie het massa tydens die laaste twee jaar betekenisvol met 3.67kg (Graad 9) en 4.5kg (Graad 10) onderskeidelik toegeneem (p=0.000). Massatoename het geen afnemende tendens aan die einde van die studie (jaar 3), soos lengte en armspan getoon nie, en het statisties betekenisvol

met 16.9kg (p=0.000) oor die verloop van drie jaar toegeneem. Hierdie blywende toename in massa, op 'n latere ouderdom, kan moontlik aan 'n verhoging in spiermassa (Malina *et al*., 2004) toegeskryf word, alhoewel die data nie gerapporteer word nie. Armstrong en McManus (2000) toon in dié verband dat liggaamsmassa konstant tot die middel twintigerjare, nadat toenames in lengte reeds 'n plato op ongeveer 17-jarige ouderdom bereik het, toeneem.

Armspan het soortgelyk aan lengte, tydens die eerste jaar, 'n toename van 9.98cm (p=0.000) ondergaan, waarna 'n stelselmatige afplatting, maar steeds statisties betekenisvolle toenames

van 4.47cm (Graad 9) en 2.15cm (Graad 10) onderskeidelik tydens die daarop volgende twee jaar voorgekom het. Mumtaz *et al*. (2009) het soortgelyke resultate gevind by armspan en liggaamslengte wat parallel ontwikkel, maar die navorsers rapporteer ook dat armspan by seuns langer is as liggaamslengte vanaf 16-jarige ouderdom. In die huidige studie was armspan deurgaans langer as liggaamslengte, maar die verskil het van 2.55cm (Graad 8) tot 5.41cm in Graad 10 toegeneem, toe die seuns 'n gemiddelde ouderdom van 15.57 jaar gehad het. Armspan het statisties betekenisvol toegeneem met 16.6cm (p=0.000) oor die verloop van die drie jaar (T1-T9), terwyl liggaamslengte 'n toename van 13.78cm getoon het. Mumtaz *et al*. (2009) toon dat daar versnelde groei in armlengte voorkom vanaf 13- tot 15-jarige ouderdom, 9.4cm en 6.3cm per jaar onderskeidelik in dié 2 jaar, waarna 'n afplatting bereik word wat met die resultate van die huidige studie ooreenstem. Alhoewel die data deur 'n dwars-deursnitstudie ingesamel is, het Pienaar en Viljoen (2010) 'n soortgelyke tendens by armspan waargeneem wat statisties betekenisvol vanaf 10- tot 15-jariges toegeneem het. Dié navorsers toon verder dat die grootste veranderinge tussen 13 en 14 jaar plaasgevind het waar armspan tot met 7.82cm verskil het in dié jaar.

Sithoogte het tussen T1 en T2 'n effense versnelling getoon maar verder 'n liniêre ontwikkelingskurwe gevolg met geen verdere versnelde groei oor die verloop van drie jaar (p=0.000) nie. Oor die verloop van drie jaar was daar slegs twee stadiums waartydens groei tussen metings nie-statisties betekenisvol was nie (T6-T7, T7-T8). Die grootste jaarlikse groei het egter tydens die eerste jaar (Graad 8) plaasgevind, met 'n verhoging van 3.38cm, wat met die resultate van Malina *et al*. (2004) ooreenstem, waar sithoogte 'n versnelling op ongeveer 13.5 jaar ondergaan het. Lee *et al*. (2005) rapporteer dat seuns ongeveer 3.7cm tussen 13 en 14 jaar groei wat met die resultate van die huidige studie ooreenstem waar 'n soortgelyke toename in sithoogte (3.83cm) tydens die eerste jaar gevind is. Verder ontwikkel sithoogte ook later ten opsigte van totale liggaamslengte (Malina *et al*., 1988) wat ook bevestig dat heelwat leerders PGV voor Graad 8 bereik het. In dié verband toon navorsing dat sithoogte tot ongeveer 18-jarige ouderdom toeneem voordat 'n plato bereik word (Fredriks *et al*., 2005; Lee *et al*., 2005). Dit kan moontlik daaraan toegeskryf word dat lengtegroei aanvanklik eers in die ledemate plaasvind en finale romplengte eers later bereik word (Malina *et al*., 1988; Wheeler, 1991).

Lengte het statisties betekenisvol met 8.07cm (p=0.000) toegeneem, terwyl *Sithoogte-ratio* 'n wisselvallige ontwikkelingskurwe oor die verloop van die drie jaar gevolg het. Tydens die eerste jaar (T1-T4) word 'n afname van 0.15% in sithoogte-ratio waargeneem wat moontlik daarop dui dat beenlengte steeds 'n groter bydrae tot totale liggaamslengte maak. In die verband het totale liggaamslengte met 8.07cm tydens dieselfde tydperk (T1-T4) toegeneem waarvan die toename in sithoogte slegs 3.83cm (42%) bygedra het en toename van die onderste ledemate 58% bygedra het. Hierdie verhouding in die bydrae tot totale liggaamslengte sal sodoende 'n effek op sithoogte-ratio uitoefen en bevestig dat seuns steeds

in hul GVF en PGV in die huidige studie was.

Die resultate van Pienaar en Viljoen (2010) bevestig die tendens waar gevind is dat sithoogte ongeveer 51% van totale liggaamslengte op 10-jarige ouderdom uitmaak, waarna dit tot 50% op 12-jarige ouderdom afgeneem het en daarna 'n plato bereik het. Sithoogte-ratio het liniêr en statisties betekenisvol (p=0.000) met 0.79% tot 50.85% aan die begin van die laaste jaar (T7) toegeneem met 'n verdere nie-betekenisvolle toename van 0.16% tot 51.01% (p=1.000).

Sithoogte-ratio het sodoende statisties betekenisvol oor die verloop van drie jaar met 0.5% (p=0.000) toegeneem. Hierdie resultate stem ooreen met Visagie (1981) (in Pienaar & Viljoen, 2010), wat gevind het dat sithoogte-ratio 51.3% (10 jaar), 51% (11 jaar), 50.58% (12 jaar), 50.99% (13 jaar), 50.74% (14 jaar) en 50.53% (15 jaar) onderskeidelik was.

Die huidige studie het leemtes gehad wat uitgelig moet word. Die data is slegs op 'n beskikbare steekproef oor 'n longitudinale tydperk van drie jaar wat strek vanaf 13-15 jarige ouderdom ingesamel. Om praktiese redes is slegs hoërskoolleerders vir die studie gebruik en gevolglik kon die totale verloop van die GVF nie in die studie ontleed word nie. Daar is geen metings vir armspan, sithoogte en sithoogte-ratio tydens die tweede metingsgeleentheid (T2), as gevolg van praktiese probleme, geneem nie. Daarom kan daar nie ten volle antwoorde gegee word oor groei tydens die GVF vir hierdie veranderlikes nie. Alhoewel slegs een skool se leerders in die Noord-Wes Provinsie van Suid-Afrika vir die studie gebruik is, is die groep wat getoets is afkomstig uit 'n verskeidenheid laerskole vanuit die omgewing wat die resultate meer veralgemeenbaar maak.

'n Verdere leemte is 'n tekort aan 'n verteenwoordigende groep seuns van 'n verskeidenheid rasgroepe wat die demografiese samestelling van die land verteenwoordig en dat die resultate gevolglik hoofsaaklik op blanke seuns se groei van toepassing is. Omgewingstoestande was ook nie oor die drie-jaar tydperk identies en soms nie optimaal nie (temperatuur verskille en nie-optimale oppervlaktes), wat moontlik die resultate kon beïnvloed het.

Laastens is die biologiese ryping status van seuns nie bepaal nie, en inligting hieroor kon dalk bygedra het tot meer in-diepte ontledings en verklarings van die resultate. Indien prakties moontlik, word ook aanbeveel dat toekomstige soortgelyke navorsing oor 'n langer tydperk van groei (11-18 jaar) uitgevoer moet word, sodat 'n meer omvattende beeld van groei by seuns in die GKV verkry kan word en antwoorde gegee kan word rondom die volle omvang van die versnellingsfase van groei by seuns. 'n Meer verteenwoordigende samestelling van rassegroepe, asook leerders wat verskeie sosio-ekonomiese omstandighede verteenwoordig, word ook aanbeveel sodat die moontlike verskille tussen rasse en die effek van sosio-ekonomiese omstandighede op groei gerapporteer kan word. Sodoende sal 'n beter beskrywing van die omvang en effek van die versnellingsfase van groei by Suid-Afrikaanse seuns weergegee kan word.

SAMEVATTING

Die studie het waardevolle inligting oor groei in lengte, massa, armspan, sithoogte en sithoogte-ratio by seuns tussen Gr. 8-10 tydens mid-adolessensie beskikbaar gestel oor die verloop van 'n twee-jaar tydperk. Toenames in lengte, massa, sithoogte en armspan was hoofsaaklik beduidend tussen 13.58 en 14.58 jaar, alhoewel individuele variasie in groeitempo steeds in die tydperk voorgekom het. Hierdie groot veranderinge het 'n

verskeidenheid konsekwensies, veral vir prestasie in sport, omdat dit tydens die eerste hoërskool jaar plaasvind, waartydens spesialisering in spesifieke sportsoorte gewoonlik begin. Afrigters en onderwysers moet voldoende kennis hê oor die omvang, die implikasies van groei en ontwikkeling in dié tydperk en die invloed daarvan op die fisieke en motoriese vermoëns van seuns. Dit sal voorsien dat die leerders tydens die tydperk korrek hanteer word om beserings te voorkom, maar ook om optimale ontwikkeling te bewerkstellig. Variasie in

groei tussen seuns was die grootste tydens dié tydperk waar die aspek van vroeë- en laat-ontwikkeling die grootste impak op sportdeelname sal uitoefen. Dit sal deeglike beplanning, maar ook voldoende kennis verg om die verskille in ontwikkeling binne 'n spesifieke groep of omgewing optimaal te hanteer.

Alle veranderinge oor die totale verloop van die studie was statisties betekenisvol ($p<0.05$) by al die eienskappe maar toenames het met die verloop van tyd kleiner geword. Lengte, massa en armspan blyk parallel vanaf Graad 8-10 te ontwikkel met duidelike afnames in groei aan die einde van die tydperk. Daar het slegs by massa geen afplatting tydens die Graad 10-jaar voorgekom nie wat met bevindinge van ander groeistudies ooreenstem. Sithoogte-ratio het die grootste veranderinge tussen 14.58 en 15.57 jaar ondergaan omrede sithoogte die laaste aspek van finale liggaamslengte is wat nog groei ondergaan. Dit bevestig dat die leerders in die finale fase van groei was.

Uitsluitende sithoogte-ratio, het al die antropometriese eienskappe statisties betekenisvolle veranderinge tydens die opvolgmetings in jaar twee en drie getoon. Volgens die LTAD („Long Term Athlete Development") model val seuns tussen 12 en 16 jaar in die "oefen om te oefen" fase. Hierdie fase vereis dat 'n aërobiese basis vasgestel moet word. Verder moet krag teen die einde van die fase gebou word om sodoende verdere sport-spesifieke vaardighede te ontwikkel. Tydens die tydperk (GVF) sal vroeë en laat ontwikkelaars verskil omrede groot lengte en massa verskille voorkom. Hierdie is gevolglik ook 'n onstabiele tydperk waar wanbalanse in die verhouding van liggaamsproporsies (spiermassa, vetmassa, neurologiese ontwikkeling), voorkom wat sportprestasie moontlik kan beïnvloed en tot beserings kan bydra. Vanuit 'n perspektief van talentidentifisering (TID) moet hierdie antropometriese groeiprofiele in gedagte gehou word ten einde die huidige ontwikkelingstatus, sowel as potensiële ontwikkeling van seuns in berekening te bring. Gevolglik behoort hierdie inligting oor groeitoenames en verskille te help om adolessente tydens sportontwikkeling beter en meer suksesvol te begelei aangesien tekortkominge in fiksheid geïdentifiseer en ontwikkel sal kan word.

SUMMARY

Growth patterns of boys during mid-adolescence: A longitudinal study of anthropometric changes

The study expands on research done worldwide and to a lesser degree in South Africa about accelerated growth and the growth spurt that occurs during adolescence. All growth (structural and physiological changes during the process of development to adulthood), and maturing processes (changes occurring in form and complexity of body organs and what has been determined by genetics) (Pienaar, 2010), that adolescents undergo during this growth phase, have an influence on their body composition and physical abilities. This in turn, will have an impact on the execution of motor skills (Viru *et al*., 1999; Pienaar, 2010).

Information about growth can improve insight into the development of a specific group, region or population and assist in the talent identification process (Du Randt & Headley, 1993), and the compilation of developmental programmes accordingly (Balyi & Way, 2005).

The study aimed to determine the anthropometric growth changes (stature, mass, arm span, sitting height and sitting-height-ratio) of boys during mid-adolescence over a period of three years. A convenience sample consisting of all the Grade 8 learners of a Quintile-5 high school in Potchefstroom in the North-West Province of South-Africa was selected to participate in a longitudinal growth research project over a three-year period ranging from 2010 (87 boys, 95 girls) to 2012 (73 boys, 79 girls). Boys with a mean age of 13.58 years in Grade 8 of whom 95.4 % were white, 2.3% black and 2.3% coloured, were used for the purpose of this study.

The anthropometric measurements form part of the Australian Sport Search Program (Australian Sports Commission, 1996) and was measured according to the ISAK (Marfell-Jones *et al*., 2011), as well as the Simmons protocol. In addition, sitting-height-ratio was calculated according to the formula, sitting height/stature x 100. "Statistica for Windows" Statsoft-computer program package (StatSoft, 2012) was used to analyse the data for descriptive purposes (means, standard deviations and minimum and maximum values). A repeated-measure over time analysis of variance (ANOVA) with a post hoc Bonferonni adjustment was applied to analyse the differences over a period of three years within the group for all variables.

The results indicate that during the period from 13.58-14.58 years, boys grow considerably in stature (8.07cm), body mass (8.73kg), arm span (9.98cm) and sitting height (3.83cm) while sitting-height-ratio (0.79%) showed the most development from 14.58-15.57 years. Stature, mass and arm span showed a parallel development up to 15-years of age until further development in stature and arm span levelled off. Mass showed no levelling off at the end of the three years. The total increases over the period of three years were significant in all anthropometrical variables including increases in stature (13.87cm), arm span (16.6cm), mass (16.9kg), sitting height (8.01cm) and sitting-height-ratio (0.95%).

It was concluded that the most significant growth changes took place from 13.58-15.57 years that falls within the mid-adolescent period. From a talent identification perspective, information of anthropometric growth profiles are important, in order to consider the developmental status and potential future development of boys during this phase.

Erkenning

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EXPLORING PUBLIC RECREATION SERVICE DELIVERY UNDER TWO POLITICAL IDEOLOGIES IN SOUTH AFRICA: 1948 – 2006

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ABSTRACT

This study aimed to explore the provision of public recreation to the citizens of South Africa under two distinct political ideologies of 'Apartheid' and the current democratic political system. Results from this qualitative and descriptive study of public recreation provision under two distinct political ideologies in South African apartheid and democracy are presented. Five themes emerged from an inductive content analysis: Philosophy and policies of public recreation service provision; Governance of public recreation provision; Legislation related to public recreation provision; Public recreation programmes and initiatives; and Recreation training and education initiatives. Findings suggested that similarities and differences of service provision existed, and neither of the two ideologies succeeded in optimising public recreation provision as instruments of social transformation to support the notion that public recreation benefits all. Although the political ideology of democracy brought progress and structure in terms of recreation policy, legislation, education and training, fragmentation of governance structures, lack of coordination, and a myopic focus on physical recreation were evident under both ideologies. It seems as if most South African citizens continue to be excluded from recreation access and opportunities as a social space conducive to individual exploration, reflecting social, cultural intellectual and spiritual growth.

Key words: Public recreation provision; Apartheid ideology; Democracy.

INTRODUCTION AND RESEARCH CONTEXT

The South African socio-political landscape from 1948 to 1994 was dominated by the political ideology of „Apartheid". The notion of Apartheid is grounded in the idea of separateness or segregation of racial groups. The backbone of the apartheid political system was a legal framework aimed at protecting and perpetuating the dominance of people of European descent (whites) over people of non-European descents (Africans, Coloureds and Indians). Under the laws of Apartheid, people were classified into racial groups based upon skin colour and geographically and legally kept apart from each other. The idea of differentiated social development in South Africa originated from a religious perspective, but soon developed into a political ideology based on white supremacy and segregation. Although the ideology of Apartheid was legalised in 1948, the roots of the notion of separate development can be traced back to 1910 in the political manifesto of the South African Party

under the leadership of General Louis Botha (Giliomee, 2003). In 1948, when the white

South African Nationalist Political Party came into power, the ideological political system of Apartheid was legalised and solidified the social exclusion of the majority of South Africans along racial lines. From 1948 to 1994, race and ethnicity became the gateways to access the basic human rights of freedom of movement, freedom of association and quality of life (Giliomee, 2003). The political ideology of apartheid applied to all facets of social life, including sport and recreation provision and participation, intertwining the history of the struggle against racial segregation in sport and recreation with political freedom. The exclusion of the majority of South Africans from access to and opportunity for sport and recreation participation in an open and fair manner gave impetus to the non-racial sport movement‟s struggle against apartheid sport.

The efforts and campaigns of the South African Sports Association (SASA) and the South African Non-Racial Olympic Congress (SANROC) spearheaded the struggle to normalise access to sport and recreation opportunities since the 1950s. This struggle is well documented in the body of literature on sport boycotts against South Africa (Nongogo, 2013). Although the apartheid political ideology segregated humans based on race and ethnicity, it did provide basic opportunities for participation in sport and recreation, albeit in segregated structures in the so-called "homelands" (geographic areas allocated for different ethnic groups). The universally accepted potential of socialisation, mobility, solidarity and social tolerance advocated by sport and recreation participation throughout the world, however, did not come to fruition in South Africa, resulting in a racially divided society.

The end of the political ideology of apartheid dawned in 1990 with the unbanning of the African National Congress, the South African Communist Party and other smaller political parties and the announcement of Nelson Mandela‟s unconditional release from prison (De Klerk, 2000). In 1994, the first democratic election in South Africa brought the African National Congress (ANC) to power. The Freedom Charter, accepted in 1995 as the ANC‟s main political and social policy, was implemented. It guaranteed free and fair access to all social structures (including sport and recreation participation) for all South Africans. This democratic and liberated social order stood in direct contrast to the previous segregated ideology of Apartheid and white supremacy. Free and fair access to sport and recreation participation became a reality to be reflected and institutionalised in democratised sport and recreation governance structures, legislation, and policy aimed at redressing imbalances of the apartheid ideology.

Access to and participation in sport and recreation always played a pivotal role in shaping South African society (Shepherd, 1942; Hain, 1971; Grundlingh *et al*., 1995; Nauright, 1997; Booth, 1998; Ramsamy, 2004). Ramsamy (2004) argues that sport at all levels remains a powerful instrument in bringing about any desired world order, whether just or unjust, while at the same time emphasising meaningful recreation activities as essential element for safeguarding total wellness of a society. Although the history of South Africa‟s struggle against apartheid sport is relatively well documented, the converse is true for public recreation provision in a South African context. It can be argued that recreation affects quality of life of more people than competitive sport due to recreation‟s inherent inclusivity and tolerance of diversity, and therefore, deserves recording. A possible reason for the lack of historical recording of public recreation provision could be contributed to its relative

unobtrusiveness as social phenomenon even though recreation provision emulates social and political dynamics of the time. Philosophy and content of public recreation service provision

campaigns equally mirror fundamental principles of a particular ideology of the ruling political party of the day. It is, therefore, imperative to record the manifestation of public recreation provision as reflections of the political ideology of the day.

AIMS OF THE STUDY

This investigation aimed to explore the provision of public recreation to the citizens of South Africa under two distinct political ideologies, namely the previous apartheid system and the current democratic political system. The researchers were especially interested in analysing manifestations of public recreation provision to determine if it was used as instruments of social transformation and change under two distinct political ideologies. Furthermore, they thematically analysed public recreation service provision to uncover similarities and differences under two distinct political ideologies. Lastly, they documented the critical contributions of recreation service provision for the enrichment of South Africa‟s and international public recreation historiography. For purposes of this investigation, recreation is defined as „activities engaged in voluntary during one‟s free time, that are beneficial to both the individual and the community and fall within the social, cultural and legal parameters of a particular society‟.

METHODOLOGY

Research design

This study followed a qualitative, descriptive and ideographic research approach. According to Creswell (2007), a descriptive study involves an in-depth analysis and description of a situation in a specific context to establish a chronological relationship between events. An ideographic research strategy aims to emphasise what is unique or distinctive in a situation or context (Mouton & Marais, 1992). In this particular investigation, the researchers explored in-depth the phenomenon of public recreation provision as a social artefact in the South African context over an extended period of time (1948–2006) to uncover similarities and differences and establish chronological relationships between public recreation service provision and the political ideology of the day. As this study aimed to understand the contexts or settings in which public recreation was provided, a qualitative approach was followed.

Demarcation of the study

The scope of research was restricted to organised recreation activity and service provision in the South African public sector in the timeframe from 1948 to 2006. This particular timeframe represents two distinct political ideologies in South African society: the segregated apartheid era (1948–April 1994) and the post-apartheid era of democracy from May 1994 onward. The end date of the timeframe of this study was set as 2006 marking the dissolution of the South African Sports Council (SASC). For the purpose of this research, the concept of *organised public recreation service provision* was delimited to recreation programmes and activities initiated by the government of the day, targeted at the masses and funded by public

funds for the purpose of reflecting and institutionalising the doctrine of a particular political ideology.

Data collection

The researchers used documentary sources and personal interviews as qualitative data collection strategies. Public reports, minutes of meetings, government policies on recreation, and legislation that described recreation provision as product of human behaviour during free time represented the units of analysis. Data triangulation was done by cross-referencing data collected from recorded personal interviews with government officials involved in recreation provision and historical documentary sources. Documentary sources were available in the public domain while informed consent was obtained from interviewees.

Data interpretation

Collected data were interpreted in the social and political contexts of Apartheid and democracy to develop a holistic picture of public recreation provision in South Africa. The researchers applied inductive content analysis to identify patterns and organise data into categories and themes cutting across both political ideologies. Five themes emerged from the content analysis: (1) Philosophy and policies of public recreation service provision; (2) Governance of public recreation provision; (3) Legislation related to public recreation provision; (4) Public recreation programmes and initiatives; and (5) Recreation training and education initiatives.

RESULTS AND DISCUSSION

Philosophy and policies of public recreation service provision

When the exclusive white Nationalist Party came into power in 1948, a strict policy of social and racial segregation was implemented, which also regulated the provision of public recreation activities. A series of acts establishing complete social segregation was promulgated within a decade. The *Group Areas Act* (1950) specified separate residential areas for different race groups. Strict influx control curbed freedom of movement of the urban black population and, in 1960, the focus of government policy shifted to the development of *homelands* – geographic areas allocated for specific ethnic groups. Basic family housing and recreation services for non-whites were provided only in homeland townships. In 1965, the act was extended to exclude non-white spectators from sports matches and other public entertainment in white areas. Additionally, *The Reservation of the Separate Amenities Act* (1953) imposed racial segregation in public places of recreation, entertainment and the sport stadiums. The *Native Law Amendment Act* of 1957 regulated segregation in various social structures such as recreation associations, clubs, schools and churches. *The Liquor Amendment Act* of 1963 forbade whites to consume alcoholic drinks with non-whites except on premises they owned, which effectively prevented persons of different races from mixing socially.

These acts controlled and prescribed the social environment in which both sport and recreation were practised. Increasing demand from non-whites for shared participation in

organised recreation and sport and joint governance and management led to the formulation of a sport and recreation policy by 1956. White and non-white population groups were to organise and practise their sport and recreation activities under separate controlling bodies, thereby preventing the integration of whites and non-whites. This policy of complete segregation stipulated that no mixed social activities would be allowed within the borders of South Africa. Non-white recreation organisations that sought international affiliation must

have done so through the already-recognised white organisations. Government, however, refused travel visas to subversive recreation scholars who sought to discredit South Africa‟s image abroad or contested government‟s racial policies (HSRC, 1982a).

In 1978 public recreation provision was centralised in the national Department of Sport and Recreation that commissioned extensive research on the status quo of sport and recreation culminating in the *Hoek Report* (Hoek *et al*., 1978). This report succeeded in fragmenting recreation provision at the national government level. It essentially recommended that recreation provision be implemented and regulated in a decentralised and fragmented manner by all public governance structures in accordance with their core functions in line with the political ideology of Apartheid based upon the above legislation discussed. The response of sport and recreation service providers to the notorious *Hoek Report*, compelled the apartheid government in 1979 to request the Human Sciences Research Council (HSRC), as a neutral scientific agency, to launch a nationally representative and scientifically-based investigation into sport and recreation provision within South Africa. The leadership proposed specific recommendations concerning a new national structure and dispensation for sport and recreation provision at all levels. This encompassing *HSRC Report* was completed and released in 1982. Where the *Hoek Report* of 1978 sought to entrench Apartheid in sport and recreation provision the *HSRC Report* sought to free it from the bondage of fundamental apartheid laws. The *HSRC Report* undoubtedly was a significant milestone in the philosophy of public recreation provision as it proposed the abolishment of or changes to certain apartheid laws and by-laws pertaining to participation in recreation. The *HSRC Report* served as a significant link between the apartheid and democracy ideologies because it provided neutral ground regarding recreation-related philosophy and policy (HSRC, 1982d; Scholtz, 2000).

In 1994, South Africa experienced major political changes when the first democratic government was elected. Both sport and recreation were identified as contributors to the social re-engineering journey of South African society (African National Congress, 1994). The significance of public recreation provision warranted a centralised governance system and a national Ministry of Sport and Recreation was re-established in 1994. For the first time in the country‟s history, a unit within the national government Department of Sport and Recreation dedicated to the provision of public recreation policy and services was established. Its mission focused on "the enhancement of the physical well-being of the nation through the provision of equitable, affordable, accessible recreation facilities, programmes, services, education and training" (Department of Sport and Recreation, 1995:8). This establishment of a national public recreation governance structure confirmed the new democratically elected government‟s commitment to the integration of sport and recreation into a desegregated social fabric of the country and resulted in the first dedicated central sport and recreation policy. The first *White Paper on Sport and Recreation* with the theme, "Getting the nation to play", was drafted in 1996 and unequivocally placed overall responsibility for policy, provision and delivery of public recreation activities with the newly established central governance structure.

For the first time in South African history, the *White Paper on Sport and Recreation* provided central government policy guidelines for the delivery of sport and recreation to all South Africans regardless race or ethnicity. Eight priority areas were to be addressed by all sport and recreation role players and stakeholders. Priority four had direct reference to public

recreation provision. It described key principles for the development of public recreation service delivery and stipulated that recreation development must be demand-driven and community-based, that participation in recreation activities is a fundamental human right and it must be based on equitable resource allocation, coordinated effort and integrated development.

Due consideration was given to the shortcomings of previous uncoordinated and visionless public recreation provision policies and activities and recreation‟s potential as an instrument of social change was recognised on government level (Department of Sport and Recreation, 1997). The most obvious contrast between the two political ideologies was the way in which the same social phenomenon (public recreation) was implemented. Under the apartheid ideology, it was utilised as a tool to segregate and divide people, while under the ideology of democracy it was regarded as a vehicle to unite society.

Governance of public recreation provision

Responsibility for creating governance infrastructure for public recreation programme provision under the apartheid ideology was shared by national government and non-governmental organisations (NGOs). Prior to 1960, pioneer initiatives to provide organised recreation programmes centred around increasing physical fitness and well-being of the white population under a National Advisory Council for Physical Education (N.A.C.P.E) housed in the Department of Education of the Union of South Africa (Botha, 1949). A journal entitled, *Vigor*, was founded in 1947 as a publication and mouthpiece of the N.A.C.P.E. This coincided with the founding of the South African Association for Health, Physical Education and Recreation (SAAHPER) in 1947 as the first scientific association in the disciplines of health, physical education and recreation. As it was governmentally funded, the ideology of segregated recreation service provision for different population groups within South Africa was reiterated and enforced.

During the so-called *Vigor* era, concerns were raised about national fitness levels of white Afrikaners and, as early as 1959, the first National Fitness Conference was held (Opperman, 1959). Interestingly, concerns were raised about national fitness levels directed only at one ethnic group (people who spoke Afrikaans) although the so-called white population group also included people of other European descents like the English, German and Dutch. Sport and recreation activities were stressed as appropriate ways to establish and reinforce the dominant political ideology of the day and gave preference to growing Afrikaner nationalism at the cost of other white ethnic groups. This approach of sub-segregation reflected in traditional dances and mass participation activities like gymnaestradas and festivals linked to political events, with the primary agenda of growing Afrikaner nationalism.

From 1948 to 1964, the function of public recreation provision was situated mainly in a national government Department of Education. In 1965, however, the apartheid government decided that a separate governance structure should be created to take care of its interest with regard to sport and recreation. In 1966, a Department of Sport and Recreation was thereby created to organise and stimulate white sport and recreation. Due to apartheid roots and motives covertly and overtly underlying the inception of this governance structure, it was, however, internally and externally perceived yet another creation of the apartheid system and was viciously rejected. These negative perceptions hampered the potential of public recreation provision, as it never was fully institutionalised in the social fabric of society.

The reaction of anti-apartheid movement organisations to the establishment of the national governance structure was to form a parallel shadow organisation called the National Sport and Olympic Council (NSOC) that operated outside the borders of the country. Under the apartheid ideology, public infrastructure was quadrupled to cater to recreation needs and demands of four racial groups with obvious financial implications. Due to economic rationalisation and changing government priorities, the autonomous national governance structure for sport and recreation was again relegated in 1980 to a sub-division within the Department of National Education (Scholtz *et al*., 1998). Fragmentation of governance structures continued even further when regional administration and development boards were created to provide public recreation delivery structures to the non-white population. Although these administrative boards were labelled as independent agencies, it was funded and controlled by national government and subject to the principles of the apartheid ideology. Public recreation programmes and services were presented in conjunction with private sector welfare organisations attempting to present a front of holistic recreation provision (Bush, 2004).

In 1966, initiatives to create scholarly governance structures and associations in recreation science gained momentum with the foundation of a scientific and scholarly South African Association for Sport Science, Physical Education and Recreation (SAASSPER). Even though it was constituted as a non-governmental association concerned with the development of scientific knowledge in physical education, sport, recreation and tourism, government funded it and membership was limited to white academics and practitioners in accordance with the apartheid laws of the day (SAASSPER, 1988). A parallel governance structure (Trim and Fitness South Africa) was established as an umbrella body for whites-only recreation associations (TRIMSA, 1985). It was aimed to stimulate mass recreation activities within communities to build capacity and infrastructure on local level. The pattern of front-organisations funded with money from the apartheid government thus continued as, although both TRIMSA and SAASSPER were constituted as non-governmental associations, it obtained formal recognition and funding from the apartheid government.

In 1994, the democratically elected government based upon the political ideology of inclusion and integration inherited a fragmented governance structure relating to public recreation service provision that undoubtedly diluted the effectiveness of service delivery. Great expectations were placed on the ability and commitment of the new ideology not to repeat the mistakes of the past and create functional governance structures conducive to the potential of recreation as agent of social change. Two parallel macro governance structures were constituted to guide the public provision of sport and recreation. A national recreation council

was tasked with coagulating collective interests of recreation service providers both in the public and in the private sector (SANREC, 1998). Additionally, a sports commission based on the Australian model cemented the position of competition sport at the national level.

Unfortunately, the powerful image and attraction of top sport at the international level overpowered the transformational power of recreation, and the issue of public recreation service provision fell by the wayside. Among recreation scholars and community leaders, there was a strong belief that the commission did not satisfactorily accommodate recreation provision at national and lower levels. The need for a separate and autonomous national governance structure dedicated to recreation comparable to the sports commission or, alternatively, the transformation of the commission to accommodate fully the notion of public

recreation provision, was explicitly expressed by recreation leaders, but with no effect (SANREC, 1998). Public recreation provision and mass participation campaigns were again fragmented to the detriment of the South African public. It became evident that although the significance of public recreation provision was verbally acknowledged under the democratic ideology, dedicated governance structures were notably absent. Governance structures and policies focused on high performance sport as reflected in the vision statement of the sports commission: "to lead South Africa to world-class sporting excellence" (South African Sports Commission, 2000:9).

The intrinsic value of recreation activities was regarded as subservient to competitive sport and the fragmentation of recreation governance structures also continued under the ideology of democracy. With the amalgamation of all macro sport governance structures into a centralised and united Olympic governance structure (SASCOC), the functions of mass recreation participation and recreation education and training were excluded and transferred back to the national government structure. It became clear that both political ideologies could not succeed in creating a functional and effective governance structure for public recreation service provision. Public recreation service provision was sent from pillar to post and by doing so largely lost its potential as agent of social change. The lack of coordination and networking between governance structures regarding public recreation provision that confronted the ideology of democracy in 1994 still persisted.

Recreation legislation

Under the apartheid ideology, no acts were promulgated to regulate public recreation provision specifically, as general apartheid legislation regulated all aspects of social life including public recreation provision (HSRC, 1982a). Under the democracy ideology, however, policy and legislation developed simultaneously. The first national policy on sport and recreation (1995) was not prescriptive and did not have any binding legal capacity; nevertheless, it provided a foundation for dedicated sport and recreation legislation that followed (Department of Sport and Recreation, 1995).

Between 1998 and 2006, national government passed legislation to regulate the promotion of sport and recreation in South Africa. For the first time in South African sport and recreation history legislation aimed at correcting imbalances in sport and recreation, promoting equity and democracy in sport and recreation, providing for dispute resolution mechanisms in sport and recreation and creating safe environments for participation were put in place. Even

though the promulgation of dedicated sport and recreation legislation entrenched the position of public recreation provision, it also contributed yet again to the fragmentation of public recreation provision, as was the case under the apartheid ideology. The fragmentation became evident from articles of the national Sport and Recreation Act when it stipulated that "every government ministry, department, province or local authority may carry out sporting and recreational activities relating to physical education, sport and recreation including training programmes and development of leadership qualities" (Republic of South Africa, 1998:7).

Public recreation programmes and initiatives

Under the apartheid ideology, the emphasis of public recreation programmes and initiatives was primarily on improving fitness levels of the white population. The emphasis on national fitness levels was justified in the context of nationalism and white supremacy propagated by

the apartheid ideology. „Trim parks" based on the German and Belgian models were selected as vehicles to improve fitness levels (HSRC, 1982b). „Trim parks" provided self-directed physical recreation programmes and opportunities and were erected on communal social spaces in white residential areas. A spectrum of public recreation campaigns followed and focused on family fitness, games, swimming and walking events for senior citizens, office workers, youths and differently abled persons.

As could be expected from government-funded campaigns, the focus was exclusively on whites (HSRC, 1982b). Some sense of social inclusivity emerged in the national trim week campaigns from 1987 to 1990. National trim weeks aimed at getting all communities (white and non-white albeit at segregated venues) involved in a week of concentrated mass physical recreation participation to improve the general well-being of all South Africa citizens. An information strategy supplemented the week of physical recreation activities. Information was disseminated to the general public on healthy lifestyles, increased quality of life through fitness and physical recreation, as well as meaningful ways to manage leisure time. The last stages of the apartheid ideology (1990-1993) also marked the first attempts under the apartheid ideology to normalise public recreation opportunities. Deliberate efforts were made to include the non-white majority of South Africans in mass physical recreation campaigns (S*port for All*) even though still organised along racial lines and delivered through segregated governance structures. Much was attempted with modest funding but in the absence of formal policy on multi-racial sport and recreation, no real progress took place (Bush, 2004).

The transition from the apartheid ideology to an ideology of democracy in 1994 uncovered a negative social scenario with high incidences of teen pregnancy, a culture of social disintegration, the rate of HIV/AIDS infection doubling each year, substance abuse, high rape and assault statistics, and a population leading a sedentary lifestyle. The need for focused intervention became imperative and mass recreation programmes and campaigns targeted at all citizens including marginalised groups of women, girls, prisoners and youth-at-risk became the drivers of this social re-engineering campaign (Tshwete, 1997). Confusion regarding a centralised governance structure, however, continued. Public mass participation recreation programmes on the national level were transferred from the national department of Sport and Recreation to the South African Sports Commission after its inception in 1999. It was then transferred back to the national Department of Sport and Recreation in 2004 after the dissolution of the South African Sports Commission.

Mass recreation programmes were premised on the belief that physical activity and recreation have important benefits for the economic, social and physical health of all South Africans. *Siyadlala* ("Let"s Play") and Sangala *(*South African National Games and Leisure Activities) acted as flagship initiatives and delivery mechanisms for the vision of „getting the nation to play". Fundamental mass recreation programme values aimed to develop a new sense of united nationalism, encouraging lifelong mass participation, forging partnerships between national, provincial and local governments, unifying diverse communities, enabling communities to have fun, and facilitating volunteerism. Indigenous games reflected cultural diversity in South Africa and linked the African Renaissance movement celebrating Africa"s diversity and contribution to global cultural capital (Sport and Recreation South Africa, 2006).

Recreation training and education initiatives

A key result of the 1982 *HSRC Report* on sport and recreation provision in South Africa was a call for in-service training programmes for recreation leaders, as well as formal academic programmes at tertiary education institutions to build social capital through competent recreation leadership (HSRC, 1982c). Although the apartheid government acknowledged the importance of structured recreation training programmes, the actual design and delivery of such programmes were left to the educational and private sector. The first training programmes in 1983 under the apartheid ideology were presented to a racially mixed group of recreation leaders employed by the Administration Boards as segregated governance structures for non-whites (Bush 2004). Although these particular governance structures were aimed at non-whites, white employees also attended and it provided a first example of educational and training services presented to racially mixed group.

At the same time, formal recreation service related academic degree programmes were developed at South African institutions of higher learning through academic offerings in Departments of Physical Education, Human Movement Sciences, Forestry, Parks and Environmental Sciences (Goslin, 1983, Scholtz, 2000). Formal degree programmes were yet again only accessible to the white population group and the body of scholarly knowledge fragmented between academic departments. The need to co-ordinate and standardise recreation education in a national qualification framework at institutions of higher learning was first expressed in 1988 (SAASSPER, 1988). A lack of mutual trust, secrecy regarding contents of academic programmes, an often irrational fear of loss of initiative, and conflicting personal interests hampered efforts in this regard. The opportunity to educate recreation scholars and practitioners to optimise the social value of recreation was alas forfeited.

The development of human resources in all sectors of society (including sport and recreation) was emphasised as a key prerequisite for social restitution and reconstruction under the democratic ideology of the African National Congress government (African National Congress, 1994). This approach was subsequently institutionalised in the national policy on sport and recreation by acknowledging that trained human power is essential for effective management of sport and recreation (Department of Sport and Recreation, 1997). Recruitment and training of volunteers spearheaded a coordinated national recreation training initiative and strategy of national government under the ideology of democracy. Public recreation training programmes were consequently developed and training courses presented in collaboration with national governance structures to qualify volunteers as community recreation leaders in senior citizen activity groups, street children shelters, rural communities and correctional institutions (Sport and Recreation South Africa, 2001).

Between 2000 and 2006, the responsibility of training community recreation leaders rested within a sub-unit in the South African Sports Commission (SASC) who developed training materials for indigenous games leaders and generic recreation management programmes. When the SASC was dissolved in 2006, a new unit for Mass Participation of the national government department of Sport and Recreation took over intellectual property rights of all recreation training programmes developed in the public sector. For the first time, career paths in the recreation industry were formalised. The focus became credit-bearing skills development and training in recreation based on the principles of Outcomes Based Education (OBE) and the National Qualifications Framework (NQF) of the South African Qualifications Authority (SAQA). Recreation training efforts developed while being funded by the public sector. They focused on generic community recreation leadership competencies that were

supplemented by training initiatives from the private sector. Substantial progress under the ideology of democracy was made in developing accessible recreation education and training programmes to contribute towards building social capital.

Similarities in public recreation service provision between political ideologies

The exclusive apartheid era and the inclusive democratic era represented two distinct political ideologies in the South African history of public recreation service provision. The inductive thematic analysis, however, revealed common trends under both ideologies. Both political ideologies acknowledged recreation participation as a basic human right and essential tool to improve the quality of life of citizens even though the majority of citizens were denied free access to recreation services under the apartheid ideology. Public recreation service provision constituted part of both ideologies‟ attempts. Policies to address social issues linked the value thereof to generic higher-level social objectives, such as nation building, socialisation, reducing crime or improving the health status of the population through mass recreation initiatives and campaigns.

Fragmentation, decentralisation and general indecisiveness regarding public governance structures responsible for driving recreation provision emerged under both political ideologies. Although the significance of public recreation service provision was acknowledged, neither political ideology succeeded in institutionalising these services in the social fabric of society. Reasons for this could be the ever-present dichotomy between sport and recreation in the minds of decision makers, as well as a lack of coordination and networking between fragmented governance structures.

Both political ideologies relegated public recreation provision to a subservient position to competitive sport. The value of recreation participation was never regarded as an end in itself but always presented as the first step to talent identification and participation in competitive sport, hence the exclusive focus on physical recreation rather than an inclusive paradigm of recreation participation. Where citizens were excluded from public recreation access along racial lines under the apartheid ideology, exclusion continued under the democratic ideology

based upon physical ability and sporting talent. Ignorance about the inherent nature and significance of recreation as a social phenomenon became obvious from the exclusive physical recreation perspective rather than an inclusive perspective acknowledging and utilising the rich diversity of the broad spectrum of recreation activities. Both ideologies focused narrowly on recreation‟s contribution to physical well-being rather than institutionalising its significant contributions to building social capital and psychological well-being.

The potential of public recreation service provision to reinforce a political ideology of the day was evident in both eras. Mass physical recreation participation programmes and festivals as vehicles to construct national identity featured prominently under both political ideologies and attempted to contribute towards a physically active nation by co-ordinating mass participation and festivals in conjunction with private and public stakeholders.

Differences in public recreation service provision between political ideologies

As was expected, marked differences between public recreation service provisions under two distinct political ideologies crystallised from the thematic analysis presented in this study.

The most prolific difference involves the efforts of the democratically elected government to create an environment conducive to the development of public recreation service delivery through establishing appropriate policy and legislation of recreation provision. A national policy document referred to as the *White Paper on Sport and Recreation* introduced a structured recreation and sport delivery strategy according to priorities that shifted the paradigm from being separate and exclusive in the apartheid era towards being inclusive in the democratic era (Department of Sport and Recreation, 1997). The period 1994–2006 reflected the first sport and recreation specific legislation promulgated to provide for unified public governance structures for sport and recreation in South Africa to mirror the inclusive strategy of service delivery to all citizens. Recreation service delivery was initially included in a unified governance structure (South African Sports Confederation and Olympic Committee), but later were relegated to decentralised governance structures, diluting the potential of public recreation provision as nation builder and agent of social change.

Human resource development and capacity building emerged as focus areas under the democratic ideology. Skills training programmes formed an integral part of public recreation service provision strategy of government while left to non-governmental institutions and the private sector under the apartheid ideology. A national qualification framework for recreation and sport was developed and career paths emerged providing access to diverse recreation-related qualifications. This reflected a definite paradigm shift towards inclusivity, as opposed to exclusivity in the apartheid regime, committed to the principle of trained recreation leaders as basis for effective service provision.

Under the democratic ideology, public physical recreation provision was approached in a more structured way as became evident from business plans that directed all actions involving mass recreation activities and festivals. Although festivals and mass participation events also existed under the apartheid ideology, continuity and clear long-term goals were lacking. The myopic perspective on physical recreation provision was regrettably entrenched in these

business plans excluding particular target groups like the elderly and differently abled citizens from the potential benefits of recreation participation.

The reality of the rich and diverse cultural fabric of South Africa was recognised under the democratic ideology. Managing this cultural diversity, racial tolerance and social integration through public recreation service provision initiatives were reflected in the indigenous games programme encouraging the different cultural groups to celebrate their cultural diversity as part of the African Renaissance initiative on the continent of Africa. Public recreation initiatives in this regard under the apartheid regime did not acknowledge cultural diversity of citizens other than the white population group in accordance with the exclusive paradigm of the apartheid government of the day resulting in a culturally polarised society.

LIMITATIONS OF THE STUDY

The provision of public recreation services to all South Africans is a dynamic process. The scope of this study focused specifically on the timeframe 1948–2006. Significant developments, however, were initiated after 2006 that need to be recorded. In 2012, for example the national Minister of Sport and Recreation, commissioned a Ministerial Recreation Advisory Committee to advise the Minister on the role of public recreation in South African society. It is, therefore, recommended that further research explore

contributions from 2006 onward.

CONCLUSION

South Africa is a society in transformation. Transformation implies that individuals and society change its form and function. South Africa transformed from a society segregated along racial lines to an open, inclusive and democratic society. Edginton and Chen (2008) noted that the world lives in a time when leisure and recreation are valued concepts. All humans aspire toward freely chosen life experiences. The provision of public recreation opportunities could provide an optimal social environment for individual exploration, reflection, social, cultural, physical, intellectual and spiritual growth. Public recreation provision has the potential to be a carrier of the collective spirit of any community in transition. Crafting policies and legislation, establishing governance structures, securing resources and opportunities, as well as facilitating education and training career paths are avenues to allow recreation to work for all.

From the thematic content analysis of public recreation provision in two distinct political ideologies, it can be concluded that neither of the ideologies fully realised the potential of public recreation provision as an instrument of transformation. Although similarities emerged, the notion of discrimination or exclusion in some form was evident throughout the period under investigation and in both political ideologies. A fundamental antecedent for public recreation to facilitate transformation is a sense of freedom of choice. Neither of the two political ideologies guaranteed freedom of choice related to public recreation provision. Under the apartheid ideology, non-whites were denied freedom of choice and association whilst under the democratic ideology public provision choices are limited to physical recreation activities. As was expected, the era of democracy brought considerable improvements in terms of policy, legislation, training and education opportunities. Social

transformation and progress are measured in terms of commitment to continuous growth and development of all citizens of a particular society. It is concluded that public recreation provision has the potential to structure social spaces where transformation can be facilitated and benefit all South African citizens.

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EFFECT OF SIXTEEN WEEKS OF COMBINED EXERCISE ON BODY COMPOSITION, PHYSICAL FITNESS AND COGNITIVE FUNCTION IN KOREAN CHILDREN

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ABSTRACT

This study examined the effects of 16-week combined exercise programme on body composition, physical fitness and cognitive function of Korean children. The 20 participants were randomly assigned to the Combined Exercise Training (CET) (resistance exercise and aerobics) group (n=10) or a control group (CG, n=10). The CET group performed 90-min exercise sessions twice per week for 16 weeks, including 40min of resistance exercise, 40min of aerobic exercise and 10min warm-up and cool-down. The CG did not participate in any exercise or physical activity. Body composition variables (weight, body mass index, fat-free mass, per cent body fat, and basal metabolic rate) were measured using bio-electrical impedance analysis. Subjects underwent a physical fitness test consisting of sit-ups, grip strength, sit-and-reach, standing long jump, side-steps and isokinetic leg extension strength. The cognitive function test consisted of electro-encephalography (EEG)

activation and the Stroop test. Significant interaction effects (time x group) on EEG activation (brain activity) in the Fp1 (p=0.034), F3 (p=0.028), and C4 (p=0.013) areas and Stroop test (cognitive function) (p=0.005) were observed in the CET group compared to the CG. There were no interaction effects (time x group) on body composition or physical fitness variables. The CET affected the cognitive function of Korean children positively.

Key words*:* Body composition; Cognitive function; Combined exercise; Electro-encephalography activation; Physical fitness; Youth.

INTRODUCTION

The World Health Organisation (WHO) reports that there are 42 million overweight children worldwide, implying that childhood overweight and obesity are increasing and becoming one of the most serious public health problems (WHO, 2013). Ogden *et al*. (2012) reported that in 2010 in the US over one-third of children and adolescents were overweight or obese. In Korea in 2012, the prevalence of obesity in boys and girls was 13.1% and 6.2%, respectively (Ministry of Education, Science and Technology, Ministry of Health and Welfare, Korea Centres for Disease Control and Prevention, 2013).

The US Centres for Disease Control and Prevention reported that childhood mental disorders, such as substance-use disorders, attention-deficit/hyperactivity disorder (ADHD), behavioural

disorders, Tourette syndrome, mood and anxiety disorders, and autism spectrum disorders are additional public health problems (US Centres for Disease Control and Prevention, 2013). As mental health is important to overall health and chronic health conditions, these health problems can affect individuals throughout life (Herpertz-Dahlmann *et al*., 2013). Therefore, public health management strategies targeting institutions such as schools (through physical education), hospitals, and community centres are important for managing weight and mental disorders in children and adolescents (Showell *et al*., 2013; Wathen & Macmillan, 2013; Wolfenden *et al*., 2014).

Physical activity is an excellent method for promoting physical health, including weight management and preventing various diseases in clinical practice (Orrow *et al*., 2012; Vuori *et al*., 2013). Moreover, physical activity positively affects psychological and social health, including the improvement of aspects, such as self-esteem, social interactions, anxiety, mood, and depression (Brown *et al*., 2013; Eime *et al*., 2013).

Furthermore, physical activity is reported to improve cognitive and memory functions (Ploughman, 2008; Flöel *et al*., 2010), which can consequently improve academic performance in adolescents (So, 2012). Ha and So (2012) found that a 12-week combined exercise programme for 80 min/day, three days/week resulted in a decrease in per cent body fat and waist circumference in 20 Korean female college students. According to the findings of Shin *et al*. (2009), after eight weeks of physical exercise muscular strength improved in elderly Korean women, while acute physical exercise around the anaerobic threshold in healthy subjects improved cognitive function (Kashihara *et al*., 2009).

One method to assess neuropsychological function is the Stroop test, which was introduced by Stroop (1935) and has become widely used (Pachana *et al*., 2004). Its validity and

reliability have been confirmed (Franzen *et al*., 1987), and many versions, including Korean and Asia versions, have been developed and their validity and reliability was confirmed (Kim *et al*., 2004; Qian & Wang, 2007). A relationship between aerobic fitness and the Stroop test has been reported (Buck *et al*., 2008; Yanagisawa *et al*., 2010).

AIM OF THE STUDY

To our knowledge, no studies on types of exercise, particularly combined exercise, have focused on Korean children. Therefore, the present study examined the effect of a 16-week combined exercise training programme on body composition, physical fitness and cognitive function of Korean children.

METHODOLOGY

Participants

A repeated-measures 2 x 2 analysis of variance (ANOVA), with an anticipated statistical power of 0.80, α error probability of 0.05, and effect size of 0.4, predicted that the appropriate sample size for the present study was 16 participants (G-power programme 3.1.3, Germany). To take into account the possibility of subjects dropping out, a sample size of 22 participants was used. The subjects were 22 elementary school students aged 8-11 years from the Mok-dong children's fitness centre in Y-gu, Seoul, Korea. Participants were randomly divided into 2 groups, namely the Combined Exercise Training (CET; n=11) and control (n=11) groups. There were 5 boys and 6 girls in each group.

None of the children exercised regularly or had any health problems. The children and their parents were requested to maintain typical dietary and activity patterns throughout the study period. Compliance was assessed by physical activity and food-frequency questionnaires at the beginning and end of the study. One girl each in the CET and control groups was excluded because they did not attend all exercise sessions or did not complete the final evaluation, respectively. Therefore, 10 participants each in the CET and control groups (4 boys and 6 girls in each) completed all pre- and post-exercise assessments. All participants and their parents provided written informed consent prior to participation. The characteristics of the participants are shown in Table 1.

TABLE 1. **CHARACTERISTICS OF SUBJECTS**

Characteristics	**Control group** (n=10)	**Exercise training group** (n=10)	***t***	**p-value**
Age (years)	9.20±1.40	8.30±0.48	1.924	0.080
Height (cm)	131.21±5.87	124.88±4.52	2.703	0.015*
Weight (kg)	27.85±3.76	26.83±4.75	0.530	0.603
BMI (kg/m^2)	16.13±1.51	17.10±2.16	-1.162	0.260
Fat-free mass (kg)	22.68±2.72	21.35±2.09	1.229	0.235
Body fat (%)	18.35±5.57	19.28±9.00	-0.279	0.784
Basal metabolic rate (kcal)	859.97±58.80	831.19±45.08	1.229	0.235

t= Independent *t*-test value * $p<0.05$

Experimental design

The CET group participated in a 16-week supervised combined resistance and aerobic exercise programme. One 90-min exercise session consisted of the following four phases: a warm-up phase; resistance exercise at 50–70% of one repetition maximum; aerobic exercise at 60-80% of heart rate reserve; and a cool-down. Exercises were performed twice per week for 16 weeks. In contrast, children in the control group were instructed to maintain their normal sedentary lifestyle.

Measurements

Body composition variables included weight, body mass index (BMI), fat-free mass, percentage body fat, and basal metabolic rate. *Physical fitness* variables included sit-ups, grip strength, sit-and-reach, standing long jump, side-steps and isokinetic leg extension strength. Finally, *cognitive function* was assessed by electro-encephalography (EEG) activation (Niedermeyer & Da Silva, 2004) and the Stroop test (Stroop, 1935). The Stroop test has been widely used to test for cognitive function (Bench *et al*., 1993; Douglas & Sharon, 2009; Yanagisawa *et al*., 2010; Palmer *et al*., 2014). All variables and parameters were measured 2

days before and after the intervention.

Body composition

Body composition variables, including weight, fat-free mass, percentage body fat, and basal metabolic rate, was assessed with an 8-polar electrode impedance instrument (InBody 720, Biospace, Seoul, Korea). This instrument measures the resistance of the arms, trunk, and legs at 1, 5, 50, 256, 512, and 1024kHz through 8 tactile electrodes, 2 on the palm and thumb of each hand and 2 on the anterior and posterior aspects of the sole of each foot (Jensky-Squires *et al*., 2008).

According to the protocol of Heyward and Wagner (2004), participants were prohibited from urinating just before impedance measurement, consuming anything in the previous 4 hours, and performing any exercise in the previous 12 hours. Each participant wore light clothing and removed all metal items, which can interfere with measurements. Body composition was assessed in accordance with established recommendations (Heyward & Wagner, 2004). The Body Mass Index (kg/m^2) of each participant was calculated from weight and height.

Physical fitness variables

The *sit-up* test was used to measure muscular endurance. Participants were instructed to lie on a sit-up board (PB-160, Proteus, Korea), bend their knees 90°, and raise the upper body and bend forward using only their abdominal muscles. The number of sit-ups completed in 60s was recorded. The *grip strength* test was used to measure muscular strength. The control lever of a grip strength machine (TKK5401, Takei, Japan) that contains a potentiometer control system was adjusted so that the second knuckle of the fingers was at the bottom of the grip bar. The participants flexed maximally during three trials, and the average strength (kg) of the three trials was recorded. For the *sit-and-reach* test, which measures flexibility, participants sat on a flexibility-measuring instrument (Sit-and-Reach Board, Shinasports, Seoul, Korea). They spread their heels approximately 5cm apart and to the edge, straightened their knees,

bent the trunk forward, and naturally made the measuring instrument board move forward. The average of 3 trials was recorded.

The *standing long jump* test is a measure of power. The participants jumped forward as far as possible from a standing jump platform. The distance was measured in centimetres, and the average of 3 trials was recorded. For the *side-step* test, which measures agility, participants stood on the centre line of a long board that had 80cm parallel lines on both sides. The participant was instructed to cross the line on the right, return to the line, cross the line on the left, and finally return to the original position on the centre line. The total number of times the participant crossed the line in 30s was recorded. Isokinetic *leg extension strength* was assessed using an ergonomic hand-held dynamometer (01163, Lafayette, LA, USA), to measure the muscle strength at the left and right knee joints individually. The participants sat on a chair adjusted so that the centre of the knee joint was aligned with the dynamometer's axle. To avoid measuring joints besides the knees, the femur and chest were stabilised, the lengths of the distal femur and axle were anatomically equalised, and the ankles were subsequently strapped in place. The average strength score (kg) of 3 trials was recorded.

Cognitive function

EEG activation was measured by the monopolar derivation method at 20 points on the surface of the head using a Neuromics-32 device (32ch Digital QEEG, Juwon Medical, Seoul, Korea). Twenty gold-coated plate-shaped disc electrodes were attached according to the International 10/20 electrode system. The reference electrode A1 was attached behind the right earlobe, and the ground electrode was attached behind the left earlobe. The signal was recorded, when the signals were stable without any interference, for more than 10s. For all electrodes, a glass resistance measurement device (EZM 5AB) was used to maintain the resistance at <5kΩ. To minimise contact resistance with the skin, the attachment area was swabbed with alcohol. The plate electrodes were attached using electrode glue (ElefixZ-401CE, Nihon Kohden, Japan) and subsequently covered with gauze to allow the glue to affix the electrodes to the surface of the head.

EEG data were collected using the Brain Mapping System for real-time data collection and time-series analysis. In addition, the EEG was amplified 50 000-fold using an EEG amplifier (EEG100B, Biopac System Inc., Korea). EEG signals from 20 channels were saved to computers at a sampling frequency of 256Hz through a 0.5-50Hz pass filter and 12-bit analogue-digital converter. The relative α power of the collected data were calculated by Telescan 2.0 software (Laxtha Inc., Daejeon, Korea), using EEG data from 4 areas: Fp1, F3, F4, and C4. The relative α power was analysed by calculating the relative ratios of the appearance of α rhythms to θ, α, β, and γ rhythms and excluding the δ rhythm. The α waves were investigated in the present study, because mental concentration can be observed as α waves among various EEG wave types during exercise (Kamp & Troost, 1978; Boutcher & Landers, 1998).

In addition, the *Stroop test* was performed to assess cognitive function (Stroop, 1935). During the Stroop test, the participants were instructed to identify verbally the colour of a written word, and not the word itself, as quickly as possible. The Stroop test contains 100 items arranged in 20 rows and 5 columns. The number of correct answers given in 2 minutes was recorded.

Exercise programme

The CET group performed 10min of whole-body stretching as a warm-up and a cool-down at each training session. The main 80-min exercise programme consisted of 40min of treadmill running at 60-80% of heart rate reserve, followed by 40min of resistance training, which included squats, leg press, leg curl, bench press, lat pull-down, seated cable row, shoulder press, bicep curls, triceps extensions, and sit-ups. The resistance exercise portion of the session involved 2 sets of 50-70% 1 repetition maximum for each exercise. Exercise intensity during the aerobic exercise training sessions was monitored using a Polar real-time system (Polar-S610, Kempele, Finland).

Statistical analysis

The mean and standard deviation were computed for each test item. Differences in the baseline characteristics between groups were assessed by independent *t*-tests. In addition, 2-way repeated-measures ANOVA was used to determine significant changes in the dependent

variables for pre- and post-exercise compared to the control group. All analyses were performed using SPSS version 18.0 (SPSS, Chicago, IL, USA). The level of significance was set at $p<0.05$.

RESULTS

There were no significant differences between groups at baseline except for height. Changes in body composition, physical fitness variables, and cognitive function after combined exercise training for 16 weeks for a group of Korean children are shown in Table 2, 3 and 4. There were significant interaction effects (time x group) on EEG activation at Fp1 (p=0.034), F3 (p=0.028), and C4 (p=0.013) and the Stroop test (p=0.005) (Table 2). However, there were no significant interaction effects (time x group) on body composition (Table 3) or physical fitness variables (Table 4).

TABLE 2. **CHANGES IN COGNITIVE FUNCTION VARIABLES**

Variables		Group	Pre-exercise	Post-exercise	Interaction F	Interaction p-value
Electro-encephalo-graphy activation for brain areas:	Fp1	Control	0.70±0.24	0.78±0.46	5.297	0.034*
		Combined	0.69±0.29	1.38±0.87		
	F3	Control	1.07±0.35	0.91±0.27	5.744	0.028*
		Combined	0.99±0.39	1.74±1.40		
	F4	Control	1.03±0.42	1.27±1.00	1.271	0.274
		Combined	1.02±0.38	1.70±1.17		
	C4	Control	2.54±2.08	1.42±0.60	7.550	0.013*
		Combined	1.69±0.68	2.63±1.90		
Stroop test (counts/2min)		Control	54.70±16.97	58.60±18.23	10.234	0.005**
		Combined	47.90±10.41	57.00±12.74		

Interaction= (Group X Time) *p< 0.05 and **p< 0.01 (Repeated-measures ANOVA)

TABLE 3. **CHANGES IN BODY COMPOSITION**

Items	Group	Pre-exercise	Post-exercise	Interaction F	Interaction p-value

Weight (kg)	Control	27.85±3.76	29.46±4.12	0.026	0.873
	Combined	26.83±4.75	28.52±5.14		
BMI (kg/m^2)	Control	16.13±1.51	16.53±1.83	0.009	0.925
	Combined	17.10±2.16	17.53±2.09		
Fat-free mass (kg)	Control	22.68±2.72	23.65±2.94	0.266	0.612
	Combined	21.35±2.09	22.15±2.47		
Body fat (%)	Control	18.35±5.57	19.44±6.39	0.949	0.343
	Combined	19.28±9.00	21.44±7.42		
BMR (Kcal)	Control	859.97±58.80	880.84±63.60	0.266	0.612
	Combined	831.19±45.08	848.39±53.41		

Interaction= (Group X Time) $p< 0.05$

TABLE 4. **CHANGES IN PHYSICAL FITNESS**

Items	**Group**	**Pre-exercise**	**Post-exercise**	**Interaction F**	**p**
Sit-ups (reps/60s)	Control	21.30±12.31	20.50±16.50	0.409	0.531
	Combined	27.10±10.41	28.00±9.78		
Grip strength (R) (kg)	Control	10.60±2.85	10.81±3.13	0.001	0.990
	Combined	9.69±2.87	9.91±3.36		
Grip strength (L) (kg)	Control	9.88±3.73	11.36±3.07	0.361	0.555
	Combined	9.22±3.17	10.17±3.68		
Sit-and-reach (cm)	Control	10.66±4.94	11.15±4.84	0.472	0.501
	Combined	9.31±3.14	10.60±3.07		
Stand. long jump (cm)	Control	125.50±24.79	127.35±19.70	0.717	0.408
	Combined	124.40±14.10	122.60±16.37		
Side-steps (reps/30s)	Control	35.70±8.43	39.80±6.65	0.281	0.603
	Combined	35.90±6.17	38.80±5.88		
Isok. leg ext. strength (R) (kg)	Control	13.60±4.83	14.00±4.48	0.016	0.900
	Combined	10.17±3.81	10.30±3.77		
Isok. leg ext. strength (L) (kg)	Control	11.48±5.60	12.41±3.79	0.415	0.527
	Combined	7.91±3.93	10.20±3.87		

Interaction= (Group X Time) $p< 0.05$

DISCUSSION

This study investigated the effects of a 16-week combined aerobic and resistance exercise programme on body composition, physical fitness, and cognitive function in a group of Korean children. The combined aerobic and resistance exercise programme significantly improved cognitive function as measured using EEG activation and the Stroop test. However, no significant improvements were observed in any body composition or physical fitness variables.

Several studies indicate that exercise intervention can positively affect body composition in obese children, including increasing fat-free mass and decreasing body fat (McGuigan *et al*.,

2009; Alberga *et al*., 2011; Alberga *et al*., 2013; Kelley & Kelley, 2013). However, in the present study, there were no significant differences in body composition after the exercise intervention. This might be because the subjects in the present study were non-obese children aged 8-11 years who were undergoing rapid growth, and exercise may have had only a relatively small effect on body composition compared to obese children. In particular, because normal non-obese children of these ages are generally in very good physical condition, relative to that in other stages in life, regular combined exercise does not significantly affect their body composition condition compared to controls. Nevertheless, additional well-designed studies are necessary to determine the effect of long-term (>6 months) exercise interventions on body composition.

The meta-analysis of Dobbins *et al.* (2013) indicates physical activity programmes help increase VO_{2max}, a measure of aerobic physical fitness. Several previous studies investigated only VO_{2max} as a measure of physical fitness (Pedersen 2007; Lee *et al*., 2010; Dobbins *et al*., 2013). Although VO_{2max} is the gold standard for assessing physical fitness per se, it is also a component of health-related physical fitness, which also includes cardio-respiratory endurance, muscular endurance, muscular strength and flexibility. Other exercise measures include motor-related physical fitness components, such as power, agility, and balance (Vivian, 2010).

In the present study, neither health- nor motor-related physical fitness variables differed significantly between the exercise and control groups post-intervention. As mentioned above, normal non-obese children have relatively good physical fitness, indicating regular exercise is unlikely to affect significantly health- or motor-related physical fitness compared to controls. Exercise is strongly associated with changes in brain function and activity (Ogoh *et al*., 2005; Helena *et al*., 2007). Moreover, it has psychological and social benefits, such as improved self-esteem, social interactions and mood, as well as decreased anxiety and depression (Brown *et al*., 2013; Eime *et al*., 2013). In addition, exercise improves cognitive and memory functions and academic performance (Ploughman, 2008; Flöel *et al*., 2010; So, 2012). Thus, although the exercise intervention had little or no effect on body composition or physical fitness in the case of the normal non-obese children in the present study, the results strongly corroborate previous findings that exercise positively affects the psychological and cognitive functions of the brain. Additional well-designed studies are required to determine the extent to which exercise affects specific brain areas, as well as psychological and cognitive functions.

This study has some limitations. Because the participants were recruited from a single children fitness centre in Korea and the sample was small, the results are not representative of all Korean children. In addition, this study entails a relatively short intervention and a lack of follow-up testing to investigate the long-term effects of the intervention. However, this study consisted of a 16-week intervention and included complicated measurements, such as cognitive function. Moreover, the number of subjects in the present study was similar to those of more advanced studies. The validity and reliability of the Stroop test have been confirmed in studies with a similar sample size to the present study. Regardless, the major strength of this study is that it focused on normal non-obese children performing a combined exercise programme.

CONCLUSION

A 16-week supervised combined exercise programme positively affected the cognitive function in this group of Korean children. However, it did not affect body composition or physical fitness. Thus, such programmes may benefit the cognitive function of children.

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REPEAT ATTENDANCE AS A FUNCTION OF LIMINALITY, COMMUNITAS AND TEAM IDENTIFICATION

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ABSTRACT

The purpose of this study was to empirically explore the linkages among liminality, communitas, team identification, and repeat attendance intention. Due to the lack of scales with which to measure liminality, this study developed a scale to represent liminality in spectator sports, using Churchill's suggested procedure for developing quality marketing constructs. Through Exploratory Factor Analysis (EFA) (n=92) and Confirmatory Factor Analysis (CFA) (n=261), the liminality scale was confirmed as a reliable, valid instrument of the liminal experiences of sport attendees. Structural Equation Modelling (SEM) was conducted to test the hypothesized relationships among the liminality, communitas, team identification, and repeat attendance intention. The study found that liminality had a direct impact on both communitas and team identification, while it had an indirect impact on repeat attendance intention via its effect on communitas. The study also revealed that communitas had a direct impact on both team identification and repeat attendance intention and that team identification had a direct impact on repeat attendance intention. In order for marketers to maximise team identification and repeat attendance intention, they need to develop specific strategies that foster transcendental experiences.

Key words: Transcendental experiences; Stadium; Spectator behaviour; Scale development.

INTRODUCTION

The tendency to „deviate" from routine life is a characteristic of modern people (Cohen & Taylor, 1992). Sport consumers are no exception. Recently, the importance of transcendental experiences, such as liminality and communitas that sport consumers" encounter has been recognised in sport consumer research (Chalip, 2006). These transcendental experiences provide sport consumers with something special that transcends the sport. For example, by entering liminality, sport consumers experience a sacred or magical world that differs from outside society (Handelman, 1990; Hopkinson & Pujari, 1999). Furthermore, in the transcendental world, sport consumers can share communal energy and feel a heightened sense of community (Chalip, 2006). In spectator sport, creating personally meaningful experiences is important to sport marketers because it can mitigate the impact of a team"s on-field performance (Hill & Green, 2000). Indeed, such transcendental experiences might play an important role in what sport fans experience in a sport venue and serve as a key factor in attracting and retaining sport fans.

Despite the importance of the transcendental experiences, little attention has been focused on the effect of such experiences on sport consumer behaviour in the context of spectator sport. A few insightful studies on transcendental experiences have been conducted in the context of participant sport (Kemp, 1999), sport anthropology (Gaffney, 2008), sport tourism (Green & Chalip, 1998) or mega sport events (Chalip, 2006). However, since even these studies have relied primarily on conceptual modelling or qualitative methods (observation) in exploring the transcendental experiences, a scale has not been developed that measures them empirically. In the case of „communitas", only McGinnis *et al*. (2008) empirically measured communitas in the context of participant sport (golf). Accordingly, with the absence of scales that directly measure the „liminality" and „communitas" of sport fans, the transcendental nature of sport fans remains largely unexplored. In this regard, comprehensive research regarding the role transcendental experiences play in spectator behaviour is required.

LITERATURE REVIEW

Liminality

Previous literature on anthropology first introduced the concept of liminality (Van Gennep, 1960; Turner, 1969). Turner (1969:95) defined liminality as the state of being betwixt and between and liminal individuals or entities as "neither here nor there; they are betwixt and between the positions assigned and arrayed by law, custom, convention, and ceremonial". In the liminal state, "social rules and social distinctions seem less important, and are sometimes suspended altogether" (Chalip, 2006:110). According to Van Gennep (1960), the liminal experience goes through three phases: separation, transition and incorporation. This liminality has been well studied and documented, mainly according to two realms of sport, such as participant sport (Kemp, 1999) and mega sport events (Chalip, 2006). For example, Kemp (1999) reported that sled dog racing serves to detach racers from their everyday lives (separation) and then to experience the transition from the previous status to another status as a racer by entering a liminal state in which they become ambiguous relative to their normal roles and status (transition). Eventually, after experiencing a new identity as sled dog racers, they are returned to mundane life (incorporation).

In the context of spectator sport, spectators might experience liminality, due to the ritualistic, quasi-sacred nature of a stadium (Gaffney, 2008). By entering a liminal space (stadium) in which spectators can engage in the ritualistic, quasi-sacred activities (cheering and supporting their home teams by wearing the same uniforms), they might be able to close off the outside world, escape from their everyday realities, feel like they are in a „different" world, and experience a new self as a spectator. Furthermore, the liminality of the stadium enables spectators to experience energy and excitement shared by other spectators, which makes sport events more fun (Chalip, 2006). It is reasonable to expect that the liminality spectators experience in the stadium plays a positive role in spectator behaviour.

Communitas

Communitas is regarded as a temporary process whereby the relationships between individuals are not based on social roles or status, but on the existential ground of a human being (Turner, 1969). It is characterised by an intense community spirit that is associated with

the feeling of equality, solidarity and togetherness among members (Turner, 1969). With

communitas, individuals with different backgrounds within an existing social order tend to share an extraordinary experience and bond with other human beings without considering one‟s social status as a divide (Deegan, 1998).

Commuinitas experiences have been largely studied in participant sports such as whitewater rafting (Arnould & Price, 1993), skydiving (Celsi *et al*., 1993), motorcycle riding (Schouten & McAlexander, 1995), golf (McGinnis *et al*., 2008), and sled dog racing (Kemp, 1999). Other works were conducted in sport tourism (Green & Chalip, 1998) and mega sport events (Chalip, 2006). These studies identified the communitas experience as a key driver for sport or event participants.

In the context of spectator sport, spectators also might experience communitas as they support their team (Chun *et al*., 2004). As spectators enter a liminal state in which social roles and status disappear, they are more likely to engage in social interactions and develop an intense feeling of comradeship in the process of supporting their team (Chun *et al*., 2005). In the context of professional baseball, Holt (1995) argued that the sense of community emerges from the consumption practice of „play‟ that is characterised by communing and socialising among fans and that to some fans the interpersonal actions (and associated communitas) are autotelic in their baseball consumption. It is reasonable to expect that the communitas that spectators experience in the stadium play a positive role in spectator behaviour.

Team identification

Team identification is regarded as a specific instance of social identity theory whereby the object to which a sport consumer identifies is a particular team (Gwinner & Swanson, 2003). Ashforth and Mael (1989) defined team identification as sport fans‟ tendency to connect to their teams and to identify the teams‟ success and failures with their own. These psychological connections, that sport consumers form with specific teams, have been explained by a variety of psychological terms, such as attraction (Hansen & Gauthier, 1989), attachment (Funk *et al*., 2000), and loyalty (Murrell & Dietz, 1992). However, Funk and James (2001) distinguished attraction from attachment in terms of an individual‟s level of team identification, implying that attraction is characterised by low team identification while attachment is defined by moderate or high team identification. A sport consumer at the level of „attraction‟ only tends to acknowledge having a favourite team while a sport consumer at the level of „attachment‟ tends to have a more stable psychological connection to the team. Considering Ashforth and Mael‟s (1989) definition of team identification, „identification‟ seems to work better for operationalising attachment rather than attraction. In addition, Lee *et al*. (2013:205) differentiate team identification from team loyalty in that “team loyalty represents a more resistant, persistent, biased cognition associated with sport teams and is also more solid in the level of commitment to the teams”. Although each term mentioned represents the relational construct between sport consumers and sport teams, team identification seems to express a stronger (weaker) relational construct compared to attraction (loyalty).

Team identification has been studied as a key determinant of a variety of sport consumer behaviours such as BIRGing or CORFing (Wann & Branscombe, 1990), game attendance

(Fisher & Wakefield, 1998) and licensed product consumption (Kwon & Armstrong, 2006). As demonstrated in the studies listed above, team identification is expected to play a positive role in spectator behaviour. Taken together, it is expected that liminality, communitas and

team identification all positively affect spectator behaviour. A theoretical framework that provides an underlying basis for developing a conceptual model for this study is shown in Figure 1.

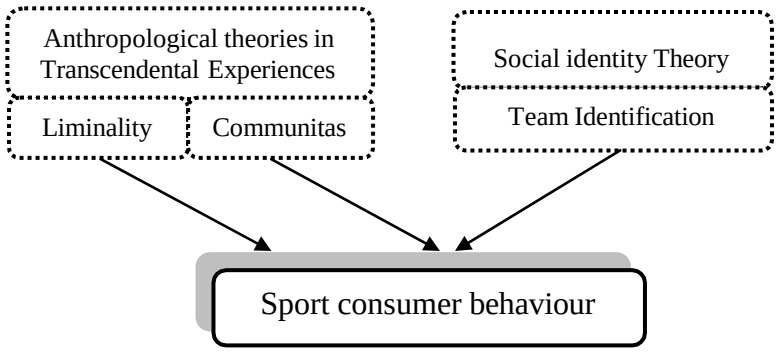

FIGURE 1. **THEORETICAL FRAMEWORK OF LIMINALITY, COMMUNITAS, AND TEAM IDENTIFICATION**

Relationships among liminality, communitas, team identification and repeat attendance intention

As shown in Figure 1, liminality, communitas and team identification have been identified as potential key constructs affecting sport spectator behaviour. Yet the three constructs seem inextricably related. This section examines potential relationships among the three constructs, and then research hypotheses will be derived regarding the relationships among them and their impacts on spectators‟ intentions to return to the stadium for other games.

Liminal states, in which ordinary social roles are suspended, tend to produce a strong sense of community that is engendered communitas (Turner, 1969; Kemp, 1999). This is possible because as normal social structures disappear, individuals tend to interact in equal levels of status (Csikszentmihalyi, 1988), which can be a foundation for communitas. In the context of mega sport events, Chalip (2006) suggest that the celebratory nature of sport events engenders liminality that can foster communitas. In a similar vein, the liminal experience of spectators in the stadium seems to serve as fodder for communitas within the stadium.

Although there is no empirical research regarding the direct effect of liminality on game attendance or repeat attendance, a few studies conceptually suggest that the liminal nature of sport events enable spectators to experience energy and excitement shared by all and that this can make the events attractive and enjoyable (Handelman, 1990; Chalip, 2006). These positive experiences associated with liminality might serve as a key driver to facilitate spectators‟ repeat attendance. Hence, it is reasonable to assume that the liminal experience of

spectators is an important factor of their repeat attendance.

In addition, liminality seems to involve identity reconstruction (Beech, 2010). As an individual enters a stadium (a liminal space), he or she would experience a new self as a

spectator (Van Gennep, 1960). Although this new identity is a temporal self that one can experience in the stadium, as studies in brand experience suggest (Schmitt, 1999), repeated positive experiences (here experiencing a new identity) with a brand (team) would contribute to the development of a more stable, brand (team) identification that spectators have beyond the stadium. Hence, the liminal experiences of spectators are expected to facilitate their team identification.

The literature suggests that a sense of community among sport fans is essential in building team identification (Sutton *et al*., 1997; Gwinner & Swanson, 2003). Finn (2005) argues that major conditions to be a „true" fan are to have some shared identification not only with a team but also with other fans. While communitas in this study is a sense of community that spectators can experience within the stadium rather than more stable, psychological connections among fans even outside the stadium suggested by the previous works, it is not surprising to suggest that communitas as a stadium experience also serves as vital input for the development of team identification.

As stated earlier, Holt (1995) suggests that interpersonal actions (communing and socialising) among spectators in the stadium and associated communitas are an important autotelic drive for baseball consumption. Hence, considering the autotelic function of communitas in sport team consumption, it is not surprising to expect that to some spectators, the communitas experience in the stadium could play a key role in their repeat attendance.

Volumes of studies in sport consumer behaviour have shown that team identification is a significant predictor of various sport consumer behaviour, particularly in the area of continuing game attendance. For example, die-hard fans rather than fair-weather fans showed higher intention to attend the future games of their teams (Wann & Branscombe, 1993; Fisher & Wakefield, 1998; Kim & Trail, 2010).

PURPOSE OF THE STUDY

The purpose of this study was to explore how the transcendental experiences that sport fans encounter in a stadium affect their behaviour. Specifically, the study empirically examines the linkages among liminality, communitas, and team identification and their effects on spectators" intentions to return to the stadium for future attendance. Furthermore, it was intended to determine the validity of the liminality scale.

Based on the discussions on *liminality*, the following hypotheses were proposed:

H1: Liminality will have a positive and direct impact on communitas.
H2: Liminality will have a positive and direct impact on intentions to return to the stadium in the future.
H3: Liminality will have a positive and direct impact on team identification.

Based on the discussions of *communitas*, the following hypotheses are proposed:

H4: Communitas will have a positive and direct impact on team identification.
H5: Communitas will have a positive and direct impact on intentions to return to the stadium in the future.

It is expected that a higher level of *team identification* could lead to a greater intention of

repeat attendance, thus the following hypothesis is proposed:

H6: Team identification will have a positive and direct impact on future intentions to revisit.

The six hypotheses have been combined to form a conceptual model specifying the expected relationships among the constructs. The constructs and the relationships among them are depicted in Figure 2.

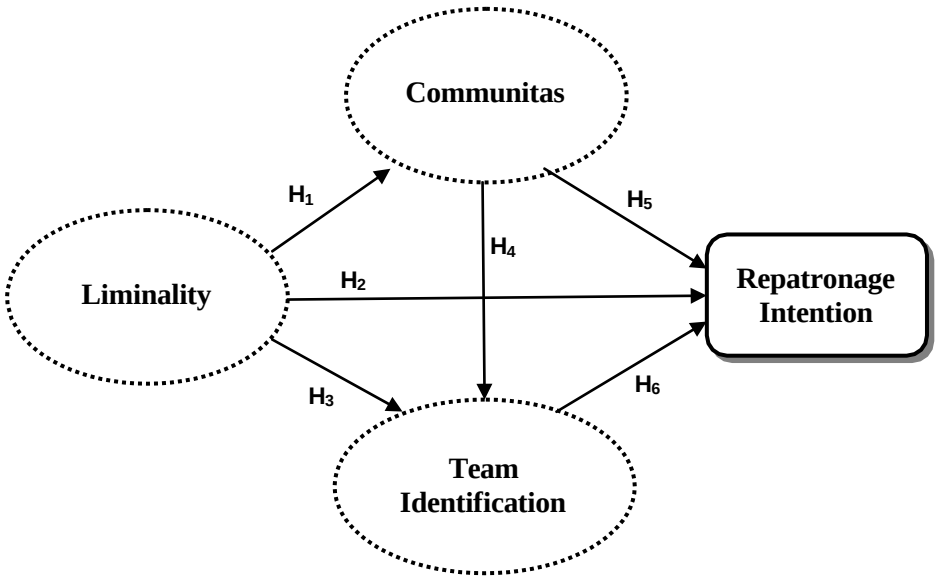

FIGURE 2. **CONCEPTUAL MODEL: EFFECTS OF LIMINALITY, COMMUNITAS AND TEAM IDENTIFICATION ON REPATRONAGE INTENTION**

METHODOLOGY

Sampling procedure

Like the scale development stage, the sample for the main study was recruited from the same minor league baseball team in Texas. The sampling was stratified by seating section. Spectators were approached randomly until an intended number of surveys were fulfilled. The survey participation was voluntarily. A total of 303 responses were obtained from the minor league baseball team site survey. Of the 303 surveys collected, 42 surveys were eliminated due to their incompleteness. Therefore, 261 usable surveys in total were analysed for the main study. Males were 57% of total sample, and respondents ranged in age from 11 to 85 years (39.6±16.0).

Measurement for liminality scale development

Since the authors could not find any previously validated scale to measure perceptions of liminality in the context of spectator sport, the study developed a scale to measure spectators'

liminal experience. Initial items were derived from anthropological work, as well as associated work in sport (Van Gennep, 1960; Turner, 1969; Handelman, 1990; Kemp, 1999; Chalip, 2006; Gaffney, 2008). Common themes of liminality described by these works were: disappearance of social boundaries or limits; relative freedom associated with such disappearance; experiencing an ambiguous world that differs from outside society; and experiencing a new identity as a member in the liminal state. In terms of mega sport events, Chalip (2006) noted that a key characteristic of liminality is experiences of energy or excitement shared by other event participants.

Based on the common themes listed above, the study developed the 5 items regarding liminality that spectators might experience within the stadium. Specifically, 4 of the 5 items were derived from 5 different works in anthropology and sport anthropology mentioned above (Van Gennep, 1960; Turner, 1969; Handelman, 1990; Kemp, 1999; Gaffney, 2008), while the last item was derived from Chalip‟s (2006) work.

Utilising Churchill‟s (1979) 5-step procedure for developing quality marketing constructs (construct specification, item generation, data collection, scale purification, and scale validation), this study was conducted in 2 stages: scale development and validation. The scale development stage consisted of the first 4 steps of Churchill‟s suggested procedure, while the scale validation stage examined the relationships among liminality, communitas, team identification, and repeat attendance intention using Structural Equation Modelling (SEM).

In order to ensure content validity, an expert panel review was conducted. A 3-person panel of experts who consist of 2 faculty members and a graduate student in sport management and anthropology examined the 5 items that were identified from the literature. They all agreed that those items represent liminality well in the context of spectator sport.

Data collection and scale purification

The survey questionnaire for the scale validation stage included the 4 research measures: liminality; communitas; team identification; and repeat attendance intention. *Liminality* was measured with five items developed from the EFA (Exploratory Factor Analysis). Respondents rated each item on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). In order to measure communitas, McGinnis‟s *et al*. (2008) 4 items were utilised with a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). However, since their scale was developed to measure communitas in the context of participant sport (golf), the items were changed to fit into the context of spectator sport. *Team identification* was measured using Trail and James‟ (2001) 3 item Team Identification Index (TII) also with a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). TII was chosen for the study because it has shown good internal consistency and validity in

various studies of spectator behaviour (Fink *et al*., 2002; Robinson & Trail, 2005; Lee *et al*., 2013). *Repeat attendance intention* was measured with a single item again using a 7-point Likert scale. A summary of the measures and their items is presented under the „Results‟ section (Table 2). Demographic information included gender and age.

Data analysis

To identify underlying dimensions of the liminality items, Exploratory Factor Analysis (EFA) was conducted. The survey questionnaire for the scale development stage included the five

items for liminality developed from the item generation step and general demographic questions, such as age and gender.

Data were subjected to a principal-components analysis with varimax (orthogonal) rotations. Item-to-total correlations were also investigated as a means of deleting and retaining items before confirming the liminality scale‟s structure (Netemeyer *et al*., 2003). Furthermore, in order to assess the internal consistency of the liminality construct, average inter-item correlation and Cronbach‟s alpha were tested.

The measurement model was tested through a first order confirmatory factor analysis with the 4 latent constructs (liminality, communitas, team identification and repeat attendance intention), using AMOS. Structural Equation Modelling (SEM) was performed to examine the structural model - the relationships among the 4 constructs. The reliability of the 3 constructs (liminality, communitas, and team identification), was assessed via Cronbach‟s alphas greater than 0.70 (Nunnally & Bernstein, 1994).

The study examined convergent validity for the 3 constructs with Average Variance Extracted (AVE) with Fornell and Larcker‟s (1981) suggestion that a construct has convergent validity if AVE is at least 0.50. The study also tested discriminant validity with Kline‟s (2005) recommendation that construct correlations lower than 0.85 display the discriminant validity. Hu and Bentler (1999) recommend using a combination of indicators to assess model fit. Therefore, cut-off criteria employed in this study were the following: Comparative Fit Index (CFI) greater than 0.95, Root Mean Square Error of Approximation (RMSEA) less than 0.06 and Standardised Root Mean Square Residual (SRMR) less than 0.08.

RESULTS

As a result of the EFA, one component was extracted based on eigen values greater than one. The one component extraction accounted for 69% of the total variance. Total variance close to 70% is deemed very appropriate (Stevens, 2002). Item loadings were strong, ranging from 0.666 (liminality_1) to 0.924 (liminality_3) (Comrey & Lee, 1992). Furthermore, the scale exhibited very strong item-to-total correlations, ranging from 0.532 (liminality_1) to 0.864 (liminlaity_3) (Tian *et al*., 2001). As Cronbach‟s alpha and average inter-item correlation were 0.882 and 0.599, respectively, the liminality measure was internally consistent (Nunnally & Bernstein, 1994). Factor loadings, item-to-total correlations, average inter-item correlation, and Cronbach‟s alpha are shown in Table 1.

TABLE 1. **SUMMARY OF EXPLORATORY FACTOR ANALYSIS (EFA)**

Items	**Factor loadings**	**Item-to-total r**	**Mean inter-item r**	***α***
Liminality 1	0.666	0.532	0.599	0.882
Liminality 2	0.873	0.781		
Liminality 3	0.924	0.864		
Liminality 4	0.793	0.677		
Liminality 5	0.861	0.762		

Measurement model

The measurement model was tested to investigate how well each set of items measures its latent construct. This work is known as Confirmatory Factor Analysis (CFA) because a primary rationale that items correlate highly with one another is that they measure the same construct (Keith, 2006). The measurement model allows correlations between latent constructs by connecting each latent construct with all other latent constructs.

Overall, the measurement model shows an adequate fit to the data (CFI=0.947; RMSEA=0.088, SRMR=0.056) (Hu & Bentler, 1999). Cronbach‟s alphas for 3 constructs were greater than the suggested cut-off value of 0.70 (Nunnally & Bernstein, 1994). In addition, all 3 constructs exhibited AVE (Average Variance Extracted) greater than 0.50 (Fornell & Larcker, 1981). All items loaded significantly on their respective factors ($p<0.01$), ranging from 0.557 (liminality_4) to 0.923 (liminality_3).

TABLE 2. **SUMMARY OF MEASURES AND CONVERGENT VALIDITY**

Constructs/Items	**Loadings**	***α***	**AVE***
Liminality			
1. Attending [team] games makes me feel like I am in a place where social boundaries or limits disappear.	0.685	0.860	0.571
2. Attending [team] games makes me feel like I have freedom from the restrictions of my ordinary life.	0.831		
3. Attending [team] games makes me feel like I am in a new kind of world that differs from outside society.	0.923		
4. Attending [team] games makes me feel like I experience energy and excitement shared by all spectators at the stadium.	0.557		
5. Attending [team] games makes me feel like I experience a new kind of self as a spectator.	0.729		

Continued

TABLE 2. **SUMMARY OF MEASURES AND CONVERGENT VALIDITY *(cont.)***

Constructs/Items	**Loadings**	***α***	**AVE***
Communitas			
1. When I attend [team] games, I feel a sense of harmony with other spectators.	0.814	0.918	0.739
2. When I attend [team] games, I feel a sense of sharing with other spectators.	0.845		
3. When I attend [team] games, I feel a sense of camaraderie.	0.896		
4. When I attend [team] games, I feel a sense of belonging with other spectators.	0.881		

Team identification			
1. I consider myself to be a "real" fan of [team].	0.881	0.894	0.748
2. I would experience a loss if I had to stop being a fan of [team].	0.793		
3. Being a fan of [team] is very important to me.	0.916		
Repatronage intention			
How interested are you in attending [team] game(s) in the future?			

* AVE = Average Variance Extracted

TABLE 3. **CORRELATIONS AMONG LATENT CONSTRUCTS**

Constructs	**1**	**2**	**3**	**4**
1 Liminality	—			
2 Communitas	0.462	—		
3 Team identification	0.393	0.476	—	
4 Repatronage intention	0.370	0.482	0.675	—

All correlation coefficients are significant at $p<0.01$ level.

These results provided support for evidence of convergent validity of the measurement model. Discriminant validity was also established because the correlations between the latent constructs were lower than 0.85 (Kline, 2005). As a result, the measurement model provides strong evidence of both convergent and discriminant validity among the latent constructs. The factor loadings, Cronbach"s alphas, and AVE are shown in Table 2. The correlations among the constructs are provided in Table 3.

Structural model

The hypothesised relationships among liminality, communitas, team identification, and repeat attendance intention were tested via SEM using AMOS. The structural model displays an adequate fit to the data in the main study (CFI=0.947, RMSEA=0.088, SRMR=0.056). Five of the proposed 6 paths were significant while only the path from liminality to repeat attendance intention was not significant. Therefore, H_1, H_3, H_4, H_5, and H_6 were supported while H_2 was not supported.

However, inspection of the standardised indirect (mediated) effects of the variables used in this study showed that liminality had a moderate, and positive, indirect effect on sport consumers‟ repeat attendance intention (0.332) (Kline, 2005). The structural model indicated that liminality explained 20.9% of the variance in communitas and that liminality and communitas predicted 32.5% of the variance in team identification. It also showed that liminality, communitas and team identification explained 54.2% of the variance in repeat attendance intention. Standardised estimates of the final structural model are shown in Figure 3.

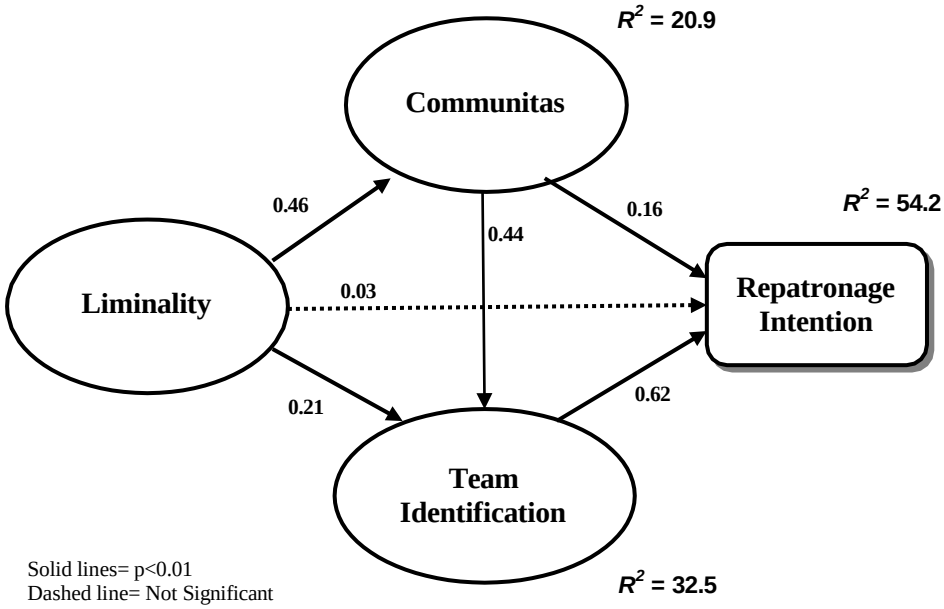

FIGURE 3. **RESULTS OF STRUCTURAL EQUATION MODELLING**

DISCUSSION

This study began with recognition that transcendental experiences, such as liminality and communitas, serve as key drivers of sport consumer behaviour in various realms of sport (participant sport, sport tourism, mega sport events), and extends this discourse to the context of spectator sport. With the development of a scale to measure liminality and adaptation of a communitas scale for participant sport, the study empirically demonstrated that spectators‟ repeat attendance intention is a function of perceived liminality, a sense of community and team identification. Specifically, the study revealed that team identification is the strongest predictor of repeat attendance intension. Liminality had a positive and direct impact on both communitas and team identification. However, contrary to expectations, liminality did not have a direct impact on repeat attendance intention, as it only had an indirect impact on repeat attendance intention via communitas. Communitas had a positive and direct impact on both team identification and repeat attendance intention. In short, liminality, communitas and team identification all had a significant direct and/or indirect effect on repeat attendance intention.

The finding about the impact of liminality on communitas is consistent with the previous work in anthropology (Turner, 1969; Handelman, 1990), participant sport (Kemp, 1999), and mega sport events (Chalip, 2006). As spectators are more immersed in the liminal state that a stadium offers, they are more likely to feel a sense of community with other spectators. This result seems to be reasonable in that a sense of relative freedom from social restrictions and the realisation of a new identity (as a spectator) that spectators can experience in the liminal state of the stadium serve as fodder for the formation of a sense of camaraderie with other spectators.

Unexpectedly, the study revealed that liminality did not have an effect on spectators‟ repeat attendance intention. While there has been little empirical work exploring the impact of liminality on spectator (repeat) attendance, this study suggested such causality based on that shared energy and excitement associated with liminality provide spectators with exciting experiences (Kemp, 1999; Chalip, 2006) that in turn drives future attendance. This unexpected outcome may be interpreted in two ways. Firstly, while this study was conducted in the context of a (regular) spectator sport (baseball), previous works (Chalip, 2006; Kemp, 1999) were conducted with one- or four-year period sport events (sled dog racing, the Olympics). Since spectators in baseball more regularly experience liminality than the one- or four-year period event participants, and therefore, get used to the liminal experience, the effect of liminality on repeat attendance would be relatively weaker. Secondly, the study was conducted in the minor league sport context. Since the stadium atmosphere of minor league sport tend to be more lax than that of the major leagues, the minor league spectators‟ immersion into the atmosphere would be less (Mayo *et al.*, 2003), which can affect the immersion into liminality. Future research should examine why liminality does not have an effect on repeat attendance in the context of minor league sport and explore other sport settings (major leagues) in which liminality might be a significant predictor of repeat attendance.

The study found the effect of liminality on team identification, proving our logical extension that the spatiotemporally limited nature of liminality (experiencing a new kind of self as a spectator in the stadium), might contribute to the formation of team identification that sport fans have beyond the spatiotemporal limit. This result is in line with recent branding works suggesting that personal, meaningful brand experiences (here liminal experience) can lead to a variety of positive consumer behaviours, particularly brand identification (Gentile *et al*., 2007; Brakus *et al*., 2009). While liminality in this study is the spatiotemporally limited experience of spectators, considering its effect on team identification that is a more stable psychological construct, sport marketers should pay close attention to spectators‟ transcendental experience. In this regard, both academics and practitioners should explore the antecedents of liminality.

The study also identified the effect of communitas on team identification. While previous studies in sport consumer behaviour suggested that a sense of community among spectators is crucial in building team identification (Sutton *et al*., 1997; Finn, 2005), their primary focus on communitas was not an on-site stadium experience, but as a more stable, psychological connection among fans that exist beyond a sport venue. Considering the significant contribution of communitas on team identification, along with liminality, sport marketers should prioritise communitas as another transcendental experience in building team identification.

This research also revealed the effect of communitas on repeat attendance intention. This finding is in line with Holt‟s (1995) work finding that autotelic, interpersonal actions (communing, socialising) among baseball spectators and the subsequent sense of community are key drivers of sport consumption. Considering the effect of communitas experience on repeat attendance intention, in addition to liminality, sport marketers should identify and develop the ways that the sense of community among spectators is created, promoted and enhanced.

As expected, the study confirmed the previous work suggesting that fans that are highly identified with their teams are more likely to show continuing attendance (Fisher & Wakefield, 1998; Kim & Trail, 2010). This finding suggests the importance of die-hard fans as a key target segment for gate revenues and the necessity of continuous, keen interest in this segment. However, when considering the positive effects of liminality and communitas on team identification, sport marketers should identify the ways to promote such transcendental experiences among fair-weather fans, which can increase their repeat attendance. In other words, the means with which to enhance liminality and communitas could serve as key tactics to move people up the sport consumer escalator, from light users to heavy users (Mullin *et al*., 2007).

Although the impact of team identification on repeat attendance intention was much greater than that of communitas, it is important to note that both constructs have a significant impact on repeat attendance intention. Further, by finding that liminality and communitas play a substantial role in the formation of team identification that has been regarded as a powerful determinant of sport consumer behaviour, the study demonstrated the importance of consumer experiences, particularly transcendental experiences in the context of spectator sport.

As with all research, this study has limitations. A primary limitation comes from the research target (a minor league baseball team) employed in this study. Some results of this study may not be able to be generalised to other sport settings (major league sport). Thus, future research should confirm the findings identified from this study across different contexts (sports, levels of sport). Secondly, this study considered repeat attendance intention, and not actual returning behaviour as an endpoint. Repeat attendance intentions are not always converted into actual returning behaviour, therefore, future research should examine how the variables used in this study influence actual returning behaviour.

MANAGERIAL IMPLICATIONS

The study highlights the ability of liminality and communitas to build team identification and to enhance repeat attendance. This suggests that sport marketers should consider spectators‟ transcendental experiences as a key factor in building a fan base. Yet, a more important consideration is how these experiences are created and designed to foster and enhance such a fan base. In this sense, three practical ways to leverage the transcendental experiences are suggested. A way to enable liminality and associated communitas is to encourage social interaction among spectators (Handelman, 1990; Kemp, 1999; Chalip, 2006). This can be generated and enhanced by sport venue designs (Chalip, 2006). For example, social interaction can be enabled in and around a stadium by providing appropriate spatial room of seats that allows spectators to turn and talk to one another, ample space with tables and chairs around concessions, or enough sites for picnicking and tailgating outside the sport venues

(Chalip, 2006). In a similar vein, swivel seats and grouped seating arrangements can be important means to promote social interaction (Melnick, 1993).

Theming also can be an appropriate means to create liminality and communitas by providing spectators with a sense of celebration (Chalip, 2006). A stadium‟s architectural appearance, interior design or decorations that reflect its locality might provide spectators with visual cues that a celebration is taking place, which makes them feel as if they are in a liminal space (Chalip, 1992). However, theming is not necessarily limited to visual cues; it can appeal to all senses of the spectators (Lee *et al*., 2012; Lee *et al*., 2013). The stadium can evoke the sense of locality through embellishing the stadium with local historic symbols or landmarks, playing local music and serving local menus (Lee *et al*., 2012). If sport teams can establish stadium themes as their own heritages that can appeal to spectators‟ five senses, this might enhance the stadium‟s festive atmosphere, a significant antecedent to liminality and associated communitas (Garcia, 2001).

In addition, sport teams can leverage the presence of spectators in a stadium in order to enhance transcendental experiences. Recent work suggests an important role of other spectators in creating a unique stadium experience (Crawford, 2004; Lee *et al*., 2012). According to Lee *et al*. (2012), South Korean baseball and European soccer spectators are not mere passive crowds, but they play a crucial role in creating the spectacle and atmosphere within the sport venues through being part of a wave, dressing up, chanting and singing, playing musical instruments or balloon sticks. In the process of participating in these activities, spectators would experience liminality and communitas. The challenge to create a transcendental experience is not merely a matter of the spatial and physical arrangement of sport venues. Rather, it depends on how spectator participation in such activities is facilitated, designed and implemented.

CONCLUSION

Today‟s sophisticated spectators demand and anticipate positive and personally meaningful experiences in their consumption. Their ultimate end is an enjoyable experience in the stadium, and a transcendental experience seems to be an important part of such positive stadium experiences. A positive, transcendental stadium experience plays a vital role in the formation of team identification and repeat attendance. This transcendental experience-based

approach to understanding sport consumer behaviour offers a new direction for experience marketing in sport that leverages the liminality and communitas experiences of sport fans. By creating and enhancing the transcendental experiences, sport teams can build a more stable fan base and enjoy increased gate revenue.

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DYNAMICS OF VALUES HELD BY FUTURE SPORTS TEACHERS: A LONGITUDINAL STUDY

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ABSTRACT

The dynamics of personal values and values pertaining to the meaning of life held by future sport teachers was investigated. The two surveys used were the Rokeach Value Survey for identification of the most important personal values and the Leontiev Life Meaning Orientations Test for the evaluation of values pertaining to the meaning of life (defined as ideas about life goals, processes, results and control of life circumstances). The cohort study model was used, and a representative number of students were surveyed during their first year of study (N=168) and then four years later during their fourth year of study (N=154). The research findings revealed that 'material well-being' (financially secure lifestyle) and 'public recognition' (respect and authority) were the most important values at the fourth-year level ($p<0.05$) compared their first-year. 'Clear life goals' was the value

pertaining to the meaning of life that was most significant to future sport teachers in their fourth year of study compared to them during their first year.

Key words: Values; Personal values; Values orientations; Future sport teachers.

INTRODUCTION

This research focuses on discovering the dynamics of values held by future sport teachers by means of a longitudinal study. Several scientific studies have been published in Lithuania, and these suggest changes in values in the fields of religion, family, work and politics (Ziliukaite, 2000a, 2000b; Mitrikas, 2005; Ziliukaite, 2007, 2008). These studies focused on the influence of age on value tendencies.

At the turn of the 21st century, an analysis of changes in family values was completed (Mitrikas, 2000). It was reported that the younger residents (persons between the ages of 15 and 30 years) of Lithuania had a more liberal attitude towards family and marriage. The younger Lithuanians linked successful marital life with the financial prosperity of the family more often and focused less on qualities such as faithfulness, mutual respect and understanding and tolerance, when compared with older respondents. The analysis of their social and political values revealed that compared to the younger Lithuanians, they supported political decisions of the government more (Ziliukaite, 2007, 2008). The younger residents of Lithuania also had stronger attitudes of civic morale and tendencies towards ethical and moral values, such as sense of duty, care for the well-being of others, solidarity with groups who experience social isolation, etc. (Ziliukaite & Ramonaite, 2006).

Values are defined as abstract concepts that describe what individual's desire or seek to achieve. Values characterise human behaviour and facilitate the development of a person's personality. They also regulate human relationships. Personal values and values pertaining to the meaning of life were analysed in this study because they are value premises that are defined as the most general conceptions of desirable and undesirable modes, means and ends of action (Albert, 1956). Personal values define the worth of an individual's being and the importance of an individual's personal beliefs. The most important personal values are ideas about what is most important in life and provide internal reference for what is good, beneficial, useful, desirable, constructive, etc. Values pertaining to the meaning of life are defined as ideas about life goals, processes, results and control of life circumstances.

Some studies (Inglehart & Baker, 2000; Mitrikas, 2005) have shown that the underlying values of individuals continue to shape themselves until young adulthood and subsequently change little. Therefore, the values that are recognised by the younger generation as essential will be the ones they follow later in life. These values will in turn shape a society. The dynamics of the value priorities of the younger generation reflect the status of and changes within an entire society. Regular and systematic research of student values, as in the present research, those of future sport teachers, is necessary because there has been a recent emphasis on problematic issues related to the academic values of teachers in higher educational institutions, since the teachers were less satisfied with their labour conditions and communication with students (Paterson, 2003; Sukys *et al.*, 2006).

Scientists have analysed the attitudes of students towards values (Cileli, 2000; Knox *et al.*, 2001; Greybeck *et al.*, 2004; McCollum, 2005; Longerbeam & Sedlacek, 2006; Jaakson,

2008). Much attention is paid to the moral values of students (sensitivity, responsibility, dutifulness and fairness), spiritual values, as well as academic and family values. However, the number of studies dedicated to analysing the values of future sport teachers is limited. Research studies have been conducted (Sukys *et al.*, 2007; Sukys, 2008) on the professionalism of future physical education and sport specialists by assessing their attitude towards moral values in sport (respect for others, honesty, cooperation, self-sacrifice), but these values have yet to be analysed further. Therefore, the scientific issue remains: What are the dynamics of the values of future sport teachers at the beginning of the 21st century? The problem of changes in value priorities is not understood well enough at this point, especially in the Baltic States. Also, the results of the research carried out thus far are rather contradictory. For instance, Jaakson (2008) found that study time had no influence on the perception of values by students, but some studies (Malinauskas, 2006a; Vihalemm & Kalmus, 2008) have observed that the values of financial well-being of the fourth-year students is strengthening.

This problem becomes more relevant against the background of globalisation and Euro-integrating processes and their influence on the values of society. It takes a long time for values to be shaped and matured, as they are under the influence of various internal (personal experience) and external factors (globalisation), which are constantly in a state of change.

The present research about the dynamics of the values of future sport teachers does not lose its relevancy, because during the period of youth changes take place rapidly. Furthermore, the educational function of sport has recently been emphasised as a means of relaying human

values and is a factor in the way sport activities change the value system (Perenyi, 2010). According to Perenyi (2010), sport activities may influence both physical development and personal value orientation. It is said that sport have an independent subculture and values that are different from general values recognised by society (Joyner & Mummery, 2006). However, a recent assumption has been made that behaviour plays a significant role during combat sport (Malinauskas, 2006a). If during training sessions and competitions the first values to be promoted and supported are humanistic ones (health, physical development and human communication), it is possible that a player coached by that future sport teacher will also focus on them (Malinauskas, 2006a). Therefore, it is important to pay attention to the values held by future sport teachers (Sniras & Malinauskas, 2005; Murphy *et al.*, 2011).

RESEARCH PROBLEM

The present research could make a novel contribution to the literature by revealing the dynamics of the values of future sport teachers after applying a longitudinal study design. The hypothesis of the study is that the values of future sports teachers are different when they commence their studies and when they are in their final year of their studies.

The purpose of the research was to reveal the dynamics of the values of future sport teachers by employing a longitudinal study design over a period of four years. The following objectives have relevance:

1. To determine changes in the most important personal values of future sport teachers;
2. To reveal the dynamics of values held regarding the meaning of life by future sport teachers.

METHODS AND MATERIALS

Study design

A longitudinal study was used, namely a repeated sociological study where the same respondents were involved over an extended period of time (in this case, 4 years). The cohort study model was used. The future sport teachers were surveyed in their first year of study and then 4 years later in their fourth year of study. The longitudinal study design was chosen because it provides the opportunity to detect changes in the characteristics of the target population (future sport teachers).

Sample

The study sample was chosen by means of proportional random sampling: every second student was selected for the questionnaire-based survey from a list of first-year students. In 2008, the research group consisted of 168 first-year students (86 males and 82 females) for the first part of the study. The second part of the study was conducted in 2012. The same respondents participated, but the research group was smaller due to students leaving their studies, refusing to take part or missing classes and consisted of 154 fourth-year future sport teachers (78 males and 76 females). Comparison of respondents by gender was not included in the analysis, as it was not an objective of this research.

Ethical clearance

The following ethical principles were adhered to in the study: written informed consent was obtained from the participants before their participation Anonymity and confidentiality were ensured using code names. The Ethics Committee of the Lithuanian Sports University approved the research proposal.

Measuring instruments and data analysis

To research the most important personal values of future sport teachers at the Lithuanian Sports University (LSU), the Rokeach Value Survey, modified by Smirnov and adapted by Sukys (2008), was employed.

The respondents were presented with 8 values (financial well-being, pleasures, family well-being, success, public recognition, health, true friendship and helpfulness towards other people), modified by Smirnov and adapted by Sukys (2008) for evaluation on an 8-point scale according to importance. Each version of a reply to the statements was evaluated accordingly: 1= *no significance* to 8= *very important*. Only the indicators of the highest rating (7-8 points) were calculated because these indicators showed which values were given highest priority. Thus, the rating mean and standard deviation were not calculated, and instead the percentage of respondents from each year (first and fourth) who evaluated each value highly (7 or 8 points), was computed. The most important personal values from the first (most important) to the eighth (least important) were rated.

Values regarding the ‘meaning of life’ and inherent to future sport teachers were evaluated using the Life Meaning Orientations Test (Leontiev, 1992). The reliability was affirmed in published studies (Malinauskas, 2006a; Malinauskas, 2007). The Life Meaning Orientations

Test consists of 20 items, which are grouped into 5 scales: life goals (future agenda); process (active life full of impressions); results (satisfaction with one's activities); self-control (the ability to control life's events); and control of life circumstances (belief in being the master of one's destiny). The respondents rated their response to each item of the Life Meaning Orientations Test on a 7-point scale that ranged from 1 (*absolutely disagree*) to 7 (*absolutely agree*).

The results of values held regarding the 'meaning of life' were analysed in the same way; only the data of the most important personal values were studied. The percentage of the respondents from each year (first and fourth) who evaluated each value held regarding the meaning of life highly (36 or more points to the goals, process and control of circumstances; 30 or more points to the results; and 24 or more points to self-control) were computed. To reveal their dynamics, all values held regarding the 'meaning of life' from the first (most important) to the fifth (least important) were rated.

Statistical analysis

A two-proportion Z-test was used to locate the statistically significant differences between the proportions (percentage) of the first- and fourth-year students who evaluated values based on their importance.

RESULTS

Health was one of the most important values to the first-year future sport teachers (Table 1). By the fourth year, the students placed this value in second place, but it still held a significant position in the hierarchy of values. No statistically significant differences regarding the rating of the 'health' value were determined between the first- and fourth-year students ($p>0.05$). By the fourth year, the students believed that the most important value to them was *financial well-being* (a financially stable life).

TABLE 1. **DISTRIBUTION OF STUDENTS (%) ACROSS AND RANKING OF MOST IMPORTANT VALUES**

Most important values	1st-year 2008		4th-year 2012		Z-value
	%	Rank	%	Rank	
Financial well-being	77	2	86	1	-2.10*
Family well-being	61	4	63	4	-0.37
Success of the activities	67	3	73	3	-1.17
Public recognition	47	7	61	5	-2.54*
Health	82	1	81	2	0.23
True friendship	48	6	36	7	2.20*
Understand importance of other people	36	8	33	8	0.57

* $p<0.05$

For future sport teachers in their first year of study, *financial well-being* was also one of the most important values. In the first-year, 77% of the students assessed 'financial well-being' as very important. The same assessment occurred with 86% of the respondents in their fourth year. According to the data provided by the fourth-year students, 'financial well-being' was

placed first because it could be that the graduating students were striving to become independent from their parents. The third place in the hierarchy of values inherent to future sport teacher respondents in their first year and fourth year was *success of the activities* (achievements), while the fourth place was reserved for *family well-being* (caring for people one is close to).

During their studies, the need to gain *public recognition* (respect and authority) in the eyes of society increased for the students. In the first year, the students placed this value in the seventh position in the value hierarchy, while in the fourth year they deemed 'public recognition' to be fifth in terms of importance. 'Public recognition' was statistically significantly more important to the students when they were in their fourth year (Z= -2.54; p<0.05) than when they were first-year students. One should note that *true friendship* was less important in the fourth year of the future sport teachers (Z= 2.20; p <0.01) than in their first year. They also cared less (Z= 2.00; p <0.01) about 'pleasure' (joy and lifestyle full of entertainment). The last position (eighth) in the hierarchy of most important personal values, understood *that one is truly important to the lives of others* (satisfaction with their own activities).

Based on the study results, it became clear that the future sport teachers were prone to a positive evaluation of values held regarding the 'meaning of life' (Table 2).

TABLE 2. **DISTRIBUTION OF STUDENTS (%) ACROSS AND RANKING OF MOST IMPORTANT VALUES REGARDING 'MEANING OF LIFE'**

Values regarding 'meaning of life'	1st-year 2008		4th-year 2012		Z-value
	%	Rank	%	Rank	
Future agenda	54	3	81	1	-5.42**
Active life full of impressions	83	1	73	2	1.97*
Satisfaction with one's activities	66	2	55	3	2.03*
Ability to control life's events	39	5	44	5	-0.91
Belief of being master of one's destiny	47	4	51	4	-0.72

* p<0.05 ** p<0.01

The data in Table 2, at the first- and fourth-year, future sport teachers indicate that they highly value an *active life full of impressions* (83% and 73%, respectively). Half of the first-year respondents found *future agenda* and *satisfaction with one's activities* very important. While the first-year students placed 'future agenda' (clear life goals) in the third place among the values held regarding the meaning of life, the assessment data in the fourth year presented it as the first position (Z= -5.42; p <0.001). This was influenced by the fact that in the fourth year the students might have thought more deeply about their life goals and strove to graduate successfully in order to implement their ideas. 'Satisfaction with one's activities' moved from the second position to third by the fourth year. The graduating students found the 'future agenda' (clarity of set goals) more important, and an 'active life full of impressions' dropped from the first position to the second (Z= 1.97; p<0.05). 'Satisfaction with one's activities' was a significantly less important value for the fourth-year future sport teachers than it was for them in their first year (Z= 2.03; p<0.05).

The fact that the *ability to control life's events* and a *belief in being the master of one's destiny* (the architect of one's own future), were placed last and second last in the hierarchy, suggests that the future sport teachers lacked resolve and initiative when planning for their future and their professional career. Presumably, the 39% in the first year and the 44% in the fourth year future sport teachers were not prepared for further changes in life because the ability to control one's life events was not as important to them as the other values. No statistically significant differences were found between their first year and their graduating year regarding their 'ability to control one's life events' and their 'belief in being the master of one's destiny'.

DISCUSSION

The results of the study confirmed the hypothesis that the importance of specific values of future sport teachers at the start of their studies is different to those held in their graduating year. The results of the present study are in line with the data of earlier research, which suggests that personalities evolved through the selection and development of values by

different future sport teachers (Malinauskas, 2006a). The study showed that the most important personal values of future sport teachers were the following: 'material well-being' (financially secure lifestyle); 'health' (good physical and psychological status); and 'achievement' and 'family well-being' (caring for the people one is close to). In the fourth year, 'true friendship' (close communication) was placed seventh, which was also reported in earlier studies (Malinauskas, 2007). The future sport teachers considered values, such as 'pleasure' and 'importance to others' as least important.

It can be suggested that the physical activities of future sport teachers create favourable conditions that nourish such values as 'health' and a 'desire to be recognised by society'. This also confirms data from other research (Sniras & Malinauskas, 2005; Malinauskas, 2006b; Malinauskas, 2007). 'Financial well-being' as a priority value was also reported in other studies that examined the opinions of Lithuanian students and high school students. For instance, Ciuzas and Ratkeviciene (2000), who analysed the value orientation of Lithuanian high school students, noted that material well-being was important to them as much as other universal values. This research, however, confirmed that the younger generation of Lithuania differs from their peers in other European countries because they place more value on material assets and money.

The results of this study are similar to those that suggest that Lithuanian residents show a clear preference for health, family and material well-being (Lazutka *et al.*, 2004). The largest portion of respondents of the present research considered these values to be of the highest priority. The first position was rarely taken by 'pleasure' (placed eighth and, in the present study, sixth), 'public recognition' (seventh place and, fifth in the present study), or 'active life full of impressions' and 'friendship' (fifth and sixth positions and seventh in the present study). As indicated by Lazutka *et al.* (2004), as respondents become older, their beliefs change regarding the three most important values of health, family well-being and material well-being. Furthermore, both male and female respondents, aged 17-24 years, are more inclined towards an active life full of impressions (Lazutka *et al.*, 2004), which is further confirmed by the results of the current research.

Future sport teachers and other students seem to have similar values (for instance, health and

family well-being), and the differences are small (Smolicz *et al.*, 2001). It has been suggested that globalisation has not seriously damaged traditional values even though several of these values (for instance, moral values) have evolved (Smolicz *et al.*, 2001). The analysis of the dynamics of values held by future sport teachers revealed that 'health' is one of the most important values to them (82% in the first year and 81% in the fourth year). These results are in line with data from similar research (Meek & Cutner-Smith, 2004; Murphy *et al.*, 2011). According to Perenyi (2010), such development is logical because health is very important to people who choose to become sport teachers.

According to the results of this study, 81% of fourth year students found 'future agenda' to be very important. The fact that 'satisfaction with one's activities' was a less important value in terms of statistical reliability for fourth-year future sport teachers compared to their first year, may mean there is possible dissatisfaction with the professional activities among some future sport teachers. The explanation for this could be that the fourth-year future sport teachers

found themselves embarking on a new stage of life. These results are in line with data from similar research (Malinauskas, 2006b).

The study of the values held regarding the meaning of life showed that students valued 'a life full of impressions' the highest. It could be that participation in sport activities created favourable conditions for spending one's time actively and entertainingly. Other authors (Ciuzas & Ratkeviciene, 2000) have also mentioned this. Again, the 'ability to control life's events' and a belief in being the 'master of one's life' (the architect of one's own future) were placed last and second-last, respectively. This suggests that the future sport teachers lack initiative and responsibility, an observation also reported in earlier studies (Malinauskas, 2006b; Malinauskas, 2007).

Further studies could be conducted to determine whether the students who chose the career of a sport teacher later distanced themselves from the values they thought most important at the beginning of their studies.

CONCLUSIONS

When comparing personal values, health and material well-being seemed to be the most important for future sport teachers. However, there were no statistically significant differences between their rating of health in the first and the fourth year. The data suggested that material well-being (a financially secure lifestyle) and public recognition (respect and authority) were the most important and statistically significant values in the fourth year ($p < 0.05$) compared to the first year. The fourth-year future sport teachers cared less ($p < 0.05$) about pleasure (joy and a life full of entertainment) and true friendship than when they were in their first year.

For the first-year students, future agenda (clear life goals) was placed third in terms of importance in the hierarchy of values held regarding the meaning of life, and by the fourth year, the students placed future agenda (clear life goals) in the first position. Future agenda ($p<0.01$) was a more important value in the fourth year than in the first year. According to the results of the study, satisfaction with ones' activities was a significantly less important value to the final year future sport teachers ($p<0.05$) than when they were first-year students.

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RELATIONSHIP BETWEEN BIOELECTRICAL IMPEDANCE-DERIVED ESTIMATES OF BASAL METABOLIC RATE AND BODY COMPOSITION PARAMETERS IN FEMALE KOREAN COLLEGE STUDENTS

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ABSTRACT

Measurements of basal metabolic rate (BMR) and body composition parameters represent an important tool for preventing obesity. This investigation examined the relationships between bioelectrical impedance-derived estimates of BMR and various body composition parameters, including age, body mass index, intracellular water, extracellular water, protein content, mineral content, fat mass, osseous content and waist-to-hip ratio. The subjects included Korean female college students (N=717) aged 18–26 years, who visited the sport medicine laboratory at Seoul Women's University in 2013. The BMR and body composition parameters were indirectly measured using a bioelectrical impedance device, and the correlations between the BMR and other variables were analysed. The BMR showed a significant negative correlation with age ($r=-0.284$, $p<0.001$); but significant positive correlations with body mass index ($r=0.477$, $p<0.001$), intracellular water ($r=0.803$, $p<0.001$), extracellular water ($r=0.205$, $p<0.001$), protein content ($r=0.991$, $p<0.001$), mineral content ($r=0.093$, $p=0.013$), fat mass ($r=0.234$, $p<0.001$), osseous content ($r=0.962$, $p<0.001$), and waist-to-hip ratio ($r=0.217$, $p<0.001$). Based on these findings, all body composition parameters correlated with the BMR in this population. Improvement of body composition parameters may lead to an increased BMR, thus this could provide an effective means for preventing obesity.

Key words:Basal Metabolic Rate; Extracellular water; Fat mass; Intracellular water; Mineral, osseous and protein content; Waist-to-hip ratio.

INTRODUCTION

According to the US Centres for Disease Control and Prevention in 2013, over 35% of American adults are obese (US Centres for Disease Control and Prevention, 2013); and, recently, the World Health Organisation reported that, worldwide, over 2.8 million people die annually as a direct result of being overweight or obese (World Health Organization, 2014). Furthermore, in Korea, the fifth Korea National Health and Nutrition Examination Survey in 2012 reported that the prevalence of obesity was 35.2% in men and 28.6% in women aged over 19 years, and the prevalence is steadily increasing (Korea Centre for Disease Control and Prevention, 2012). Obesity is associated with a number of serious health and social problems, and the benefits of maintaining a healthy weight are hence numerous (Thomas &

Albert, 2002). Measurements of basal metabolic rate and body composition parameters may be important for preventing obesity, and may thus aid in solving many of the public health and social problems associated with this condition.

It is well established that weight gain and obesity are directly caused by an imbalance in energy consumption and expenditure (Thomas & Albert, 2002). This balance has been demonstrated to be affected by a number of factors, including the socio-economic environment of the individual, family history of obesity, genetic factors, physical activity (or lack thereof) and eating habits (Thomas & Albert, 2002). Particularly, the energy expenditure of each individual is dependent on his or her body composition components, which, in turn, are dependent on the basal metabolic rate of the individual. The basal metabolic rate, which is the rate of energy expenditure at rest, is negatively affected by increased body weight; and, for this reason, an increased basal metabolic rate has many potential benefits for the treatment and prevention of obesity (Thomas & Albert, 2002).

In general, the basal metabolic rate is affected by various factors such as fat-free mass, fat mass, intracellular water, extracellular water, protein content, mineral content, body mass index, age, waist circumference, and osseous content (primary bone tissue), which is a relatively lightweight but hard composite (Keys *et al*., 1973; Fukagawa *et al*., 1990; Goran *et al*., 1994; Johnstone *et al*., 2005; Wang *et al*., 2007). However, most previous studies on the topic have been focused on Caucasian (Weyer *et al*., 1999; Lazzer *et al*., 2010) or African-American populations (Kim & So, 2013), and evidence regarding the correlation between basal metabolic rate and body composition components in Korean populations is lacking.

PURPOSE OF RESEARCH

The purpose of the present study was to investigate the relationship between bioelectrical impedance-derived estimates of basal metabolic rate and the body composition parameters of age, body mass index, intracellular water, extracellular water, protein content, mineral content, fat mass, osseous content, and waist-to-hip ratio in female Korean college students.

METHODOLOGY

Participants

A total of 717 female Korean college students aged 18–26 years who visited the sport medicine laboratory in Seoul Women's University, Seoul, Republic of Korea in 2013 were

included in the study after providing informed consent. Subjects agreeing to participate in the study were instructed to answer an anonymous self-administered questionnaire. Subjects who were unwilling to participate were not analysed further.

Measurement parameters

The participants underwent a series of tests to evaluate their basal metabolic rate (BMR) (kcal), age (years), body mass index (kg/m^2), intracellular water (l), extracellular water (litter), protein content (kg), mineral content (kg), fat mass (kg), osseous content (kg), and waist-to-hip ratio (%). The body mass index (BMI) (kg/m^2) of the subjects was calculated based on their measured weight and height. The BMR, intracellular water, extracellular water, protein content, mineral content, fat mass, osseous content, and waist-to-hip ratio were measured using Inbody 720 equipment (Biospace, Seoul) according to the manufacturer's instructions.

Experimental procedures

Age was recorded using a self-reported questionnaire. The subjects were instructed to wear light clothing, and to remove all metal items that could interrupt the electric current during the measurements. The laboratory was open between 09:00 to 11:00, Monday to Friday, and the time required for measuring each subject was less than 10 minutes. All participants were prohibited from consuming any food or water for 12h, from performing any exercise for 24h, and from urinating just before the measurement. Subjects who were menstruating were excluded from the study at this stage.

Statistical analysis

All results are based on mean±standard deviation calculations. Pearson's correlation analysis was used to investigate the relationships between the BMR and age, BMI, intracellular water, extracellular water, protein content, mineral content, fat mass, osseous content and waist-to-hip ratio. Statistical significance was set at $p<0.05$. All analyses were performed using SPSS version 18.0 (SPSS, Chicago, IL).

RESULTS

The mean and standard deviation for each of the following body composition components of the subjects are presented in Table 1, namely age, height, weight, body mass index (kg/m^2), intracellular water, extracellular water, protein content, mineral content, fat mass, osseous content, fat mass percentage, waist-to-hip ratio and BMR.

TABLE 1. **BODY COMPOSITION COMPONENTS AND BMR SCORES (M±SD)**

Variable	Scores (n=717)
Age (years)	20.55±1.87
Height (cm)	163.12±4.98
Weight (kg)	55.55±7.06
BMI (kg/m^2)	20.86±2.28
Intracellular water (litre)	18.56±2.08
Extracellular water (litre)	10.77±1.43
Protein (kg)	8.57±1.41
Mineral (kg)	2.78±0.38

Fat mass (kg)	14.87±4.28
Osseous (kg)	2.44±0.26
Waist-to-hip ratio (%)	0.78±0.03
BMR (kcal)	1301.21±141.23

BMI= Body Mass Index BMR= Basal Metabolic Rate

The results of the correlation analyses between the bioelectrical impedance-derived estimates of basal metabolic rate and the body composition parameters of the participants are shown in Table 2 and Figures 1-9.

TABLE 2. **PEARSON'S (r) CORRELATION OF ESTIMATES OF BMR WITH BODY COMPOSITION COMPONENTS**

Components	**Correlation with BMR#** (n=717) **r**	**p-value**
Age (years)	-0.284	<0.001***
BMI (kg/m^2)	0.477	<0.001***
Intracellular water (litre)	0.803	<0.001***
Extracellular water (litre)	0.205	<0.001***
Protein (kg)	0.991	<0.001***
Mineral (kg)	0.093	0.013*
Fat mass (kg)	0.234	<0.001***
Osseous (kg)	0.962	<0.001***
Waist-to-hip ratio (%)	0.217	<0.001***

*p<0.05 ***p<0.001 BMR= Basal Metabolic Rate BMI= Body Mass Index
Bioelectrical impedance-derived BMR

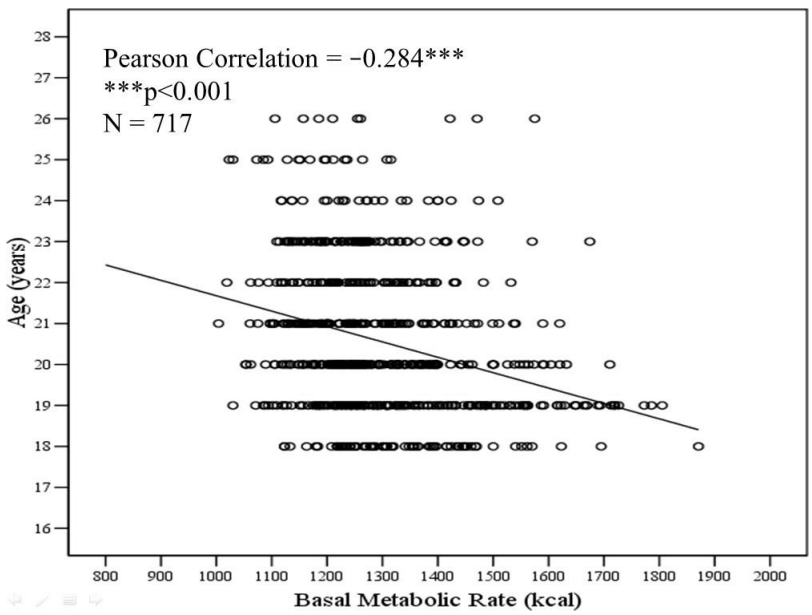

FIGURE 1. **CORRELATION BETWEEN BMR AND AGE**

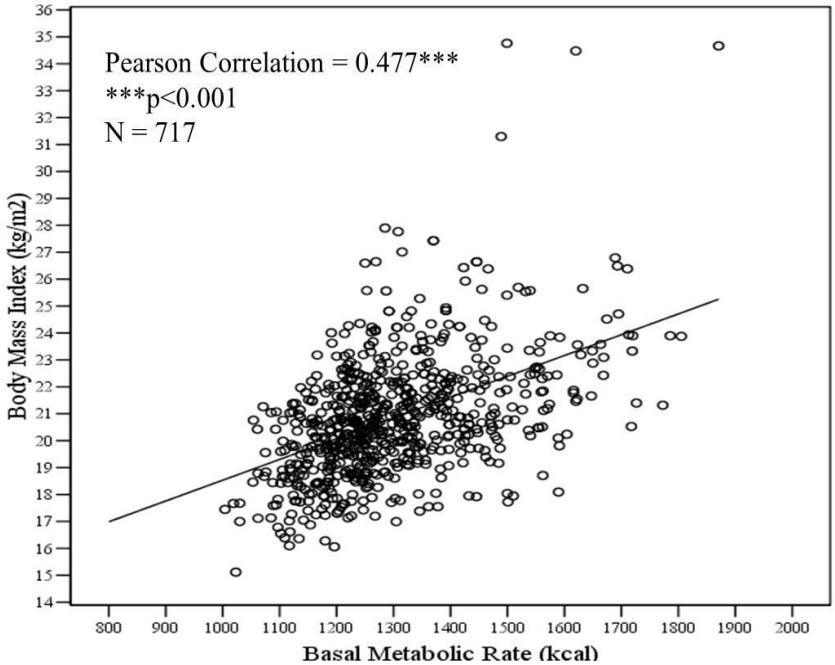

FIGURE 2. **CORRELATION BETWEEN BMR AND BMI**

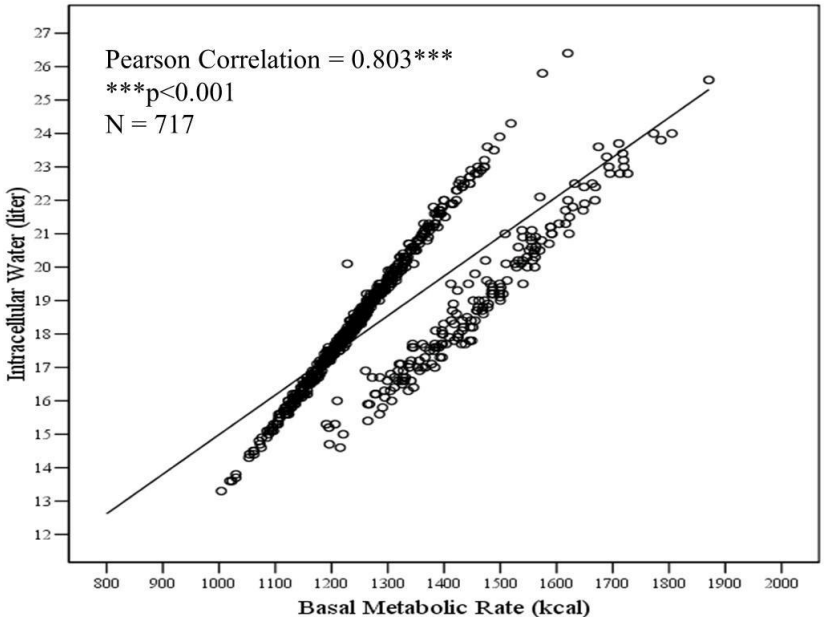

FIGURE 3. **CORRELATION BETWEEN BMR AND INTRACELLULAR WATER**

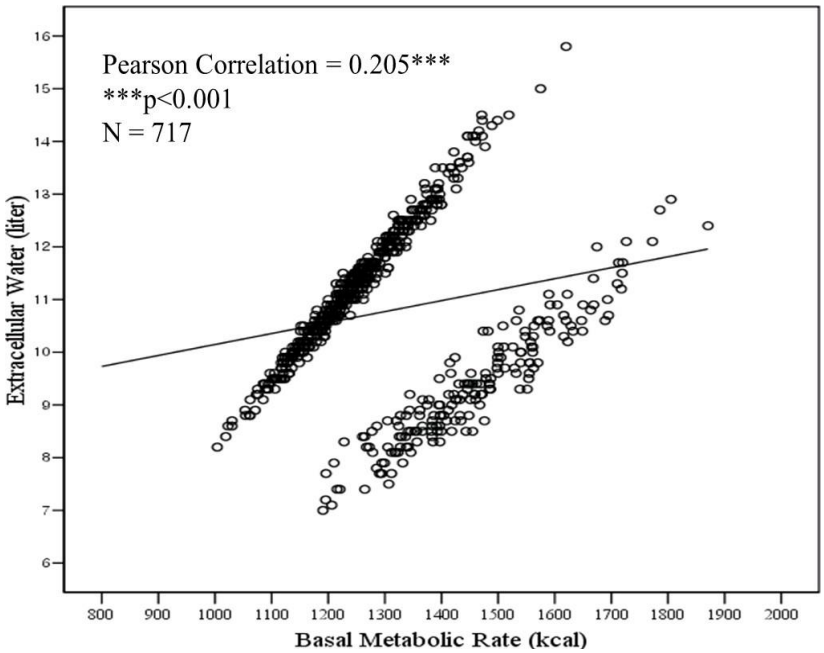

FIGURE 4. **CORRELATION BETWEEN BMR AND EXTRACELLULAR WATER**

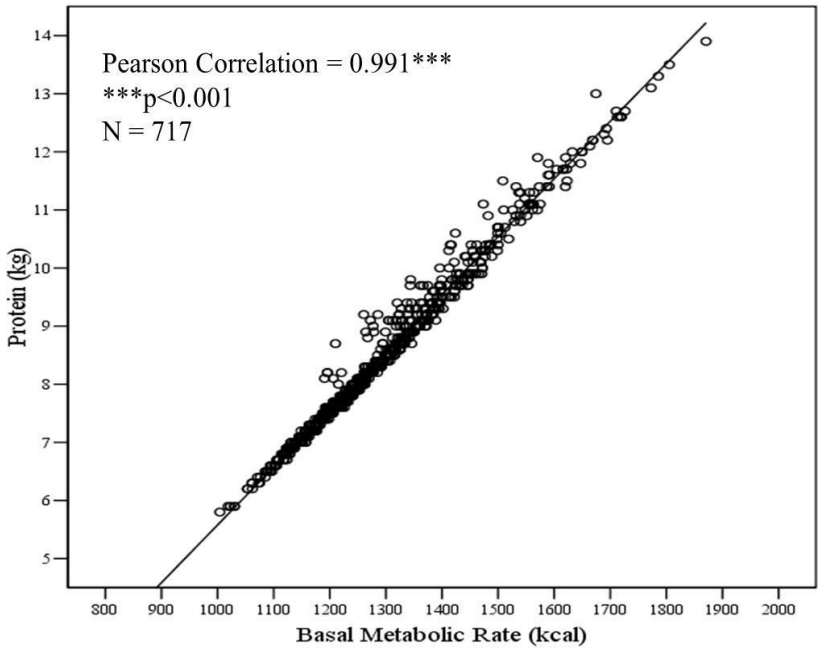

FIGURE 5. **CORRELATION BETWEEN BMR AND PROTEIN CONTENT**

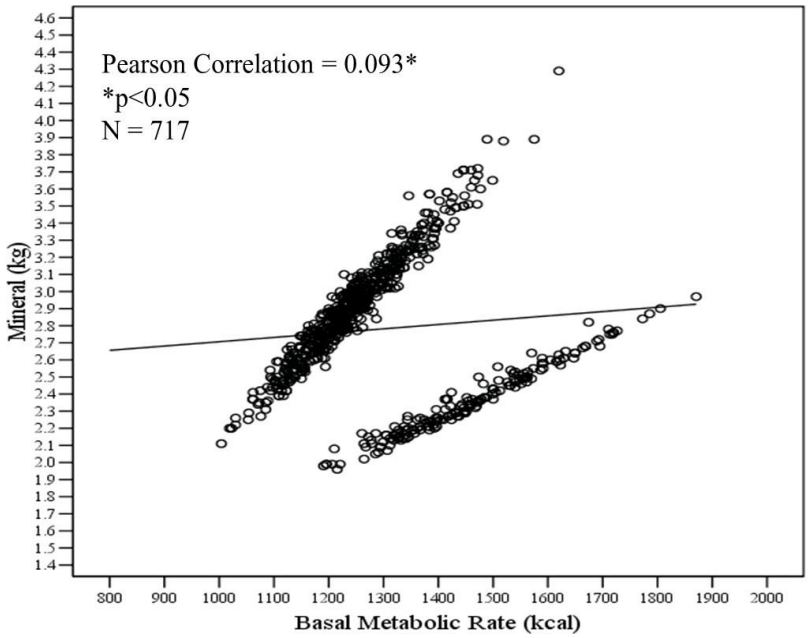

FIGURE 6. **CORRELATION BETWEEN BMR AND MINERAL CONTENT**

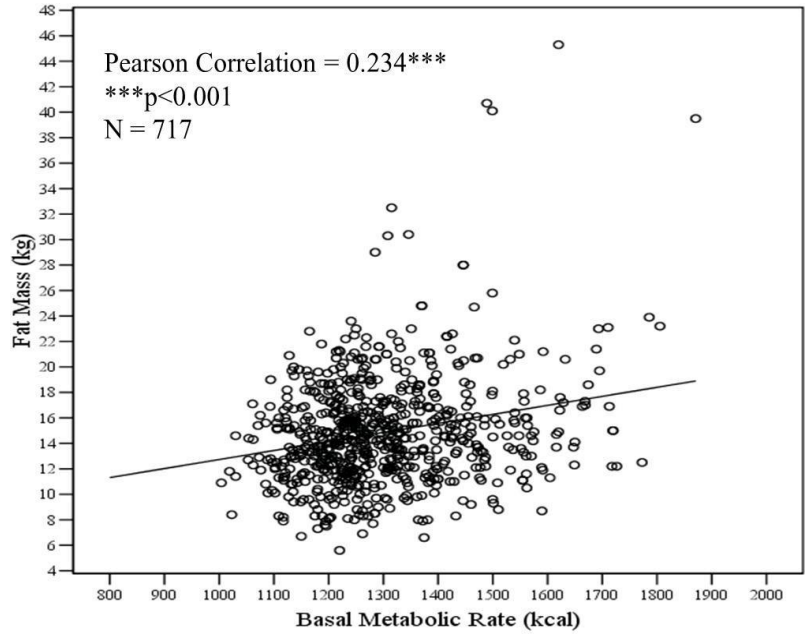

FIGURE 7. **CORRELATION BETWEEN BMR AND FAT MASS**

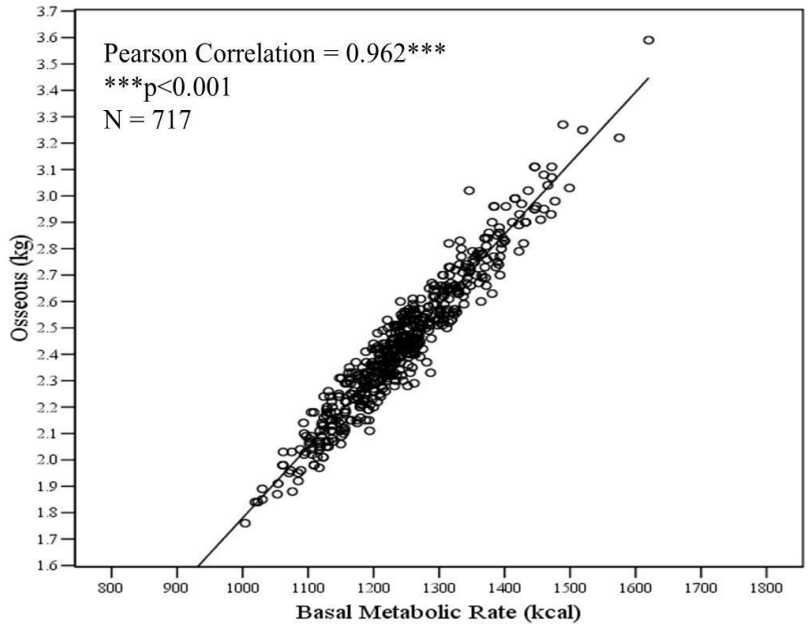

FIGURE 8. **CORRELATION BETWEEN BMR AND OSSEOUS CONTENT**

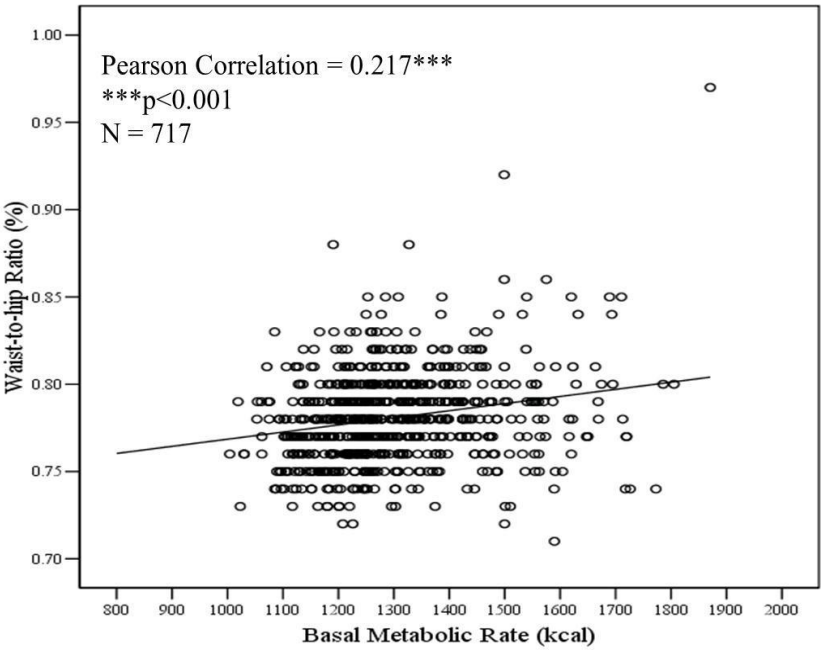

FIGURE 9. **CORRELATION BETWEEN BMR AND WAIST-TO-HIP RATIO**

The basal metabolic rate in this population (Table 2) significantly negatively correlated with age (r= -0.284, p<0.001), whereas significant positive correlations were observed between the

basal metabolic rate and body mass index ($r=0.477$, $p<0.001$), intracellular water ($r=0.803$, $p<0.001$), extracellular water ($r=0.205$, $p<0.001$), protein content ($r=0.991$, $p<0.001$), mineral content ($r=0.093$, $p=0.013$), fat mass ($r=0.234$, $p<0.001$), osseous content ($r=0.962$, $p<0.001$), and waist-to-hip ratio ($r=0.217$, $p<0.001$).

DISCUSSION

This study investigated the correlations between bioelectrical impedance-derived estimates of basal metabolic rate and body composition parameters in female Korean college students. Previous studies have found that, in addition to fat-free mass, which is known to affect largely the basal metabolic rate (Cunningham, 1991; Weinsier *et al*., 1992), fat mass represents another contributing factor to the basal metabolic rate (Fukagawa *et al*., 1990; Nelson *et al*., 1992). In one recent study, it was reported that the fat-free mass, fat mass and age were the main factors influencing the basal metabolic rate (63%, 6% and 2% of the basal metabolic rate, respectively) (Johnstone *et al*., 2005). However, other previous studies have been unable to identify a relationship among these factors (Bogardus *et al*., 1986; Svendsen *et al*., 1993). Thus, the effects of many of these variables, including fat-free mass and fat mass, on the basal metabolic rate are still highly controversial, especially in Asia.

In addition, many previous studies have reported that increased age is associated with a decreased basal metabolic rate, which is most likely related to the decrease in fat-free mass during the aging process (Gallagher *et al*., 2000; Wang *et al*., 2005). The results of the current support the findings of these previous studies, and indicate that increased age is associated with a reduced basal metabolic rate in female Korean college students.

Lazzer *et al*. (2010) reported that the prediction equations based on anthropometric data, such as waist circumference and the body mass index, as well as body composition components such as fat mass, were associated with the same R^2 values and similar root mean squared errors of the estimate. This indicates that waist measurements and body mass index, similarly to waist circumference, positively correlate with the basal metabolic rate. In accordance with these results, a significant correlation between the basal metabolic rate and body mass index, waist-to-hip ratio and fat mass in the population of these 717 female Koreans were observed.

The results, moreover, demonstrated that other body composition components, such as intracellular and extracellular water, and protein, mineral, and osseous contents, significantly correlated with the bioelectrical impedance-derived estimates of basal metabolic rate (Table 2), indicating that these factors may also represent significant determinants of the BMR in this population. However, further studies should be performed to validate these results in other populations, including in males and older individuals, both in Korea and worldwide.

This study had a number of limitations. Firstly, because this was a single-institution study, the study population may not represent the general college student population in Korea. Secondly, only female subjects were included in the study, and the body compositions and MBR between female and male individuals are known to differ. Thirdly, the same apparatus was used to estimate the body composition and BMR parameters in this study. This might be

associated with some conceptual problems and may present a statistical dilemma. However, the sample size of the present study (N=717) was considered relatively large, and is regarded as one of the greatest merits of this study. In addition, the fact that it was conducted in a

Korean population, where currently very limited data exists concerning the associations between BMR and body composition components in non-Caucasian and non-African-American populations, adds to the merits.

For this population of female college students in Korea, BMI, intracellular water, protein content and osseous content was highly correlated with the BMR, whereas age, extracellular water, mineral content, fat mass, and waist-to-hip ratio showed low correlations with the BMR.

CONCLUSION

All body composition parameters correlated with the BMR in this population. As improvement of the body composition parameters may lead to an increased BMR, this may represent an effective means for the prevention of obesity. Further studies are warranted to confirm these findings.

Acknowledgement

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ANTHROPOMETRIC CHARACTERISTICS AND LOWER LIMB POWER OF PROFESSIONAL FEMALE VOLLEYBALL PLAYERS

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ABSTRACT

Success in performing professional sport is determined by many factors. Motor skills, psychological conditions and somatic structure are important. The aim of this research was to investigate detailed anthropometrical characteristics of highly skilled female volleyball players and their non-sporting peers. Additionally, the diversity of those features based on court position was examined. The sample consisted of first league female volleyball players (N=17), while 50 students from the University School of Physical Education served as reference group. The 35 anthropometric measurements, complemented by a biomechanical evaluation of lower limb power using the counter movement jump (CMJ), were examined. The values of height, length, width and body circumference were significantly higher for female volleyball players than those obtained from the reference group. The female volleyball players revealed a balanced mesomorphic somatotype. Stature differed and was related to court position. In comparison to the attackers and setters, the receivers, middle and libero players were characterised by better CMJ. This knowledge could enable coaches to individualise and determine suitable training methods, depending on the somatic predisposition of an athlete, which will reduce the risk of injury.

Key words: Anthropometry; Body composition; Counter movement jump; Volleyball.

INTRODUCTION

Success in performing professional sports is determined by many factors. Not only motor skills and psychological conditions are important. Knowledge of morphological body build specific to different sport disciplines facilitates a pre-selection process, and in the case of team games, can be an important factor determining a player's position on the court (Gualdi-Russo, 2001; Duncan *et al*., 2006).

Anthropometric research conducted on women participating in volleyball has been investigated frequently and is often related to different levels of women's skills (Viviani & Baldin, 1993; Bayios *et al*., 2006; Malousaris *et al*., 2008; Buśko *et al*., 2012). A few studies examine the anthropometric measurements for evaluating the specific body build of volleyball players. The majority of research confirms that volleyball pre-selection is based on previously determined, basic somatic criteria, such as body height and mass. Such morphological selection results in significantly higher body height of volleyball players in comparison to their non-practising peers and women practising other sports (Viviani & Baldin, 1993; Bayios *et al*., 2006). The results of much of the research point to a certain diversification of volleyball players' body build, which depends on the playing position on the court (Giatsis *et al*., 2011, Sattler *et al.*, 2012).

Morphological predispositions frequently determine a player's functional abilities. In the case of volleyball, strength and speed training lead to changes in muscle mass, endurance, strength, power and jumping abilities. The height of vertical jump in volleyball players is determined by a certain level of strength, which also influences their efficiency (Sheppard *et al*., 2008).

Biomechanical analyses of sportspersons are related to different parameters. Those performed on volleyball players frequently examine their jumping abilities and strength. The results of

this research are frequently different, and depend on players' level of participation, position on the court, training experience and age (Smith *et al*., 1992; Newton *et al*., 1999; Newton *et al*., 2006; Marques *et al*., 2008; Buśko, 2009; Ziv & Lidor, 2010; González-Ravé *et al*., 2011; Buśko *et al.*, 2012; Sattler *et al*., 2012).

RESEARCH PROBLEM

The aim of this research was to prepare detailed characteristics of morphological body build, body proportions and body tissue composition of highly skilled female volleyball players and their non-sporting peers for comparison. The diverse features were also examined based on the court playing position of the volleyball players. The anthropometric measures were complemented by a biomechanical evaluation of lower limb power of the players to establish whether there is a relationship between jumping height and the somatic features.

METHODOLOGY

Ethical approval

Ethical approval for the project was obtained from the Ethical Committee at the University School of Physical Education in Wrocław (Ethical clearance 23.10.12). Their ethical guidelines were honoured throughout the study. Participants provided oral informed consent prior to testing. The study conducted within the framework of scientific projects number 69/0203/S/2013 and 09/0202/S/2013.

Participants

Seventeen (n=17) First League female volleyball players. This group constituted spikers (n=3), setters (n=4), middle blockers (n=4), receivers (n=4), libero players (n=2). The reference group consisted of female students (N=50) of the University School of Physical Education who did not participate in any sports. These groups were chosen by means of simple random selection. The mean age of the players was 20.89 years and that of the reference group was 20.59 years.

Measurements

Measurements were administered according to International Standards for Anthropometric Assessment (ISAK) (Norton & Olds, 2002). They were supplemented by a few additional measurements. The following anthropometric measurements included: body stature (B-v), acromial-dactylion length (a-da3), height from the floor to the trochanterion (B-tro), tibial-lateral height (B-ti), sitting height (B-vs), arm span (da3-da3), transverse chest (thl-thl), anterior-posterior chest depth (xi-ths), bi-acromial diameter (a-a), bi-iliocristal diameter (ic-ic), bi-epicondylar humerus breadth (cl-cm), bi-epicondylar femur breadth (epl-epm), wrist breadth (spr-spu), bi-malleolare breadth (mlt-mlf), foot length (pte-ap), foot breadth (mtt-mtf), and girths and skinfolds of the trunk and limbs.

Body height, lengths and breadths were measured to the nearest 0.1cm with the use of a GPM Anthropological Instruments (SiberHegner Machinery Ltd., UK). Skinfold thickness was measured with a Tanner/Whitehouse skinfold calliper (Holtain, UK) with 0.2mm graduation. Body mass was measured with an electronic weighing scale with an accuracy of 0.1kg.

The evaluation of the body build components was based on Heath and Carter's endomporphy, mesomorphy and ectomorphy. Body tissue composition was analysed with the use of Akern BIA 101 with Bodygram software. This device determines the amount of fat (FM), lean body fat (FFM), muscle (MM) and water (TBW) in total body mass. Results showed BIA to be extremely reliable and valid techniques for estimating body composition in female athletes (Fornetti *et al*., 1999). The Counter Movement Jump (CMJ) was used to evaluate lower limb power. A *KISTLER* dynamometric plate and BioWare software was used. This measuring system enables the measurement of the vertical component of ground reaction forces and the determination of power in the take-off phase while a jump was performed. The athletes were examined in their preparatory period of training.

Statistical analysis

The results obtained were analysed with the use of basic statistical methods (Statistica 9.0). Student *t*-test was applied to determine intergroup diversity among the reference group and female volleyball players. The normalisation of the players' features was computed with reference to mean and standard deviation of the non-sporting females. Normalisation involves adjusting the values measured on different scales to a common scale. This procedure allows establishing the significance of differences between the two groups for the various variables. The evaluation of different player positions was conducted by applying the analysis of variance and the Tukey test. The somatotypes for each group are compared with SANOVA, special analysis of variance that uses the somatotype attitudinal distances within and between groups (software by Sweat Technologist©). The correlation between the height of CMJ, power and morphological features was examined using Spearman's rank correlation coefficient.

RESULTS

The values of height, length, width and body circumference were significantly higher for female volleyball players than those obtained from the reference group (Table 1).

TABLE 1. **COMPARISON (Mean±SD) BETWEEN VOLLEY BALL PLAYERS AND REFERENCE GROUP: ANTHROPOMETRICAL MEASUREMENTS**

Variables	Volleyball players	Reference group	Significance
Body mass (kg)	69.99±6.1	54.85±5.6	0.000*
B-v (cm)	178.42±6.1	164.84±5.4	0.000*
B-tro (cm)	94.64±3.4	86.74±4.3	0.000*
B-ti (cm)	48.14±2.0	43.90±2.0	0.000*
B-vs (cm)	93.98±4.0	87.64±3.1	0.000*
a-daIII (cm)	77.31±4.0	70.74±2.2	0.000*
tro-ti (cm)	46.49±1.9	42.84±3.0	0.000*
daIII-daIII (cm)	178.48±7.8	163.81±5.5	0.000*
a-a (cm)	39.10±1.6	36.08±1.3	0.000*
dl-dl (cm)	43.03±1.5	40.04±2.3	0.000*
ic-ic (cm)	29.94±1.5	26.06±1.7	0.000*
pte-ap (cm)	26.23±1.2	24.05±1.0	0.000*
mtt-mtf (cm)	9.68±0.4	8.79±0.6	0.000*

mr-mu (cm)	7.81±0.4	7.57±0.4	0.022*
cl-cm (cm)	6.34±0.3	6.02±0.3	0.000*
spr-spu (cm)	5.33±0.4	4.97±0.3	0.000*
epl-epm(cm)	9.82±0.5	8.91±0.5	0.000*
mlt-mlf (cm)	7.36±0.6	6.66±0.4	0.000*
shoulder girdle girth (cm)	107.24±3.2	98.32±4.3	0.000*
chest girth in rest (cm)	79.47±3.9	73.65±4.2	0.000*
chest girth (inspiration) (cm)	85.62±3.8	79.42±3.9	0.000*
chest girth (expiration) (cm)	76.56±3.5	70.91±4.5	0.000*
Waist girth (cm)	73.65±3.0	65.50±3.7	0.000*
arm girth relaxed (cm)	28.71±1.4	24.82±2.0	0.000*
arm girth flexed and tensed (cm)	29.98±2.5	26.43±2.0	0.000*
forearm girth (max. relaxed) (cm)	24.75±1.3	22.53±1.3	0.000*
gluteal girth (max.) (cm)	101.88±4.6	92.13±4.6	0.000*
thigh girth (cm)	59.65±2.9	52.91±3.8	0.000*
calf girth (cm)	37.13±2.0	34.30±2.3	0.000*

* Significance: $p<0.05$

Key: (B-v) body stature; (B-tro) height from the floor to the trochanterion; (B-ti) tibial-lateral height; (B-vs) sitting height; (a-da3) acromial-dactylion length; (tro-ti) length of thigh; (da3-da3) arm span; (a-a) bi-acromial breadth; (dl-dl) bi-deltoid breadth; (ic-ic) bi-iliocrista breadth, (pte-ap) foot length; (mtt-mtf) foot breadth; (mu-mr) hand breadth; (cl-cm) humerus breadth; (spr-spu) wrist breadth; (epl-epm) femur breadth; (mlt-mlf) bi-malleolare breadth.

The normalisation of the players' features with reference to the mean and standard deviation of the students are presented in Figure 1 and Figure 2.

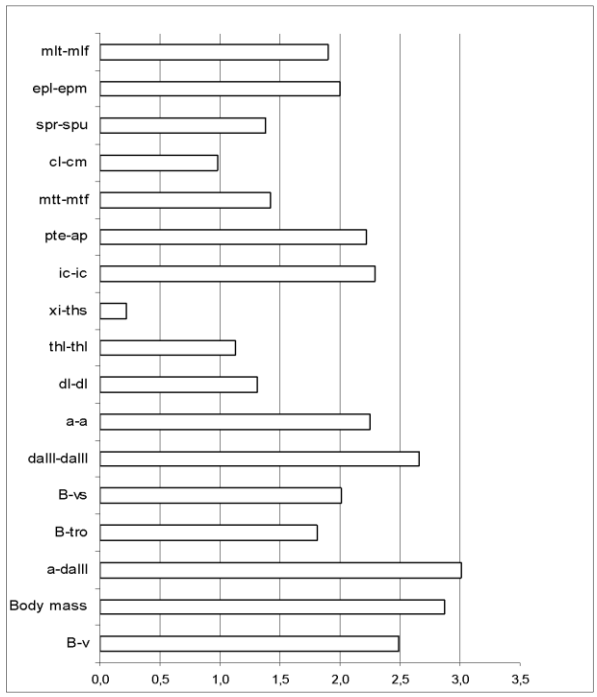

FIGURE 1. **NORMALISED VALUES OF LENGTHS, BREADTHS AND BODY MASS OF PLAYERS AND REFERENCE GROUP (MEAN±SD)**

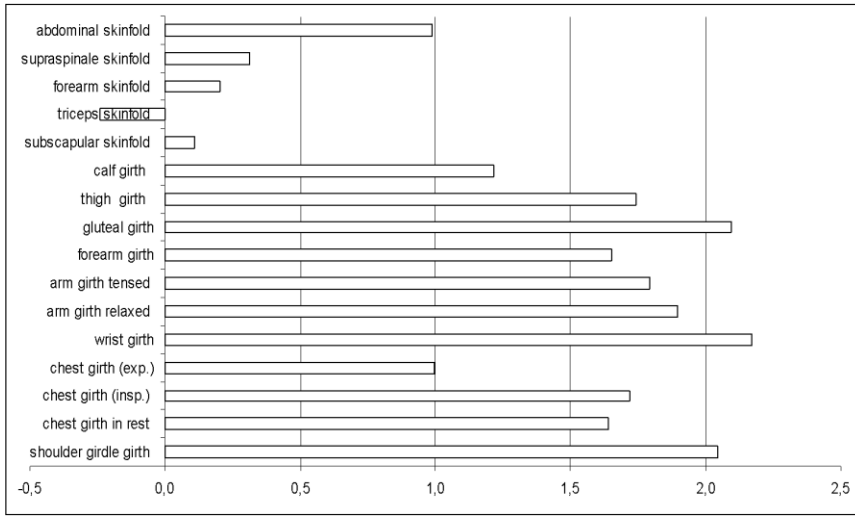

FIGURE 2. **NORMALISED VALUES OF SKINFOLDS AND CIRCUMFERENCES OF PLAYERS AND REFERENCE GROUP (MEAN±SD)**

Among the examined length and width parameters, the greatest differences were observed in body stature, acromial-dactylion length, arm span, bi-acromial and bi-iloicristal breadth, sitting height, foot length and bi-epicondylar femur breadth (Figure 1). The highest normalised positive values among those obtained for body girths were of waist, shoulder girdle, arm and thigh. There was no significant intergroup diversification with reference to skinfolds (Table 2, Figure 2).

TABLE 2. **SKINFOLD THICKNESS AND BODY COMPOSITION: COMPARISON BETWEEN PLAYERS AND REFERENCE GROUP (MEAN±SD)**

Variables	Volleyball players	Reference group	Significance
subscapular skinfold (mm)	9.69±2.4	9.42±2.5	0.698
triceps skinfold (mm)	8.60±1.5	9.29±2.8	0.339
forearm skinfold (mm)	5.04±1.3	4.29±1.1	0.025
supraspinal skinfold (mm)	12.34±2.9	11.23±5.5	0.426
abdominal skinfold (mm)	12.62±3.1	11.15±4.7	0.230
calf skinfold (mm)	9.33±1.5	6.96±2.4	0.000*
Endomorphy	3.12±0.6	3.01±0.9	0.631
Mesomorphy	3.86±0.8	3.62±0.9	0.327
Ectomorphy	2.91±1.0	3.25±0.9	0.199
FFM (kg)	50.44±3.9	40.90±3.8	0.000*
TBW (kg)	36.93±2.9	29.94±2.8	0.000*
FM (kg)	19.56±3.5	13.99±3.0	0.000*
FM (%)	27.82±3.4	25.50±3.2	0.012*

FFM (%)	72.18±3.4	74.50±3.2	0.012*
TBW (%)	52.85±2.5	54.53±2.3	0.013*

* Significance: p<0.05 Key: (FM) fat mass; (FFM) fat free mass; (TBW) total body water

TABLE 3. **HEIGHT, MASS AND FAT: VOLLEYBALL PLAYERS**

Positions	Height (cm)	Mass (kg)	Fat (kg)
Spikers	181.0±0.0*[a]	75.4±3.4	24.3±1.9*[c]
Setters	175.3±3.6	70.9±6.0	19.0±2.9
Middle blockers	184.6±2.7*[b]	72.8±5.1	19.4±3.6
Receivers	176.8±2.6	70.4±2.1	18.5±0.7
Libero players	167.8±4.2	61.5±3.4	15.5±2.8

* Significance: p<0.05
[a] spikers vs libero players [b] middle blockers vs receivers, setters, libero players
[c] spikers vs libero players

The comparison of the basic morphological features of the volleyball players in relation to court position suggests that the tallest players played the middle position (Table 3). Their mean body stature was 184.6±2.7cm. The next tallest players were spikers who measured 181.0±0.0cm. The next group was the receivers whose mean stature was 176.8±2.6cm. Average stature was observed in the setters (175.3± 3.6cm). The players playing the libero position were the shortest, however, they displayed greater discrepancy in values and their mean height was 167.8±4.2cm. Significant differences (p<0.05) regarding body stature were found between middle blockers and the receivers, setters and libero players.

The highest body mass was observed in the spikers (75.4±3.4kg). The mean weight of middle position players was 72.8 ±5.1kg, while the weight of the setters was lower and displayed a great discrepancy in values (70.9 ±6.0kg). Similar values were observed in the receivers who displayed a lower level of discrepancy (70.4±2.1kg). The lightest group of players were libero players whose mean weight was 61.5±3.4kg.

The highest values for the amount of fat were found in spikers (24.3 ±1.9kg). The setters (19.0±2.9kg), receivers (18.5±0.7kg) and middle players (19.4 ±3.6kg) had a similar fat level. Libero players displayed the least fat (15.5±2.8kg). Significant differences (p<0.05) were found between spikers and libero players.

TABLE 4. **BODY BUILD COMPONENTS: VOLLEYBALL PLAYERS**

Playing position	Endomorphy	Mesomorphy	Ectomorphy
Spikers	3.7±0.8	3.6±0.7	2.8±0.4
Setters	3.0±0.6	3.7±0.9	2.6±1.1
Middle blockers	3.0±0.5	3.8±0.3	3.5±0.9
Receivers	3.0±0.5	4.4±0.7	2.8±0.5
Libero players	3.0±0.5	3.8±0.8	2.6±1.1

The female volleyball players examined revealed balanced mesomorphic somatotypes (3.1-

3.9-2.9). SANOVA analysis did not show any statistically significant differences between the groups (F=0.45; p=0.228). Nevertheless, the differences observed between the players of the examined teams might have resulted from their court position (Table 4). Spikers were characterised by endo-mesomorphic somatotype (3.7-3.6-2.8), while the middle players by meso-ectomorphic ones (3.0-3.8-3.5).

The receivers (32.2±0.36cm), middle (31.3±0.40cm) and libero players (31.0±1.14cm) performed the highest jumps, while spikers (25.4±0.19cm) and setters (26.3±047cm) obtained lower CMJ values (Table 5). On the other hand, the values of power during the take-off phase looked slightly different. In this case, the receivers obtained the highest values. The power obtained by spikers (856.3±138.1W) was over 100W smaller than the power obtained by the receivers (960.0±122.0W), while the power values obtained by the middle players (756.4±119.9W) and setters (779.5±125.3W) was approximately 100W smaller than that obtained by the strikers. The libero players (602.5±101.1W) generated much less power than the remaining players did. Significant differences ($p<0.05$) were found between receivers and libero players.

TABLE 5. **MEAN±SD FOR CMJ AND POWER OF FEMALE VOLLEYBALL PLAYERS**

Players & positions	CMJ (cm)	Power (W)
Whole group	29.2±0.51	797.3±149.6
Spikers	25.4±0.19	856.3±138.1
Setters	26.3±0.47	779.5±125.3
Middle blockers	31.3±0.40	756.4±119.9
Receivers	32.2±0.36	960.0±122.0
Libero players	31.0±1.14	602.5±101.1*

* Significance: $p<0.05$ for difference between the scores of libero players vs receivers

TABLE 6. **RANK CORRELATION BETWEEN CMJ AND POWER FOR ALL EXAMINED FEATURES**

Variable	CMJ	Power	Variable	CMJ	Power
Body mass (kg)	-0.108	0.404	shoulder girdle girth (cm)	0.083	0.497*
B-v (cm)	0.271	0.133	chest girth in rest (cm)	0.006	0.208
B-tro (cm)	0.015	0.074	chest girth (inspiration) (cm)	0.137	0.245
B-ti (cm)	0.246	-0.022	chest girth (expiration) (cm)	-0.105	0.245
B-vs (cm)	0.305	0.193	waist girth (cm)	0.014	0.051
daIII-daIII (cm)	0.301	0.226	arm girth relaxed (cm)	0.219	-0.084
a-a (cm)	0.044	0.277	arm girth tensed (cm)	0.064	-0.071
dl-dl (cm)	0.069	0.399	forearm girth (cm)	0.317	0.363
ic-ic (cm)	0.211	0.426	gluteal girth (cm)	0.118	0.302
mr-mu (cm)	0.289	0.094	thigh girth (cm)	-0.075	0.106
cl-cm (cm)	0.499*	0.074	calf girth (cm)	0.239	0.378
spr-spu (cm)	0.361	0.113	subscapular skinfold (mm)	-0.007	-0.375
epl-epm(cm)	0.122	0.137	triceps skinfold (mm)	-0.116	-0.042

mlt-mlf (cm)	-0.059	-0.025	forearm skinfold (mm)	-0.205	0.248
Endomorphy	-0.085	-0.275	supraspinal skinfold (mm)	0.052	-0.139
Mesomorphy	-0.233	0.164	abdominal skinfold (mm)	-0.046	-0.172
Ectomorphy	0.516*	-0.263	calf skinfold (mm)	-0.059	0.112
FFM	0.440	0.151	FM	-0.272	0.418

* Significance: $p<0.05$

Key: (B-v) body stature; (B-tro) height from the floor to the trochanterion; (B-ti) tibial-lateral height; (B-vs) sitting height; (a-da3) acromial-dactylion length; (tro-ti) length of thigh; (da3-da3) arm span; (a-a) bi-acromial breadth; (dl-dl) bi-deltoid breadth; (ic-ic) bi-iliocrista breadth, (pte-ap) foot length; (mtt-mtf) foot breadth; (mu-mr) hand breadth; (cl-cm) humerus breadth; (spr-spu) wrist breadth; (epl-epm) femur breadth; (mlt-mlf) bi-malleolare breadth.

The analysis of correlation coefficients between the power and the examined anthropometric features mostly did not reveal any significant correlations (Table 6). The only significant interrelationship was observed between power and shoulder girdle. The height of CMJ jumps

indicated a significant positive correlation with ectomorphy (r=0.516) and elbow breadth (r=0.499).

DISCUSSION

This research has confirmed that the volleyball players were taller than their non-practising peers which is typical for the sport discipline. Many researchers have confirmed that female volleyball players are the tallest sportswomen, regardless of their age (Viviani & Baldin, 1993; Bayios *et al.*, 2006; Lidor & Ziv, 2010). However, the literature describes differences observed in the body stature in different teams. The height of top Polish female volleyball players examined by Buśko *et al.* (2012) was 184.8cm, while those from the Academic Sports Association (ASA) measured 177.9cm (Buśko & Lipińska, 2012). Bozo and Lleshi (2012) have also observed differences in height in Albanian female volleyball players. They stated that it depends on the level of their sport skills. These researchers have also observed that the height of players depends on court position. The tallest players took the middle and spiker positions, while those shorter, took the position of a setters and receivers. The results obtained (Viviani & Baldin, 1993; Giatsis *et al.*, 2011) was confirmed by the current research.

The upper limbs were also longer in volleyball players in comparison to the limbs of reference group. This phenomenon is biomechanically justified. Long limbs are one of the most significant features of volleyball players since they play an important part during offence and defence (Papadopoulou, 2003). Owing to this feature, it is possible to obtain greater angular speed, which means that the ball may travel faster during service. What is more, long upper limbs help during hitting and their swing enables the achievement of longer upward acceleration. This produces an inertial force, which acts on the trunk and legs remaining on the surface. This pressure increases ground reaction forces and the force of a hit. Take-off and the counter jump performed by a player frequently determine the efficiency of the task (attack, block). The force in the take-off phase and the time of action of this force determines the height of the jump. Length features, in comparison to those of body breadth and circumference, are highly dependent on hereditary factors (Malina, 1970). That is why it is important to consider these when conducting pre-selection of volleyball players.

The examined female players were characterised by substantial bi-iliocristal diameter. It

enables them to have greater balance during a match. Players can lower their centre of gravity due to the greater bi-iloicristal and smaller bi-acromial diameter. The examined competitors had quite a significant amount of fat in their body mass (27.8%). The amount of fat differed depending on the research. It was related to the method applied to measure its content in body mass. Research conducted by Tsunawake *et al.* (2003) who used the underwater weighing method, showed that female volleyball players had 15-19% of fat. However, much research has reported that the amount of fat can exceed 20% (Papadopoulou, 2003; Malousaris *et al*., 2008). Similarly, Buśko and Lipińska (2012) obtained high values in research conducted on second division volleyball players from the ASA University of Physical Education in Warsaw. The differences reported by the research are the result of the different methods applied by the researchers. Some results were obtained by means of hydrostatic weighing (Tsunawake *et al*., 2003), while others determine the amount of fat by means of skinfolds (Papadopoulou, 2003; Malousaris *et al*., 2008). Research conducted with the use of the BIA

method frequently reveals the highest percentage of body fat (Buśko & Lipińska, 2012). An analysis of existing research enables concluding that the greater amount of fat may influence the lower level of motor fitness. Papadopoulou (2003) has observed a negative relation between fat and explosive jumps in volleyball. According to him, the superfluous body weight caused by high body fat decreases jumping abilities, and therefore, height of the vertical jump of a player. Furthermore, excessive fat has a negative effect on horizontal movements, thus top athletes have less fat. Our research did not confirm these findings where the correlations between body fat and jump height were not statistically significant.

Somatotype of the examined female volleyball players was determined by the level of morphological features. It could be referred to as balanced mesomorphic somatotype (3.1-3.9-2.9). However, the observed differences depended on the player's court position. Other authors have also reported similar diversification. According to Bayios *et al.* (2006), Greek female volleyball players were represented by a balanced endomorphic somatotype (3.4-2.7-2.9). On the other hand, players examined by Viviani and Baldin (1993) had an endo-mesomorphic somatotype (4.9-3.8-2.6 and 4.7-3.9-2.3). Turkish top players were characterised by ectomorphic body build (3.4-2.1-4.5) (Ayan *et al*., 2012). Gualdi-Russo and Zaccagni (2001) described their somatotype as balanced (3.0-3.3-2.9), but they determined that the differences were based on court position. The most ectomorphic body build was observed in middle players, while the remaining competitors displayed more mesomorphic somatotypes. Dunkan *et al.* (2006) have also pointed to the somatotype differences determined by court position. Setters' body build was described as endomorphic and ectomorphic, strikers and receivers as balanced ectomorphic, while middle blockers displayed ectomorphic and mesomorphic somatotype. Carvajal *et al.* (2012) and Martín-Matillas *et al*. (2014) also described differences according to playing positions. Our research results are compatible with those published in the literature to some extent.

The most popular tests applied to evaluate power and force parameters are jumping trials. An evaluation of lower limb explosive power is best performed with the use of a dynamometric plate, which enables researchers to conduct the measurement of height of a CMJ and power (Young *et al.*, 2011). The results of such examinations may be useful for coaches who need to evaluate a player's skill level. Such measurements are significant in sport disciplines, which require sudden acceleration, turns and jumps, such as soccer, basketball and volleyball. Somatic body build constitutes a key to performance. The height of a vertical jump is the most significant factor in the efficiency of volleyball performance. Thus, it is important to

find methods, which could improve the performance of players. The results obtained by Marques *et al.* (2008) indicated that elite female volleyball players could improve strength and power during a competition season by implementing a well-designed training programme, which includes plyometric exercises.

Both the force obtained in the take-off phase, as well as the height of CMJ jump obtained by the examined volleyball players, were small in comparison to the values obtained by different groups of competitors. The values of CMJ jump of female beach volleyball players recorded by Riggs and Sheppard (2009) were 38.58cm (28.63-48.57cm). The mean power of those players was quite low, namely only 442.11±188.29W (264.91-1061.16). The jump values obtained by Polish elite cadets (junior and senior female volleyball players) recorded by Buśko *et al.* (2012) varied from 38.8 to 40.7cm. Darlymple *et al.* (2010), in research

conducted on female collegiate National Collegiate Athletic Association (NCAA) Division II volleyball players, have reported similar CMJ values to those obtained in this research. Jumps performed by players after stretching were within the range of 28-31cm. Results of research describing analysed biomechanical parameters with reference to player position are not always consistent. Marques *et al.* (2009) applied the CMJ to examine the correlation between a playing position and jumping skills. He did not observe any significant relationship between these two parameters. Duncan *et al.* (2006) examined elite junior players and found no correlation between vertical jumping ability and court position. Sattler *et al.* (2012) conducted research based on different heights of CMJs with reference to court position. According Sattler *et al*. (2012), libero players and receivers obtained the best results. Our research has not revealed any significant differences in the CMJ of the examined subjects with reference to their position. However, the receivers, middle and libero players jumped higher than the attackers and setters.

The results of this research have not revealed significant correlations between body build, CMJ height and force. Riggs and Sheppard (2009) also did not find any correlations between body mass, jump height and power, nevertheless, they observed a significant relationship between the height of a jump and mean power. Sheppard *et al.* (2008) have reported a significant correlation between the height of a CMJ and body height (r=0.77), on the other hand, they did not observe any relationship between jumping skills evaluated by the use of CMJs and the sum of skinfolds (r=0.15). In the examined players, no significant correlations between CJM, body fat and thick skinfolds were observed. However, they observed a stronger correlation between CMJ jump and the amount of lean body (r=0.44). The increased fat free mass of players may increase the strength of serve. This strength results from giving the ball suitable momentum. The momentum is influenced by many factors, such as the mass of the hitting part, which can be increased by engaging the whole body to swing and hit. The higher the fat-free mass of a player, the stronger the hit. This can be explained by the greater body mass of female volleyball players.

CONCLUSIONS AND PRACTICAL APPLICATION

The study conducted enabled the researchers to draw conclusions about the anthropometric and power characteristics of the participating group of highly skilled female volleyball players. Body height observed in the examined players differed and was related to their court position. Such dependency is typical for volleyball players. The tallest players took middle position, followed by strikers, receivers and setters. The shortest were libero players. In

comparison to the attackers and setters, the receivers, middle and libero players were characterised by better jumping skills. The height of CMJ attained by the examined players indicated a significant correlation only with the ectomorphy component. The power of the lower limbs was related significantly to the shoulder girdle girth and features describing bone mass. These findings could enable coaches to individualise and determine suitable training methods, depending on the somatic predisposition of an athlete.

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PHYSICAL FITNESS CLASSIFICATION STANDARDS FOR POLISH EARLY EDUCATION TEACHERS

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ABSTRACT

This study determined the general fitness level of female early education teachers (EETs) (N=217) based on fitness test standards, and compared the results with those of preschool children (N=700), early elementary school children (n=1306) and female early education university students (FEEUSs) (N=303) in Poland. All participants were subjected to height and weight measurements and their BMI scores were determined. Based on eight motor fitness tests, the general physical fitness level of EETs was 'average', based on the classification standards in Podstawski's Test. The scores of the EETs were 'poor' in three motor tests, 'average' in four tests and 'good' in only one test. The EETs scores were significantly poorer than early elementary school children in 4x10m shuttle run, sit-ups in 30s, bent arm hang on bar and a 1-minute Burpee test. The results of the EETs were significantly below those of FEEUSs in the standing long jump, 4x10m shuttle run, sit-ups in 30s, medicine ball backward throw and downward bend from astanding position. Physical fitness plays a very important role in the daily work of EETs. Recruitment principles for early education programmes should be revised to include fitness tests and early education curricula should be expanded to include physical education classes.

Key words: Early education teachers (EETs); Female university students; Six- to nine-year-olds; General physical fitness; Classification standards.

INTRODUCTION

Physical fitness is one of the key indicators of biological and motor development, as well as human health. The concept of physical fitness has been researched extensively in physical education and exercise science. Health-Related Fitness (H-RF) has recently emerged as the most effective approach to achieving the optimal quality of life. According to the H-RF concept, a physically fit person should be characterised by high levels of cardio-respiratory

endurance, vigour, positive relations with other people, healthy body fat levels, high levels of muscular strength and flexibility and a healthy lower back (lumbo-sacral region of the spine) (Howley & Franks, 1997).

Although the definition of and assessment criteria for physical fitness have been revised in the past two decades (Szopa *et al.*, 1998; Raczek, 2010), physical fitness tests are still very important in evaluating motor skills development in children (Bénéfice & Ndiaye, 2005; Tudor *et al.*, 2009; Podstawski & Borysławski, 2012), adolescents (Tomkinson, 2007; Houtari *et al.*, 2009), and their contribution to sport training (Mikulić & Ružic, 2008; Gabbett, 2009).

Most research studies investigate general fitness levels at various stages of ontogenetic development and the influence of physical activity on fitness levels (Pangrazi *et al*., 1996; Prista *et al.*, 1997; Boreham & Riddoch, 2001; Corbin, 2002; Podstawski, 2006; Kovac *et al.*, 2012). Longitudinal studies (Hands, 2008; Bürgi *et al*., 2011) and cross-sectional studies (Yagi *et al.*, 1989; Claessens & Lefevre, 1992; Tomkinson, 2007), conducted on various populations and over different time periods (a decade) contribute very valuable data. A steady increase in the incidence and prevalence of lifestyle diseases and a progressive decrease in physical activity levels contribute to the relevance of these research studies. In some cases, research findings are the only diagnostic tool for health forecasting in selected human populations (Wolański *et al.*, 1992).

Fitness evaluations are performed in various populations, and physical fitness is analysed based on different criteria. The only occupational group whose fitness level was investigated to a limited degree are physical education teachers (PETs) and early education teachers (EETs) who are nearly completely responsible for physical education in Polish kindergartens and elementary schools. This deficiency stands in contradiction to the very nature and purpose of physical educators' work. PETs and EETs can instil a positive attitude towards the body and physical activity in children and adolescents, thus motivating students to become more physically active. Teachers need extensive theoretical knowledge and years of practical experience to promote physical fitness effectively among preschool children and early elementary school students (Graham *et al.*, 2004; Mitchell *et al*, 2006). According to the National Standards for Physical Education, which have been created by the Michigan Department of Education (2004) and the National Association for Sport and Physical Education (2008), a physically educated person should:

- demonstrate competency in motor skills and movement patterns needed to perform a variety of physical activities;
- demonstrate understanding of movement concepts, principles, strategies and tactics as they apply to the learning and performance of physical activities;
- participate regularly in lifelong physical activity;
- achieve and maintain a health-enhancing level of physical fitness;
- exhibit responsible personal and social behaviour that respects self and others in physical activity settings; and
- value physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

Above all, a physical education (PE) teacher should demonstrate a high level of physical fitness because in preschool and early elementary schoolchildren, the attitudes towards sport and physical activity are shaped through visual rather than verbal stimuli (Melville, 1999; Cardinal, 2001). In PE classes, children learn new movements by imitating the teacher whose movements should be smooth and harmonised and who should perform the demonstrated physical activities with ease (Ziegler, 2003). Children develop locomotor (movement with change of position), non-locomotor (movement without change of position), and manipulative (object handling) skills in preschool age (Hraski *et al*., 2011). Preschool children develop awareness that physical activity affects their bodies, deliver health benefits, improve social opportunities and contributes to the quality of life (Ziegler, 2003; Castelli & Williams, 2007).

The PE teacher (Manross & Templeton, 1997) should instil this knowledge in their students. Physical education teachers, who have poor motor skills and are overweight/obese, evoke a negative response in students and are not considered role models for PE (Melville & Maddalozzo, 1988; Melville & Cardinal, 1997). This theory was confirmed by Archibald *et al*. (2009) who examined pre-service teachers' game performance competencies in soccer, basketball and volleyball, and observed that highly skilled teacher candidates demonstrated more effective teaching practices than lower skilled candidates.

There are no studies comparing the physical fitness levels of PETs and EETs with those of schoolchildren and adolescents. The fitness levels of both teacher groups have been rarely investigated, but the correlations between PETs' qualifications and performance during PE classes have been analysed by a number of studies. According to applicants planning to study PE, a PE teacher should be characterised by a love of sport and physical activity (Dodds *et al.*, 1992; Smith, 1993). He/she should demonstrate an adequate level of physical fitness and serve as a role model for the students (Melville & Cardinal, 1997; Pagnano & Langley, 2001).

Physical education teachers that have low motor skills and game performance skills could have a negative impact on PE programmes, and they are unlikely to promote the development of physically educated individuals. PETs that lack the required skills and fitness will not provide their students with adequate demonstrations, accurate analysis or comprehensive feedback. In the worst-case scenario, those educators may not teach such content at all. PETs' motor skills and fitness levels lend credibility to their content knowledge. Research indicates that PETs' motor skill competence plays a key role in developing children's physical fitness levels into adulthood (Stodden *et al.*, 2009). Physically fit children often want to test their skills by competing with the teacher. They encourage PETs to demonstrate their motor skills and are strict critics of the teacher's performance (Ferrari, 1996; McAlister *et al*., 2008). This process brings to mind the „master and pupil‟ relationship.

MOTIVATION FOR STUDY

An evaluation of the physical fitness level of EETs and its comparison with those of preschool children, early elementary schoolchildren and female early education university students (FEEUSs) would provide highly interesting and valuable insights. These findings could be applied to reverse the progressive decrease in physical activity among children (Ara

et al., 2007) and adolescents (Powell *et al.*, 2006). The results could also contribute to the development of new physical fitness standards for EETs.

PURPOSE OF RESEARCH

The objective of this study was to evaluate the level of general physical fitness in female EETs based on fitness test standards, and to compare the results with those achieved by preschool children (6-year-olds), early elementary school students (7- to 9-year-olds) and FEEUSs (19- to 20-year-olds) from the University of Warmia and Mazury in Olsztyn, Poland.

METHODOLOGY

Participants

Physical fitness tests were conducted with 12 kindergarten groups and 14 elementary school groups and among first-year, full-time EEFUSs from the University of Warmia and Mazury in Olsztyn (UWM). EETs participated in fitness evaluations at the workplace (40 kindergarten and 50 elementary school teachers). Tests were conducted in kindergarten classes and schools in rural areas, small towns, medium-sized towns and big cities in the Region of Warmia and Mazury to ensure that the participants' socio-economic status was broadly represented. The study was performed in the Region of Warmia and Mazury in north-eastern Poland (Figure 1).

FIGURE 1. **REGION OF WARMIA AND MAZURY IN POLAND**

The participants were 700 kindergarten pupils (Girls=367; Boys=333) with a mean age of 5.80 years, 1306 early elementary school pupils with a mean age of 7.99 years (Grade 1: 225 girls & 201 boys; Grade 2: 219 girls & 213 boys; Grade 3: 233 girls & 215 boys), 303 first-year full-time female students of the UWM with a mean age of 19.01 years and 217 certified and professionally active EETs with a mean age of 26.24 years.

A total of 96% pupils from the evaluated kindergartens and elementary schools participated in the fitness tests. Only pupils who were absent on the day of the evaluation were not

included in the study. Early education teachers that were excused from PE classes for medical reasons or were not willing to participate in the study did not perform the fitness tests. Of the group of 721 EETs who were invited to participate in the study, 167 were medically certified or had permanent damage to locomotor organs and 337 women refused to participate without stating a reason and thus did not partake in the testing.

The study involved preschool children and early elementary school pupils attending obligatory PE classes (three 45-minute classes per week) who did not perform any additional forms of physical activity. Students involved in extracurricular physical activities were not chosen for the study because their performance could significantly skew the results. Early education students of the UWM attended obligatory PE classes at university (two 45-minute classes per week). The analysed population was large, therefore, the obtained data can be regarded as representative of the focus groups.

Ethical clearance

The Bioethics Committee of the University of Warmia and Mazury in Olsztyn approved the study, which did not violate the principles of the analysed kindergartens and schools, or affect the safety of the evaluated students and teachers. The study was conducted according to the WMA (World Medical Association) Declaration of Helsinki.

Measurement instruments

The participants were subjected to *height* and *weight* measurements, and the results were used to calculate their BMI. The BMI scores of adults were evaluated based on WHO guidelines (WHO, 2000), and the scores of preschool and early elementary school pupils were processed in accordance with the international standards developed by Cole *et al*. (2007). The results obtained by the participants in individual motor competence tests constituted dependent variables.

Motor abilities were evaluated in eight motor competence tests: *standing long jump* (cm), *4x10m shuttle runs* (sec.), *skipping with hand clapping* in 8sec. (number of claps), *sit-ups in 30sec.* (number of sit-ups), *medicine ball* (2kg & 4kg) *backward throw* (cm), *bent arm hang* on bar (sec.), *downward bend from standing position* (cm), and *1-minute Burpee test* (number of cycles). The accuracy and reliability of each motor test has been confirmed by numerous studies (Pilicz, 1997; Szopa *et al.*, 1998).

All motor skill tests were conducted in the gym facilities of kindergartens, elementary schools and the UWM to ensure that all participants were tested in similar conditions. Children from two kindergartens were tested in the gyms of nearby elementary schools that also participated in the study. Motor skill tests were administered by all co-authors who were assisted by female EETs responsible for the evaluated groups of preschool children and elementary school pupils.

The tests were always administered in the same order, starting with the coordination tests, through agility, speed, flexibility and strength tests, and ending in strength-endurance tests.

The physical fitness level of EETs was evaluated based on the classification standards of Podstawski's Test (5-point grading scale: unsatisfactory, poor, average, good, very good), and score tables developed for a T-scale (Podstawski, 2006). The tables were used to score every

fitness test separately. The classification standards of Podstawski's Test were developed based on the results of female university students who, similar to EETs, were residents of the Region of Warmia and Mazury.

Both the pupils and EETs were also classified in the same developmental stage. Every participant was instructed on the proper technique of executing the given motor tasks during lessons preceding the actual tests and were given time to practise them. The project manager, who demonstrated the proper technique of performing each exercise, instructed the EETs and they were allowed to practise on their own. The participants took part in a 10-minute warm-up routine before the testing commenced. The warm-up routine was identical for all groups, and it comprised selected physical exercises and movement patterns, including jogging, wrist, elbow and arm circles, leg swings, jumps, balance exercises, front hold exercises, two 20-meter dashes, dynamic stretching and corrective drills (Frandkin *et al.*, 2010). The study was conducted in March, in the summer of the 2011/2012 academic year.

Statistical analysis

The results were processed in the Statistica PL v. 10 application using the descriptive statistics module and the Mann-Whitney U-test for two independent samples at the significance level of α=0.05. When the probability that the calculated value would be exceeded was smaller than the adopted significance level ($p<0.05$), the differences between the analysed groups for a given fitness test were regarded as significant.

RESULTS

The participants' height, weight and BMI scores are presented in Table 1. Fitness test scores based on the classification standards of Podstawski's Test are given in Table 2. The differences in test scores between groups are presented in Tables 3 and 4. In line with the research objective, the description of results focused on analysing EETs' scores and comparing them with the performance of the other groups.

The results presented in Table 1 indicate that EETs' *weight*, *height* and *BMI* scores were significantly higher than the values reported for preschool children, early elementary school students and first-year female university students. EETs' average BMI scores (25.16 kg/m^2) placed them in the overweight category.

Based on the classification standards of Podstawski's Test (Podstawski, 2006) (Table 2), EETs received „poor" scores in 3 motor tests (standing long jump, sit-ups in 30sec., 1-minute Burpee test), „average" scores in 4 tests (skipping with hand clapping, bent arm hang on bar, medicine ball backward throw, downward bend from standing position), and a „good" score in only 1 test (4x10m shuttle run). Their average overall score was 373 points, which is indicative of an average level of physical fitness (330-460 points) (Podstawski, 2006:54).

TABLE 1. **BODY HEIGHT, BODY WEIGHT AND BMI SCORES**

Participant groups	N	Mean±SD (min–max) Age (years)	Weight (kg)	Height (cm)	BMI (kg/m^2)
a. Preschool girls	367	5.79±0.405 (5.07–6.06)	18.82±1.988 (15.00–26.00)	117±3.692 (107–126)	13.64±1.182 (11.91–18.90)

b. Preschool boys	333	5.81±0.394 (5.07–6.06)	22.67±2.260 (17.40–9.00)	119±4.174 (112–128)	15.99±1.378 (12.98–20.48)
c. Grade 1 girls	225	6.99±0.120 (6.00–7.00)	24.76±5.327 (18.00–41.00)	124±7.727 (111–152)	16.12±2.387 (11.48–24.96)
d. Grade 1 boys	201	6.97±0.192 (6.00–8.00)	27.20±6.038 (18.00–50.90)	126±7.569 (111–152)	17.11±2.701 (13.01–30.59)
e. Grade 2 girls	219	7.98±0.193 (7.00–9.00)	28.33±6.200 (20.00–53.00)	131±5.921 (118–147)	16.48±2.653 (11.39–24.78)
f. Grade 2 boys	213	7.99 ± 0.200 (7.00–9.00)	30.30±7.010 (18.70–52.00)	134±5.935 (113–152)	16.82±3.271 (11.35–30.59)
g. Grade 3 girls	233	9.00±0.188 (8.00–10.00)	31.56±5.451 (22.00–52.10)	135±6.044 (122–155)	17.24±2.385 (12.72–29.27)
h. Grade 3 boys	215	9.02±0.187 (8.00–10.00)	34.10±7.031 (20.10–59.60)	137±6.176 (116–155)	18.14±2.856 (13.40–25.08)
i. 1st yr fem. students	303	19.01±0.244 (18.00–20.00)	61.33 ± 6.501 (49.20–89.50)	160±8.130 (146–183)	24.18±3.575 (17.30–39.78)
j. EETs female	217	26.24±1.679 (23.00–31.00)	68.22±9.330 (49.00–101.00)	164±7.654 (149–192)	25.16±2.465 (19.14–32.81)
Significance (Mann-Whitney U-test):		– for body weight: j > a, b, c, d, e, f, g, h, i, **			
		– for body height: j > a, b, c, d, e, f, g, h, i, **			
		– for BMI: j > a, b, c, d, e, f, g, h, i, **			

* p<0.05 ** p<0.01

TABLE 2. **GENERAL PHYSICAL FITNESS OF EETs**

Motor test	**EETs' Mean±SD (min-max)**	**Podstawski Score**
Standing long jump (cm)	134.90±11.26 (91–171)	32 (poor)
4 x 10 m shuttle run (sec.)	13.68±0.76 (11.78–16.07)	67 (good)
Skipping with clapping in 8 sec. (No. of claps)	24.11±2.91 (11–33)	57 (average)
Sit-ups in 30sec. (No. of sit-ups)	14.78±4.08 (0–25)	36 (poor)
Bent arm hang on bar (sec.)	5.36±3.60 (0–18.91)	44 (average)
Medicine ball (4 kg) backward throw (cm)	633.69±84.42 (320–890)	51 (average)
1-minute Burpee test (No. of cycles)	17.90±3.36 (9–25)	39 (poor)
Downward bend from standing (cm)	9.51±4.76 (-14–18)	47 (average)
	General physical fitness	373 (average)

TABLE 3. **ANALYSIS OF VARIANCE OF TEST SCORES: FOUR TESTS**

Tests & Groups	**Mean±SD (min–max)**	**Analysis of variance**	
Standing long jump [cm]			
Female teachers	134.90±11.258 (91.0–171.0)	**Z**	**p**
Preschool girls	84.64±19.624 (24.0–147.0)	19.4572	0.0000

Preschool boys	95.28±17.564 (39.0–146.0)	19.1704	0.0000
Grade 1 girls	92.35 ±18.396 (50.0–140.0)	17.4700	0.0000
Grade 1 boys	105.76±22.049 (50.0–170.0)	13.8471	0.0000
Grade 2 girls	108.28±18.569 (62.0–181.0)	14.8027	0.0000
Grade 2 boys	115.37±19.787 (75.0–162.0)	10.5274	0.0000
Grade 3 girls	106.58±24.260 (60.0–167.0)	12.6841	0.0000
Grade 3 boys	132.53±23.755 (79.0–190.0)	0.4574	0.6473
First-year female students	162.74±17.637 (111.0–211.0)	-16.0013	0.0000
4 x 10 m shuttle run [s]			
Female teachers	13.68±0.760 (11.78–16.07)	**Z**	**p**
Preschool girls	17.66±1.847 (13.67–26.00)	-19.8487	0.0000
Preschool boys	16.56±1.497 (13.00–21.00)	-18.2440	0.0000
Grade 1 girls	13.45±1.656 (10.70–19.06)	1.8915	0.0586
Grade 1 boys	13.13±1.709 (10.40–19.30)	5.1913	0.0000
Grade 2 girls	13.58±1.419 (10.50–18.06)	1.8517	0.0641
Grade 2 boys	12.86±1.572 (9.70–19.00)	7.7485	0.0000
Grade 3 girls	13.55±2.017 (9.30–21.00)	-0.5898	0.5553
Grade 3 boys	12.66±1.872 (8.80–19.56)	9.3230	0.0000
First-year female students	12.61±0.906 (10.28–15.87)	12.5649	0.0000
Skipping + hand clap in 8s	*[no. of claps]*		
Female teachers	24.11±2.914 (11–33)	Z	p
Preschool girls	12.69±2.738 (0–22)	19.9127	0.0000
Preschool boys	12.17±3.829 (0–21)	19.5132	0.0000
Grade 1 girls	15.48±3.804 (6–29)	16.4913	0.0000
Grade 1 boys	16.44±5.514 (4–41)	14.5039	0.0000
Grade 2 girls	18.50±5.017 (7–41)	13.6013	0.0000
Grade 2 boys	18.52±4.363 (11–30)	12.5396	0.0000
Grade 3 girls	19.27±7.014 (3–47)	11.4727	0.0000
Grade 3 boys	19.36±6.705 (4–44)	10.2757	0.0000
First-year female students	23.75±3.063 (16–36)	1.0941	0.2739

continued

TABLE 3. **ANALYSIS OF VARIANCE OF TEST SCORES: FOUR TESTS *(cont.)***

Tests & Groups	**Mean±SD (min–max)**	**Analysis of variance**	
Sit-ups 30s [no. sit-ups]			
Female teachers	14.78±4.084 (0–25)	**Z**	**p**
Preschool girls	6.70±3.948 (0–18)	17.1812	0.0000
Preschool boys	5.89±4.552 (0–17)	16.6956	0.0000

Grade 1 girls	11.82±4.958 (0–25)	6.5941	0.0000
Grade 1 boys	11.98±5.023 (0–27)	5.6563	0.0000
Grade 2 girls	15.49±5.892 (0–34)	-1.4698	0.1416
Grade 2 boys	15.53±5.514 (2–28)	-1.2473	0.2123
Grade 3 girls	17.18±5.799 (3–35)	-4.0722	0.0000
Grade 3 boys	18.53±4.656 (0–34)	-8.4756	0.0000
First-year female students	18.43±3.795 (7–27)	-9.4577	0.0000

z = standard score p = probability that the calculated value will be exceeded

The results of the analysis of variance for the *standing long jump*, *4x10m shuttle run*, *skipping with hand clapping* and *sit-ups in 30sec.* are presented in Table 3. A statistical analysis (Mann-Whitney U-test) revealed that EETs scored significantly higher (p=0.0000) than 6-year-old girls (by 50.26cm), 6-year-old boys (by 39.62cm), Grade 1 girls (by 42.55cm), Grade 1 boys (by 29.14cm), Grade 2 girls (by 26.62cm), Grade 2 boys (by 19.53cm), Grade 3 girls (by 28.32cm). No significant differences in results were noted between EETs and Grade 3 boys (p=0.6473). EETs scored significantly below (p=0.0000) the first-year female students (by 27.84cm) (Table 3).

In the *4x10m shuttle run*, EETs scored significantly higher (p=0.0000) than 6-year-old girls (by 3.98sec.) and 6-year-old boys (by 2.88sec.). No significant differences were reported between EETs and Grade 1 girls (0.23sec.), Grade 2 girls (0.1sec.) or Grade 3 girls (0.13sec.). The results scored by EETs were significantly below (p=0.0000) those of Grade 1 boys (by 0.55sec.), Grade 2 boys (by 0.82sec.), Grade 3 boys (by 1.02sec.) and first-year female students (by 1.07sec.) (Table 3).

The results scored by EETs in the *skipping with hand clapping* test were significantly higher (p=0.0000) in comparison with all preschool children and early elementary school students (Grades 1 to 3). No significant differences (p=0.2739) were observed between EETs and first-year female students (0.36 claps). In the *sit-ups* test, EETs scored significantly better results (p=0.0000) than preschool girls and boys (difference of 8.08 and 8.89 sit-ups, respectively) and Grade 1 girls and boys (difference of 2.96 and 2.8 sit-ups, respectively). No significant differences were noted between EETs and Grade 2 girls (p=0.1416) or Grade 2 boys (p=0.2123). EETs scored significantly below (p=0.0000) Grade 3 girls and boys (difference of 2.4 and 3.75 sit-ups, respectively), and first-year female students (3.65 sit-ups) (Table 3).

TABLE 4. **ANALYSIS OF VARIANCE OF TEST SCORES: 2nd FOUR TESTS**

Tests & Groups	**Mean±SD (min–max)**	**Analysis of variance**	
Bent arm hang on bar [s]			
Female teachers	5.36±3.599 (0–18.91)	**Z**	**p**
Preschool girls	6.64±6.125 (0–37)	-1.3997	0.1616
Preschool boys	4.99±4.012 (0–17)	1.8753	0.0607
Grade 1 girls	3.51±3.055 (0–15)	5.8746	0.0000
Grade 1 boys	5.14±4.847 (0–23)	1.8905	0.0587
Grade 2 girls	7.46±6.061 (0–36)	-3.8133	0.0001

Grade 2 boys	7.33±5.354 (0–30)	-3.8965	0.0001
Grade 3 girls	8.39±10.385 (0–62)	-0.8872	0.3750
Grade 3 boys	12.05±13.396 (0–82)	-5.7365	0.0000
First-year female students	5.97±3.966 (0–51.34)	0.9535	0.3403
Med. ball backw. throw [cm]			
Female teachers	633.69±84.416 (320–890)	**Z**	**p**
Preschool girls	125.79±33.819 (70–216)	20.2088	0.0000
Preschool boys	154.04±38.898 (70–287)	19.8349	0.0000
Grade 1 girls	176.91±88.949 (40–530)	18.1397	0.0000
Grade 1 boys	206.32±79.177 (70–540)	17.6269	0.0000
Grade 2 girls	268.90±74.180 (80–467)	17.9923	0.0000
Grade 2 boys	301.82±95.529 (100–570)	17.5971	0.0000
Grade 3 girls	249.84±97.249 (86–530)	18.1800	0.0000
Grade 3 boys	375.91±114.529 (70–690)	16.5235	0.0000
First-year female students	692.25±137.019 (350–1080)	-4.7290	0.0000
1min Burpee test [no. cycles]			
Female teachers	17.90±3.358 (9–25)	Z	p
Preschool girls	14.64±3.036 (6–24)	10.7550	0.0000
Preschool boys	15.96±4.706 (7–56)	7.2620	0.0000
Grade 1 girls	14.69±3.464 (5–32)	9.3772	0.0000
Grade 1 boys	13.43±4.296 (4–29)	10.5074	0.0000
Grade 2 girls	18.89±5.421 (8–36)	-0.3580	0.7203
Grade 2 boys	19.92±6.623 (6–37)	-2.5007	0.0123
Grade 3 girls	19.27±6.317 (7–35)	-1.2887	0.1975
Grade 3 boys	21.56±5.950 (7–45)	-7.1531	0.0000
First-year female students	17.81±2.857 (10–34)	0.5842	0.5591

continued

TABLE 4. **ANALYSIS OF VARIANCE OF TEST SCORES: 2nd FOUR TESTS *(cont.)***

Tests & Groups	**Mean±SD (min–max)**	**Analysis of variance**	
Down bend from stand.[cm]			
Female teachers	9.51±4.757 (-14–18)	**Z**	**p**
Preschool girls	1.80±4.010 (-22–10)	7.3019	0.0000
Preschool boys	0.76±3.645 (-20–11)	9.6537	0.0000
Grade 1 girls	1.52±5.674 (-28–16)	6.0970	0.0000
Grade 1 boys	0.29±5.024 (-20–10)	8.3151	0.0000
Grade 2 girls	-0.89±6.637 (-16–18)	8.9922	0.0000
Grade 2 boys	-0.59±5.526 (-21–16)	9.6337	0.0000

Grade 3 girls	1.63±6.316 (-15–21)	5.6976	0.0000
Grade 3 boys	0.53±5.217 (-27–14)	7.9317	0.0000
First-year female students	6.42±4.801 (-9–21)	-3.6556	0.0003

z = standard score p = probability that the calculated value will be exceeded

Early education teachers scored significantly higher (p=0.0000) in the *bent arm hang on bar* test in comparison with Grade 1 girls (by 1.85cm), whereas the differences observed between EETs and preschool girls (p=0.1616), preschool boys (p=0.0607), Grade 1 boys (p=0.0587), Grade 3 girls (p=0.3750) and first-year female students (p=0.3403) were not statistically significant. EETs' results were significantly below (p=0.0001) those scored by Grade 2 girls (by 2.1cm), Grade 2 boys (by 1.97 cm) and Grade 3 boys (p=0.0000, by 6.69 cm). In the *medicine ball backward throw* test, EETs performed significantly (p=0.0000) better than preschool children and early elementary school pupils, but significantly poorer (p=0.0000) than first-year female students (by 58.56cm) (Table 4).

In the *1-minute Burpee* test, the results scored by EETs were significantly higher (p=0.0000) than those noted in the group of preschool children (girls by 3.26 cycles; boys by 1.94 cycles) and Grade 1 students (girls by 3.21 cycles; boys by 4.47 cycles). No significant differences were observed between EETs and Grade 2 girls (p=0.7203), Grade 3 girls (p=0.1975) and first-year female students (p=0.5591). EETs performed significantly worse than Grade 2 boys (p=0.0123, by 2.02 cycles) and Grade 3 boys (p=0.0000, by 3.66 cycles) (Table 4). In the *downward bend* test, EETs scored significantly better results than preschool children did (p=0.0000), early elementary school pupils (p=0.0000) and first-year female university students (p=0.0003) (Table 4).

DISCUSSION

The physical fitness level of university students enrolled in early education programmes is insufficient to teach PE to children. The existing programmes do not provide future educators with sufficient practical skills in PE. In the vast majority of cases, the future EETs' exposure to physical culture is limited to obligatory PE classes at university. Many students are excused from PE classes for medical reasons, and some may even have physical disabilities (Podstawski & Borysławski, 2014).

Low student recruitment criteria and narrow PE curricula contribute to low levels of competence and physical fitness among EETs. The hiring of PETs with insufficient fitness levels is highly detrimental to education, but unfortunately it is increasingly observed in school practice (Patton *et al.*, 2009). The role of PE, which received priority treatment in the early 20th century, seems to have declined in the modern schooling system (Sargent, 1900). The above observations were confirmed by the results of this study, which demonstrated that the general fitness level of EETs was average and, in some cases, similar to or significantly lower than that of early elementary school (Grades 1 to 3) pupils or even preschool children.

Some of the differences or the absence of differences between EETs and the pupils are easy to explain. Early education teachers can be expected to score significantly better than the preschool, as well as early elementary school pupils, in tests such as medicine ball backward

throw where body height and weight play a key role (Stockbrugger & Hannel, 2001; Mayhew *et al.*, 2005). A reverse correlation was noted in the bent arm hang test where low body weight is a critical success factor (Milanese, *et al.*, 2010; Podstawski & Borysławski, 2012; Sheikh *et al.*, 2012). Early education teachers scored significantly poorer in the bent arm hang test because they were significantly heavier than the other participants were. Their body weight also negatively influenced their endurance and speed, as demonstrated by the results of the 1-minute Burpee test.

The fact that EETs scored significantly better than preschool and early elementary school children in the skipping with hand clapping test can also be logically justified. The above trial measures coordination ability (Mynarski, 2000), and a temporarily stagnant period in the development of motor coordination is noted in 7- to 10-year-olds (28% of girls and 22% of boys), whereas around 10% of children from the above age group may even experience regression (Hirtz, 1998). The motor coordination ability of 6-year-olds is very poorly developed in comparison with EETs (Bardaglio *et al.*, 2012; Leversen *et al.*, 2012).

In line with the principles of ontogenetic development, motor abilities increase steadily from childhood (7-9 years) and begin to decrease at the end of young adulthood (19-25 years) until old age (66-80 years) and death (Leversen *et al*, 2012). The highest level of motor competence is noted at the age of 20-30 years (Wilmore *et al.*, 2008), therefore, the fitness level of the analysed EETs could be expected to be significantly higher than those of preschool and early elementary school children and similar to that of first-year female students. In addition to motor skills, physical fitness also involves movement skills (Raczek, 2010), which should be acquired by early education students in different sport disciplines during a degree programme. The majority of PE students are highly physically active and fit individuals who score much higher results than those reported for the EETs in this study (Boraczyński & Boraczyńska, 2009; Hraski *et al*., 2011; Wasiluk, 2011) and other students of Polish universities (Lisicki, 2004). For this reason, PE curricula for EETs should be expanded to include various sport disciplines and forms of physical activity.

It is highly probable that women's physical fitness deteriorates significantly after university graduation due to a lower level of participation in physical activity. This was reported about

Flemish (Duvigneaud *et al.*, 2007) and American women (Church *et al.*, 2007), who did not aspire to become PE teachers. The low fitness level limits the teacher's ability to correctly demonstrate many exercises in class or set a positive example for the students (Zeigler, 2003). Teachers who do not have the required physical skills are unable to conduct the class in an interesting and effective manner, and they fail to foster positive changes in a child's motor development (Melville & Cardinal, 1997; Pagnano & Langley, 2001), in particular, when obligatory PE classes are the only form of physical activity in which children engage. A study in 2008 demonstrated that children taught by qualified PETs (graduates of a five-year university course in PE) were characterised by a significantly higher level of physical fitness than those exercising with EETs (Podstawski & Borysławski, 2014).

In the 1960s, attempts were made to raise the rank of PE in elementary schools in Poland, but they failed to produce the anticipated results (Jaworski, 2012). This was the result of a shortage of university graduates with a degree in PE (which was required to teach PE classes in Polish schools at the time), most of whom were employed in secondary schools. Today, PE graduates find it difficult to find employment in elementary schools because PE classes in

Grades 1 to 3 are taught by EETs (Jaworski, 2012). As part of the integrated learning system in Grades 1 to 3, the same teacher teaches PE and other subjects. In Grades 1 to 3, 99% of teachers are women, and only 9% of them are fully qualified to teach PE (SIO DATA, 2009).

LIMITATIONS

One of the limitations of this study was the absence of publications analysing the level of physical fitness in PETs. Although this drawback contributes to the significance of our research, it prevents us from comparing the current results with other findings. The study covered only the Region of Warmia and Mazury. Our research should be continued in other Polish regions to produce reliable and comparable results. It should also be noted that 167 out of the 721 women (23.16%) who were invited to participate in the study were unable to perform any physical exercise due to medical certification or permanent damage to locomotive organs. Those results significantly deteriorated the general fitness level of EETs who took part in the study. A similar percentage (25%) of women with permanent disabilities was noted in a preliminary study, which revealed the lowest (unsatisfactory) level of motor competence in the majority of EETs tested (Podstawski *et al.*, 2013).

Physical fitness standards for Podstawski's Test were developed based on the results of women for whom, in the majority of cases, obligatory PE classes were the only form of physical activity (Podstawski, 2006). The International Committee on the Standardisation of Physical Fitness Tests (ICSPFT) (Pilicz *et al*., 2002) and Eurofit (Adam *et al*., 1988) applied similar principles in the process of developing test norms. New and more appropriate physical fitness standards should be proposed for EETs and qualified teachers who are PE graduates.

CONCLUSIONS

The average results scored by EETs in eight motor tests indicate that the teachers were characterised by an average level of general physical fitness (on a five-point grading scale). The results obtained by EETs in selected tests were significantly below those scored by early

elementary school pupils (4x10m shuttle run, sit-ups in 30s, bent arm hang on bar, 1-minute Burpee test) and first-year female university students (standing long jump, 4x10m shuttle run, sit-ups in 30s, medicine ball backward throw, downward bend from standing position). Physical fitness plays a very important role in the daily work of EETs. The average physical fitness level and a high rate of sick leave among EETs are an indication of:

- low level of physical activity in the evaluated group of teachers;
- the need for revised recruitment principles for early education programmes, including fitness tests; and
- the need to expand early education curricula to include PE classes.

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SUID-AFRIKAANSE SOLDATE EN HUL SPORT TYDENS DIE EERSTE WÊRELDOORLOG

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ABSTRACT

For many service men in the period 1914-1918/19, sport was a distraction from the terrors of the war, provided essential amusement and served as a link between the front and the respective civilian homes of the service men. This wartime sport was based on two strong and converging traditions, the well-known obsession with sport among the British civilian masses and the sporting tradition adopted by the British forces since 1914. As Britain largely made use of a citizen army, they introduced many civilian customs to humanise the new life at the front. Sport did not benefit only the individual soldier, but also the army as a whole. Until then, sport had been pursued unofficially and widely, but then became formally integrated into the British military system. This article investigates the following questions: To what extent did the troops and prisoners of war experience a need to participate in sport under conditions of war? Which sports and games were played? What role did the relevant environments play in these activities? To what extent did the military authorities influence the sporting activities? Was sport an instrument of cultural and social change?

Key words: World War I; Sport; Britain; South Africa; Prisoners of war; Military.

INLEIDING

Met die naderende eeufeesviering ter gedagtenis aan die uitbreek van die Eerste Wêreldoorlog kan hierdie onderwerp as aktueel beskou word, veral in die lig van die feit dat sporthistorici sportdeelname tydens oorlogvoering tot onlangs toe nog geïgnoreer het. Algemene sekondêre bronne wat die Eerste Wêreldoorlog breedvoerig bespreek, verswyg gewoonlik die aanwesigheid van sport en spele en die groot rol wat dit aan en agter die fronte sowel as in die krygsgevangekampe, gespeel het. Tony Mason en Eliza Riedi vat dit soos volg saam:

> "If the more mainstream military historians have tended to neglect the social fabric of military life, a new generation, influenced by the wider developments of social and cultural history, has begun to explore this important area of wartime experience. Nevertheless, the „behind-the-lines" experience – and the part sport played in it – has, despite the *Field*"s optimistic prediction, been less examined." (Mason & Riedi, 2010:82)

Daar was wel die afgelope dekade in Engeland en Frankryk "n oplewing in navorsing en publikasies oor sport tydens die Eerste Wêreldoorlog. Hierdie artikel behels die slotbevindings van "n omvattende ondersoek na Suid-Afrikaanse soldate en hul sport tydens die Eerste Wêreldoorlog. In dié oorlog het die meeste van die Suid-Afrikaanse soldate in eenhede, oftewel "Imperial Service Units", gedien, wat bedekte Suid-Afrikaanse eenhede was. "n Groot gros troepe het egter ook in verskeie ander imperiale eenhede diens gedoen.

NAVORSINGSVRAE

Hierdie navorsing moes poog om antwoorde op die volgende vrae te vind, naamlik: In welke mate het die soldate en krygsgevangenes "n behoefte aan sport ervaar? Watter sport en spele is beoefen? Watter uitwerking het die geografiese omgewing op hierdie aktiwiteite gehad? In watter mate het die militêre owerhede hierdie aktiwiteite beïnvloed? Was sport "n instrument vir kulturele en sosiale verandering?

AFBAKENING EN INLIGTINGSBRONNE

Die historikus maak gebruik van amptelike publikasies, foto materiaal, memoirs en onderhoude om die geskiedenis so getrou moontlik te probeer rekonstrueer. Van hierdie primêre bronne is kontemporêre briewe en dagboeke "n uitstekende bron van inligting. Dit is "n spontane, eerlike en onopgetofte bron (Laffin, 1973:2-3), maar selfs dan hang dit af van die skrywer se eie betrokkenheid by en liefde vir sport hoeveel aandag hy aan hierdie aspek gewy het.

Die leemte wat in die sporthistoriografie bestaan rakende Suid-Afrika se betrokkenheid by die Eerste Wêreldoorlog en waaraan derhalwe aandag gegee is, is die sportaktiwiteite van die Suid-Afrikaanse soldate en krygsgevangenes. Sport, wat in sy wydste vorm vertolk word en aktiwiteite soos kaart- en bordspele insluit, het die kern van die ondersoek gevorm. Ander vorms van vermaak soos toneelspel, musiek, lees en debatvoering is nie aangeraak nie.

Die studie is beperk tot veldtogte en streke waar die grootste konsentrasie Suid-Afrikaanse soldate en krygsgevangenes hulle bevind het. Dit behels Duits-Suidwes-Afrika, Duits-Oos-

Afrika, Noord-Afrika, die Midde-Ooste, Vlaandere en Frankryk, asook die krygsgevange-kampe in Afrika en Duitsland. Die opleidingstydperk van die Suid-Afrikaanse troepe in Engeland word ook ingesluit. Die tydperk gedek, is vanaf Suid-Afrika se toetrede tot die oorlog in Augustus 1914 tot en met die demobilisasietydperk (middel 1919).

METODOLOGIE

Die histories-wetenskaplike metode van navorsing is gebruik om die verlede so betroubaar moontlik te rekonstrueer en te analiseer. Primêre geskrewe bronne in Suidelike Afrika en Engeland het voorrang geniet. Bewaarplekke wat besoek is, is die JS Gericke-biblioteek in Stellenbosch, die Nasionale Biblioteek van Suid-Afrika (Kaapstad-tak), die Parlementsbiblioteek (Kaapstad), die Kaapse Argief, die Staatsargief (Pretoria), die Argief van die Suid-Afrikaanse Nasionale Verdedigingsmag (SANDFA) in Pretoria, enkele regimentsargiewe (Natal en Wes-Kaap), die Suid-Afrikaanse Museum vir Kultuurgeskiedenis, die Suid-Afrikaanse Nasionale Museum vir Krygsgeskiedenis, die „Strange Library‟ (almal in Johannesburg), die „Cory Library for Historical Research‟ in

Grahamstad, asook die Nasionale Argief van Namibië (Windhoek). Talle artikels en boeke wat nie in hierdie bewaarplekke gevind is nie, maar wel in Suid-Afrika beskikbaar was, is deur die interbiblioteek-leningsdiens van die JS Gericke-biblioteek bekom.

In England is die volgende bewaarplekke geraadpleeg: In Londen die „British Library‟, die „Colindale Newspaper Archive‟, die „Imperial War Museum‟, die „Templer Study Centre‟ van die „National Army Museum‟, die „Liddell Hart Centre for Military Archives‟ by King‟s College en die „National Archive‟ in Kew Gardens; By die Universiteit van Leeds die „Peter H. Liddle‟-versameling in die „Brotherton Library‟; By die Universiteit van Birmingham die spesiale versameling in die „Cadbury Research Library‟ sowel as die oop rakke van die hoofbiblioteek (die „Centre for First World War Studies‟ het intussen ontbind); In Oxford is die „Central Library‟ en „Cambridge County Library‟ benut.

Die internet was ook van groot waarde. Hier word veral na die „Maurice L. Ettinghausen Collection of Ruhleben Civilian Internment Camp Papers, 1914-1937‟ verwys. Dié versameling word gehuisves by die „Harvard Law School Library, Historical & Special Collections, Harvard University‟. Dit bevat 16 dose van sy aandenkings uit dié kamp in Duitsland.

Die grootste enkele leemte in hierdie studie is die gebrek aan persoonlike onderhoude met oorlogsveterane as gevolg van die lang tydsverloop van amper ‟n eeu sedert die oorlog. Nog ‟n beperking was die onvermoë om Duitse en Franse bronne te lees. Toegang tot tersaaklike Franse navorsing is weliswaar deur die werk van Arnaud Waquet (in Engels) bekom.

Watter van die deelnemers aan imperiale spanne Suid-Afrikaners was, kon nie in alle gevalle vasgestel word nie. Baie Suid-Afrikaners het gedurende die oorlog in Britse eenhede diens gedoen en is derhalwe in daardie sportspanne opgeneem sonder dat hulle Suid-Afrikaanse identiteite gespesifiseer is. So is daar soms net na die “British Forces” verwys en in die krygsgevangekampe is die Suid-Afrikaners as “British” beskou.

In ‟n era waar internasionale sport in Europa ‟n tydelike halt geroep het (die 1916-Olimpiese Spele in Berlyn is byvoorbeeld gekanselleer en so ook die jaarlikse Tour de France), het

weermagsport ‟n reuse-oplewing geniet, in so ‟n mate dat binne die raamwerk van die oorlog, kompetisie op internasionale vlak ‟n groot stimulus ontvang het (Waquet & Vincent, 2011:372).

As groot sportliefhebbers het die Britse soldate binne enkele maande vandat hulle op die kontinent voet aan wal gesit het, die nodige reëlings getref om hul gewilde voetbal (sokker) te speel. Die toenemende aantal sportberigte in kontemporêre koerante wat analogieë getref het tussen oorlog en sport, dui op hoe belangrik sport as deel van die soldaat se opleiding geword het. Al die eienskappe wat nodig was vir loopgraaf-oorlogvoering, soos stamina, dapperheid en spangees, kon daardeur ontwikkel word (Waquet, 2011:335). Sport kon dus help om die perfekte soldaat te kweek.

Met die navorsingsvrae as uitgangspunt, kan daar in die geheel gesien tot die volgende slotsom gekom word.

IN WELKE MATE HET DIE SOLDATE EN KRYGSGEVANGENES 'N BEHOEFTE AAN SPORT ERVAAR?

Een van die grootste faktore waaruit die behoefte aan sport gebore is, was verveeldheid. Ivor Gurney, ‟n komponis en digter en lid van die Gloucestershire Regiment, het in Junie 1916 geskryf:

> "This is a queer war though. Guns are going in the distance, and every moment there is the chance of a strafe (we have had one, not a bad one) yet the note of the whole affair is boredom. The Army is an awful life for an artist … [e]ither it is slogging along uselessly with a pack or doing nothing but hang about after – or boredom or hell in the trenches. Very little between." (aangehaal deur Thornton, 1984:70)

In *The Outpost*, ‟n soldate koerantjie aan die Wesfront, het iemand geskryf: "There is no doubt about it, life out here is pretty much what we make it, and we, who always make the best of everything, never let the thought of war interfere with our enjoyment" en "[n]o less important, such entertainments were a relief from boredom, and boredom was the inescapable condition of army life" (aangehaal deur Fuller, 1990: 92). 'n Ander inskrywing het gelui: "In this context, „the best of all antidotes … prove to be games. Sports break the deadening inertia, introduce to the men a new interest in which they revel – and are utilized, more and more, as a definite part of the day"s programs" (aangehaal deur Fuller, 1990:93).

Daar was ‟n rotasiestelsel aan die Wesfront. Eenhede het van die frontlinie na die ondersteuningslinie beweeg, alvorens hulle na die reserwe en uiteindelik na die rusarea verplaas is. Omtrent drie-vyfdes (60%) van ‟n infanteris se diens is agter die frontlinie deurgebring (Riedi & Mason, 2006:487-488). Dit is hoekom verveeldheid as so ‟n groot faktor beskou is.

Tydens die moeson-reënseisoen in Duits-Oos-Afrika het ‟n skietstilstand geheers wat maklik tot verveeldheid kon lei, al is daar met opleiding voortgegaan. Atletiek, ‟n gimkana, rugby-, sokker- en hokkiewedstryde is gehou om die verveeldheid teen te werk: "This tedious delay in the midst of a campaign might have been expected to have a bad effect on the morale of the troops, but the 5th Battery showed no signs of such an effect when it eventually marched out of its rainy season quarters" (Adler *et al.*, 1958:50). Die soldate was duidelik verfris ná

die geleentheid om sport te beoefen.

Nog 'n faktor was die gemeenskaplike kultuur, naamlik die feit dat die Britse en Dominium-troepe almal ‟n liefde vir sport gedeel het. Richard Holmes vat dit raak toe hy geskryf het dat "[s]o many of the habits of peace slipped easily into war. There were divisional horse shows and race meetings, both popular and well attended" (Holmes, 2004:603). Toeskouervermaak was net so belangrik as eie deelname. Daarom is daar soms uit die pad gegaan om sport te ondersteun. So byvoorbeeld is die „1/14th Battalion London Regiment (London Scottish)‟ toegelaat om hul loopgrawe te verlaat om die Royal Engineers in die half-eindstryd van die 56th Divisional Cup aan te durf. Na die wedstryd het hulle weer hul posisies in die loopgrawe ingeneem (Riedi & Mason, 2006:507).

‟n Oorsig van die Britse koerante van einde 1916 toon dat daar toe al genoeg siviele en militêre sport was om die bladsye van spesifiek sportblaaie soos *The Athletic News*, *Sporting Life* en *Sportsman* te vul. Die hoofdoel van hierdie wedstryde en toernooie was om geld vir die toenemende aantal oorlogsliefdadigheidsorganisasies te vind, asook om as goedkoop vermaak te dien vir die soldate wat opleiding ondergaan, sowel as dié wat in die oorlogsnywerhede gewerk het (Riedi & Mason, 2006:491; Mason & Riedi, 2010:84).

'n Derde faktor was die troepe se behoefte aan 'n moraalopwekker en sport het daardie rol help vervul. Generaal Sir Charles Harington Harington van die 2de Leër het daarna verwys toe hy gesê het "[h]ow many times did one see a Battalion which had come out of the line in the Ypres Salient and elsewhere, battered to pieces and sad at heart at having lost so many Officers and men, hold up its head again and recover in a few hours by kicking a football or punching with the glove?"(Mason & Riedi, 2010:94-95). Sport het daardie vereiste ontspanning verskaf soos geen ander middel nie. Wanneer die soldaat uit die loopgraaf gekom het, was hy uitgeput, modderig, waarskynlik honger en gewoonlik sopnat. Tog het hulle hul eerste oomblikke van "vryheid" benut deur 'n bal rond te skop. Dit was hierdie oomblikke van ontspanning wat 'n belangrike rol gespeel het om by die toestande van die Wesfront aan te pas.

Hoe ook al na die oorlog gekyk word, is dit belangrik dat kennis gedra word van die soldate se lewe in die loopgrawe asook agter die gevegslinies. Omdat die oorlog so 'n verskriklike ervaring was (ná baie se drome van glorie), moes daar periodieke ontsnappings wees. Dit was belangrik dat hulle kon ontsnap na die wêreld wat hulle voor die oorlog geken het – 'n wêreld waar hulle geestesgesondheid nog nie deur die oorlog oorboord gegooi is nie (Fuller, 1990:91, 176). Fuller vat dit mooi saam as "… [h]e [the soldier] sought intervals of pleasure to relieve the suffering, and exercised ingenuity to create islands of sanity in the midst of the horror" (Fuller, 1990:177).

Sport het ook 'n belangrike rol in die krygsgevangekampe gespeel. Vir die krygsgevangenes was voetbal (sokker en rugby), krieket, tennis en gholf waardevolle teenmiddels vir die sogenaamde doringdraad-stres ("barbed-wire disease") (Powell & Gribble, 1919:157). Die effek van gevangeskap op die mens bly oral dieselfde. So ‟n persoon ly weens die gebrek aan vryheid, verlies van toegeneentheid en gedwonge ledigheid met sy dodelike onaktiwiteit (Desson, 1917:90). Dit is hierdie omstandighede van die kamplewe wat tot verveling lei wat weer sielkundige letsels kon laat.

Aan die begin van hul gevangeskap het die soldate nog hul aandag gevestig op voedsel, hul

fisieke toestand en die moontlikheid van vrylating. Na ‟n paar maande het ‟n paradigmaskuif ingetree. Die kampaktiwiteite het dan opgehou om eenvoudige tydverdrywe te wees en vir baie het dit nou absorberende en gewaardeerde aktiwiteite geword (Ketchum, 1965:213). So byvoorbeeld was een van die verlossende eienskappe van die lewe in Ruhleben-kamp die goed georganiseerde aard van hul sport. Vir die oningeligte mag dit lyk asof hulle ‟n vreeslik aangename tyd gehad het, maar dié aktiwiteite was eerder ‟n noodsaaklikheid as ‟n luuksheid (Cohen, 1917:132).

Om te oorleef het hulle besef dat hulle die kamp (in hierdie geval Ruhleben) so na moontlik volgens hul eie Britse tradisies moes bestuur. Hulle moes dus ‟n stukkie tuiste reg in die hart

van die vyand skep. Alles het van hulself afgehang (Mahoney, 1918:80, 106). So was daar etlikes wat nie die depressie kon afskud wat hulle met inhegtenisname opgedoen het nie. Hulle het stadig weggesink in ‟n toestand van ongeneesbare swaarmoedigheid. Diesulkes het na twee jaar in die kamp dit steeds onvanpas gevind om vermaak of sport by te woon. Hulle het genot gevind in hulle gebrom en gemopper (Cohen, 1917:110, 192). Hulle het die pret- en plesiermakery in die kamp verdoem in tye waarin hulle land bedreig is (Powell & Gribble, 1919:164-165). Die feit dat die meeste mense die gevangenskap as ‟n stimulerende ervaring beskryf het en dat betreklik min negatief daardeur geraak is, kan toegeskryf word aan die sosiale klimaat in die kampe. Sport, vermaak en studie het veroorsaak dat hulle ‟n doelgerigte lewe kon lei en daardeur hulle geestelike integriteit kon behou (Ketchum, 1965:210).

WATTER SPORT EN SPELE IS BEOEFEN?

Sport het inderdaad sy voete in die oorlog kon vind. Voor die oorlog was sokker dié militêre sport in Brittanje, dermate dat daar in 1906 soveel as 578 sokkerspanne in die Britse Leër was en 180 spanne in die Vloot. Daarteenoor was daar net ‟n handjievol rugbyspanne in hul weermag. Dit was eers in die dekade voor die oorlog dat die „Rugby Football Union (RFU)‟ besluit het om rugby in die weermag te bevorder. Die RFU het ‟n bekertoernooi vir die regimentspanne in die Leër ingestel, alhoewel dit net tot offisiere beperk was. Teen die tyd dat die oorlog in 1914 uitgebreek het, het rugby in die weermag ‟n groter vastrapplek gevind. Die twee toere van die All Blacks (1905) en die Springbokke (1906) het bygedra tot rugby se aanspraak op imperiale belangrikheid (Collins, 2002:799-800).

Tog het rugby steeds tweede viool onder die Britse troepe aan die oorlogsfront gespeel. Sokker was verreweg die gewildste sport. ‟n Korrespondent van *The Times* het na rugby verwys toe hy geskryf het “it is strange that the game was so little played in France during the war. There was never any difficulty raising sides to play Association [sokker], and there was scarcely a squadron, cavalry, engineers or signallers, or a platoon that did not possess its own team and its own wonderfully coloured jersey. Yet, Rugby games were few and far between.” (Collins, 2002:805).

Selfs die dagboek van ‟n rugbyspeler van „Huddersfield‟ en „England Northern Union‟ toon dat hy in 1917 in Frankryk in etlike sokkerwedstryde gespeel het teenoor net een rugbywedstryd. Die rede hiervoor was die gevaar van beserings in rugby, asook die gebrek aan 'n geskikte terrein. Dit was die praktiese redes. Aan die ander kant was daar ook die sosiale redes. Sokker was ‟n voorbeeld van klassesamewerking. Soldate van alle range kon (later) saamspeel en dit het gehelp om die *esprit de corps* (samehorigheid) te bevorder. Daarteenoor is rugby toe nog beskou as ‟n eksklusiewe spel vir offisiere.

Met aanvang 1916 het die wiel vir rugby begin draai. Aansienlik meer rekrute (onder wie baie professionele rugbyspelers van die „Northern Union‟) is gewerf en daar was ook ‟n groot invloei van troepe uit die rugbyspelende kolonies soos Suid-Afrika, Nieu-Seeland en Australië. Skielik het die aantal rugbywedstryde die hoogte ingeskiet (Collins, 2002:806). Soos dit later in die Tweede Wêreldoorlog die geval sou wees, het die Suid-Afrikaners, Nieu-Seelanders en Australiërs groot sprankel aan rugby tydens die oorlog verleen (Van der Merwe, 1999; Collins, 2009:56).

Teen Desember 1914 het *The Athletic News* gereeld oor voetbalwedstryde (sokker en rugby) agter die linies in Frankryk en Egipte berig. Terwyl geïmproviseerde sport voortgeduur het, was dit vroeg in 1915 dat gestruktureerde kompetisies en toernooie in Frankryk ingestel is omdat die militêre situasie gestabiliseer het. Kompetisies is van peloton- tot divisievlak georganiseer. Daar was byvoorbeeld wedstryde om die "Bishop of Khartoum‟s Cup" (Riedi & Mason, 2006:492-494). Hierdie interpeloton- en spesifiek interkompaniesokkerkompetisies het ‟n addisionele doel gehad, naamlik om as proewe vir die interbataljon-wedstryde te dien. Daarbenewens het dit verhoudinge tussen eenhede bevorder (Mason & Riedi, 2010:99).

Sport onder die Britse en Dominium-troepe was net so gewild soos variété-teater („music halls‟). Sokker en krieket, met rugby in mindere mate, is deur entoesiaste van privaat hoërskole aangevuur en het ander tradisionele sportsoorte min of meer onderdruk (Fuller, 1990:133). Krieket het in die somer van 1915 op 'n spontane grondslag voortgegaan. "A former Northamptonshire captain organised one with hop poles for bats, bully beef tins for wickets, and a tennis ball" (Mason & Riedi, 2010: 86). Twee pelotonne van die „1/7th (Robin Hood) Battalion Sherwood Foresters‟ het by Sanctuary Wood (naby Ypres in België) ‟n wedstryd in die loopgraaf gespeel. ‟n Ou konfytblik het as bal gedien en die kolf was ‟n weermag-graaf. Daar is nietemin met groot geesdrif meegeding (Mason & Riedi, 2010:86).

Joernaliste wat voorstanders van sport was (soos Frank J. Starr, ‟n joernalis van Aldershot en militêre korrespondent wat onder die skuilnaam "Rifleman" in *The Athletic News* en *The Times* geskryf het), het sterk voorbrand gemaak vir die voordele wat ontspanning ingehou het vir die duisende troepe wat opleiding aan die groot militêre sentra in Engeland ontvang het. In ‟n reeks artikels is die voordele van veral boks, landlope en voetbal uitgestippel. Daar is ook voorgestel dat daar weekliks ‟n halfdag hiervoor uitgehou moes word. Baie bevelvoerende offisiere het hierdie gedagte ondersteun. Boks was baie gewild agter die linies. Die voordeel wat dit bo ander sportsoorte geniet het, was dat dit binnenshuis kon geskied – veral gedurende die bitterkoue Noord-Franse winters. Die ander voordeel was dat dit deur alle range geniet is, maar soos by atletiek is aparte kompetisies vir die offisiere en die ander range gereël (Riedi & Mason, 2006:490-491, 494). Bokskampioene het groot status aan ‟n eenheid verleen (Mason & Riedi, 2010:106).

Atletiek was ook gewild. Menige pretnommers is by die program gevoeg, soos byvoorbeeld driebeenresies, kussinggevegte, kruiwaresies, krieketbalgooi, sakresies, ens. (Mason & Riedi, 2010:88). Ander gewilde aktiwiteite was perdeskoue en perdewedrenne en dit is waar ook al moontlik gehou. Perdewedrenne het groot skares gelok, natuurlik ook vir die geleentheid wat dit vir dobbel gebied het. Dit het daarenteen gimkanas behels waar van perdespringsport tot stoei vanaf die perd se rug gewilde nommers was.

Onder die lewendige belangstelling in sport wat van vroeg af aan die fronte bestaan het, tel

tradisionele sportsoorte wat kenmerkend van Britse offisiere was. So byvoorbeeld het hulle die tradisionele jagseisoen in die herfs van 1914 ook in Frankryk laat geld. Troppe honde is vir die jag van hase en jakkalse ontplooi, totdat die Franse boere teen Februarie 1915 ‟n klag gelê het weens die skade aan hulle landerye. In sommige dele is dit toe verbied.

Ook in Duits-Suidwes-Afrika en in Duits-Oos-Afrika is grootwild gejag en in Salonika (Tessalonika) het die „Scottish Horse‟ op Saterdae graag hase gaan jag. Vanuit Mesopotamië

was daar ‟n groot aanvraag na visstokke (Riedi & Mason, 2006:492-493, 495, 501). Die krygsgevangenes het nogal 'n verskeidenheid sport en spele beoefen, afhangende natuurlik van die omstandighede van die kampe waar hulle hul bevind het. Sokker, rugby, krieket, boks, atletiek, tennis, gimnastiek, skaak, kaartspeel en selfs gholf is in sekere kampe gevind (Van der Merwe, 2013).

WATTER UITWERKING HET DIE GEOGRAFIESE OMGEWING OP HIERDIE AKTIWITEITE GEHAD?

In Duits-Suidwes-Afrika was die hitte, droogte en sand (sandstorms ingesluit) ‟n beperkende faktor (Juta, 1933:80-81) en in Duits-Oos-Afrika weer die tropiese siektes, digte plantegroei en reënstorms (Edmonds, 1951:402-403). Dit wil voorkom asof daar in Noord-Afrika en Europa meer sport beoefen is, maar dit kan aan die invloed van die dominante Britse kultuur toegeskryf word. Dit blyk duidelik uit die studie dat oral waar soldate hulle langs water bevind het, hulle deeglik daarvan gebruik gemaak het om te swem of te baai en vis te vang.

In die geheel gesien was sokker die gewildste onder die meer mededingende sportsoorte, alhoewel die Suid-Afrikaners ‟n duidelike voorkeur vir rugby getoon het. Hierdie spele is agter die loopgrawe, maar binne hoorafstand en soms selfs trefafstand van die geskut, geniet. Talle voorbeelde bestaan van gevalle waar grofgeskut nie hulle sportlus kon demp nie.

Onder die krygsgevangenes was die betrokke kamp waarin die soldaat hom bevind het die bepalende faktor. Sekere kampowerhede was meer geneë om sport toe te laat as ander en sekere kampe het meer fasiliteite gebied as ander. Offisiere het meer vryheid geniet en beter voeding ontvang. In die kampe waar hulle aangehou is, was daar dus meer kans op sport en ontspanning (Van der Merwe, 2013). Hospitale en hersteloorde het die rehabilitasie- en ontspanningswaarde van sport besef. Dit was veral die Suid-Afrikaanse mediese personeel in Richmond, Engeland, wat hulle hier deeglik laat geld het. Die aandag wat hulle tydskrif, *The Springbok Magazine*, aan sport geskenk het, is ‟n sprekende voorbeeld hiervan.

IN WATTER MATE HET DIE MILITÊRE OWERHEDE HIERDIE AKTIWITEITE BEÏNVLOED?

Met Waquet en Vincent (2011:374) se toegang tot die Franse argiewe het hulle tot dieselfde gevolgtrekking as hierdie studie gekom, naamlik dat die militêre owerhede ‟n beduidende rol in die ontplooiing van sport tydens die Eerste Wêreldoorlog gespeel het. Die afgryslikheid en onverwagte duur van die oorlog het die militêre owerhede genoop om maatreëls te tref rakende die soldate se moraal en fisieke gemak. Die Britse soldate (wat Suid-Afrikaners ingesluit het) was te ver van hulle tuiste om met kort rukkies verlof huis toe te kon gaan en daarom is hulle kwartiere met die nodige geriewe toegerus. Dit het biblioteke, bioskope, sportvelde en selfs bordele ingesluit. Sokker is byvoorbeeld amptelik deur die militêre

owerhede aangemoedig, offisiere het toegesien dat speelvelde naby alle kwartiere geskep word, en balle is verskaf. Teen die agtergrond van eindelose gevegte het sokker (oftewel sport) deel van die "oorlogservaring" geword, net soos alkohol, kaartspeel en die lewe in die loopgraaf (Waquet, 2011:333, 336).

Die bevelvoerders het ook tydens geleenthede, soos Kersfees, grootskaalse feestelikhede op bataljons- of regimentsvlak ondersteun. Dit het 'n blaaskans van die oorlog, genoeg kos en drank, asook georganiseerde vermaak soos sport en konserte ingesluit. Alles met die doel om weer die moraal op te wek in hierdie tyd waar die verlange na die huis of gesin op sy grootste was (Wakefield, 2006:x).

"n Brigade het gewoonlik "n gedeelte van sy mag in die voorste linie van die gevegsarea aangewend, met "n tweede gedeelte in nabye ondersteuning en "n derde ietwat verder terug. Die infanteriste van die brigade se vier bataljons (later drie) het mekaar deur hierdie drie fases afgelos. Daar was ook "n vierde fase wanneer die brigade in die geheel in divisionele reserwe was. "n Vyfde fase was wanneer die hele divisie gerus het. Wanneer daar na die voorste linie en nabye ondersteuning verwys word, word loopgrawe bedoel. Sowat 42% van "n soldaat se tyd is daar deurgebring, met ongeveer 38% in kwartiere en 20% in rusareas. Amper 60% van die tyd het hulle dus in "n rusfase verkeer.

Die tyd wat in die loopgrawe deurgebring is, was natuurlik die ergste vir "n infanteris. Daar was hy blootgestel aan modder, reën, koue, bombardering, luise en rotte. Wanneer infanteriste hulself in die loopgrawe bevind het, het hulle tyd bestee aan gereedstaan, wagstaan, kampdiens, vervoerwerk, inspeksie, wapenversorging en werk aan die loopgrawe sodat hulle betreklik min tyd vir hulself gehad het. Sommige tydverdrywe soos lees, skryf en dobbel het wel sporadies voorgekom (Fuller, 1990:58-59, 62).

Wanneer hulle in rus gegaan het, was dit egter allesbehalwe rus in die ware sin van die woord. Soggens was sonder uitsondering tot vervelens toe aan "n uitputtende oefenprogram gewy. Soveel so dat die woord, "rus", later "n grap geword het. In een van die soldate koerantjies aan die front is dit as "n verfynde vorm van straf beskryf - "A short term used to express endless parades, ceaseless polishing, burnishings and „inspections"" (Fuller, 1990:78). In so "n mate dat hulle na "n paar weke van „rus" heel gewillig was om na die loopgrawe terug te keer. Soos die oorlog gevorder het, is die middae toenemend vir ander aktiwiteite, veral sport, gebruik (Fuller, 1990:78).

Dit was in die post-Somme-tydperk (na Julie-November 1916) wat die militêre owerheid sport en ander vermaak op 'n geïnstitusionaliseerde wyse deel van die soldaat se lewe aan die oorlogsfront gemaak het. Die 19de Britse Divisie se ruskans na die Derde Slag van Ypres (Passchendaele) in Augustus 1917 dien as voorbeeld. Die infanteriste is met 'n brigade-gimkana getrakteer. Die program was tipies van 'n jaarlikse dorpskermis, waarvan onder andere 'n fietsresies, driebeenresies, toutrek, swemkompetisie, appel-en-emmer-resies, hindernis, stoeldans op muile en sokkerwedstryde deel uitgemaak het (Roberts, 2006:41).

In Februarie 1916 het *The Athletic News* (1916:4) onder die opskrif "Army at play. Sport at the front" vertel van "n beweging wat anderkant die Engelse kanaal tradisionele sportkompetisies soos dit in vredestyd in die militêre lewe bestaan het, wou laat herleef. Die militêre leiers in Europa het al lankal die herstellende en versterkende waarde van sport vir die loopgraaf-moë soldate besef. Selfs die herstelkampe en hospitale wat oorspanne senuwees

en wonde moes genees, het sportsoorte soos onder andere voetbal, hokkie, atletiek en krieket ingespan om hulle doel te bereik. In die kwartiere waar die troepe ontlading moes vind na ‟n tydperk van diens in die loopgrawe, is sport van net soveel waarde geag as roetemarse,

opknapping van toerusting en driloefeninge. Ook *The Times* sluit hierby aan deur te verwys na die waarde van sport of spele tydens die opleiding van die Britse soldate soos dit sedert Maart 1916 in Frankryk toegepas is. ‟n Demonstrasie hiervan is deur kol. R.B. Campbell van die Gordon Highlanders en sy span gimnastiekinstrukteurs van die „Army Gymnastic Staff‟ by Flixécourt gelewer (*Times*, 1919b:5).

Oor die waarde van sport tydens oorlogvoering het Richard Holmes die volgende te sê:

> "The glue which holds armies together has a complex and variable composition, which includes not only major components like belief in a nation‟s war aims and hostility towards the enemy, but small, and often more powerful, ones like the bonds that link men in their sections, companies and battalions. The formal structure of the military hierarchy, backed by the constraints of discipline, also plays its part, and wise leaders recognise that the stick of discipline must work alongside carrots such as sport, entertainment, decorations and leave." (Holmes, 2004:555)

Uit die aard van die saak het sport fiksheid en stamina bevorder, maar dit was nie noodwendig ‟n onontbeerlike deel van ‟n soldaat se voorbereiding vir oorlog nie. Sommige sportvaardighede was tot groter voordeel vir oorlogvoering. Vergelyk byvoorbeeld die boul van ‟n krieketbal met die gooi van bomme en handgranate (Riedi & Mason, 2006:498). Nog só ‟n sport is boks. Dit is as die beste voorbereiding vir ‟n jong rekruut beskou. Dit het hom vinnige reaksies geleer, onafhanklik van ander en fiks in die wydste sin van die woord gemaak, en verder is dit ‟n handige vaardigheid indien ‟n soldaat handgemeen met sy vyand raak. Dit het dikwels gebeur dat die vyand se linies ingeneem en gevegte man tot man tot op bajonet punt gevoer is.

Sport se militêre nuttigheid om fiksheid te bevorder, verveeldheid te verlig, aandag van die oorlogswreedheid af te lei, moraal op te bou, verhouding tussen offisiere en manskappe te bevorder, en ook die *esprit de corps* te bevorder, is dus na waarde geskat. Generaal Sir Charles Harington Harington het verklaar dat dit leer, in die vorm van voetballe en bokshandskoene, was wat vir Brittanje die Eerste Wêreldoorlog help wen het. Hiermee het hy in oordrewe mate amptelik erkenning aan die militêre waarde van sport gegee.

Na 40 jaar van georganiseerde weermagsport het die Britte teen 1914 algemeen aanvaar dat sport ‟n aantal praktiese voordele ingehou het, soos dat dit fiksheid verhoog, verveeldheid bekamp, dronkenskap verminder, help om regimentsidentiteit te bou, om verhoudings tussen offisiere en manskappe (ander range) − asook tussen die weermag en die burgerlikes − te verbeter, en laastens om moraal te verbeter. Dit het verder ‟n belangrike rol gespeel om die soldate se aandag van die gruwels van die oorlog af te lei (Riedi & Mason, 2006:487, 496-499). So het Mason en Riedi (2010:92) verklaar - "we were arranging football matches and boxing to keep our minds off this terrible war as much as possible". Sport het ook as ‟n belangrike skakel met hul tuiste gedien – ‟n herinnering aan die siviele lewe en hul identiteit (Mason & Riedi, 2010:93).

Sport, veral ‟n sport soos rugby, leer ‟n soldaat dapperheid en aggressiwiteit (Riedi & Mason, 2006:497). Dit is hierdie gewelddadige en fisieke aard van die spel wat dit so goed by

destydse oorlogvoering laat inpas. Lord Jellicoe, Admiraal en hoof van die Britse seestaf tydens die oorlog, het geskryf "Rugby football, to my mind, above all games is one which develops the qualities which go to make good fighting men. It teaches unselfishness, *esprit de corps*, quickness of decision, and keeps fit those engaged in it" (*Graphic*, 1917:20; Collins, 2009:59, 61).

In die 19de en vroeë 20ste eeu is die opvatting dat sport 'n handige opleidingsmeganisme vir oorlogvoering was, algemeen aanvaar en dit kan duidelik waargeneem word uit die generale-staf se instruksies vir die opleiding van pelotons vir offensiewe optrede van 1917. Hier word benewens dril, bajonetoefening, granaatgooi, skietkuns en liggaamlike fiksheidsprogramme, ook ontspanningsaktiwiteite soos sokker, rugby en snipperjagte ("paper chases") ingesluit. Laasgenoemde moes op Woensdag- en Saterdagmiddae plaasvind aangesien dit as halwe vakansiedae beskou is. Eenhede ágter die linies het egter soggens opleiding ontvang en smiddae gespeel (nie net Woensdae en Saterdae nie) (Riedi & Mason, 2006:510).

Die Britse weermag se opleidingshandboek van 1918 het die volgende voorstel bevat: "Too much attention cannot be paid to the part played by games in fostering the fighting spirit ... [h]e [the platoon commander] should not only personally and actively arrange for games and competitions for his men, but take part in them himself" (Roberts, 2006:37).

Junior offisiere met karige opleiding vir die tipe oorlog waarin hulle hul bevind het, moes baie keer terugval op hul eie ervaring en verbeelding as dit by die opleiding van hul manskappe gekom het. Dan het hulle op hulle sport ervaring staatgemaak vir inspirasie, gerugsteun deur die amptelike erkenning van sport as opleidingshulpmiddel. Deur opleiding as 'n vorm van sport te beskou, het hulle dit meer aantreklik vir hul mede-sportliefhebbers in die laer range gemaak (Sheffield, 2000:47). Lt. Henry P.M. Jones het in Mei 1915 in *The Alleynian* geskryf oor amateursport as die beste manier van voorbereiding vir oorlog:

> "Nothing but athletics has succeeded in doing this sort of work in England. Religion has failed, intellect has failed, art has failed, science has failed. It is clear why: because each of these has laid emphasis on man‟s selfish side; the saving of his own soul, the cultivation of his own mind, the pleasing of his own senses. But your sportsman joins the Colours because in his games he has felt the real spirit of unselfishness, and has become accustomed to give up all for a body to whose service he is sworn. Besides this, he has acquired the physical fitness necessary for a campaign. These facts explain the grand part played by sport in this war; they also explain why the amateur has done so enormously better than the professional." (Jones, 1918:47)

Om te verseker dat almal betrokke kon wees, is sokker toernooie byvoorbeeld op 'n uitklopbasis van drie fases beslis. Fase een was tussen saamgeraapte spanne ("scratch teams") binne elke bataljon sodat almal die geleentheid kon kry om te speel. Fase twee was tussen die beste spanne in elke bataljon en dié wenners sou dan in fase drie speel om as die divisie se beste span aangewys te word (Roberts, 2006: 39).

Tot op hierdie tydstip in die oorlog is sport egter sporadies toegepas en het dit ook baie van

die betrokke offisiere afgehang. As daar een of twee offisiere in die bataljon of brigade was

wat ‟n belang by sport gehad het, is dit “toegepas”. By sommige regimente het hulle offisiere sport regdeur die oorlog bevorder, maar by ander het die verplasing of lewensverlies van sulke offisiere ook die verlies aan sport in die betrokke eenheid beteken. So was Suid-Afrikaanse soldate wat byvoorbeeld onder die bevel van maj.genl. Sir Henry Timson Lukin was, bevoorreg want hy was ‟n groot sportliefhebber. Hy was erg oor alle uitdagende sportsoorte (“manly sports”). Hy het veral van gimkana, polo, krieket en perdewedrenne gehou. Tydens die oorlog het hy onder andere rugby bevorder deur die Lukin-beker te skenk en gereeld atletiekbyeenkomste ondersteun (SANDFA).

Nog 'n voorbeeld van 'n rolmodel is lt.kol. John Campbell van die „Coldstream Guards‟ wat op 'n kritieke tydstip van die Slag van die Somme (Julie 1916) 'n suksesvolle aanval met 'n jagbeuel ingelui het. Genl. Forestier-Walker van die 27ste Britse Divisie het einde 1917 in Salonika besluit om die verveeldheid teen te werk deur 'n jakkals- en haasjag met plaaslike honde te reël. Dit het in die Struma-vallei plaasgevind en 125 offisiere het deelgeneem, onder andere die korps se bevelvoerder, genl. Sir Charles Briggs, die divisie-bevelvoerder en vyf ander generaals. Hierna het hulle elke Saterdagmiddag, as die gevegte dit toegelaat het, vir hierdie doel byeengekom. Een van hierdie offisiere, lt.kol. George Railston, het by elke moontlike geleentheid polo wedstryde gereël. By een so 'n geleentheid, wat deur die Scottish Horse gewen is, het vyandelike skrapnel die teeparty wat na die wedstryd gevolg het, beëindig (Dawson, 1936:14-15, 83-87, 94, 97).

Soos die oorlog gevorder het, het offisiere op alle vlakke toenemend die waarde van sport besef en dit aktief bevorder. Generaal Sir Hubert Gough, as bevelvoerder van die 5de Britse Leër, het in August 1916 die aanlê van voetbalvelde in elke brigade-area onder sy bewind gelas. Teen 1917 is daar al 'n indrukwekkende aantal speelvelde geskep. Divisionele bevelvoerders het toenemend sulke kompetisies aangemoedig en selfs kampioenskapstrofeë geskenk (Fuller, 1990:88).

Lt.kol. William Croft het as een van die bevelvoerders in die 9de (Skotse) Divisie ook sy deel bygedra. Hy het byvoorbeeld in sy poging om van sy offisiere so ver te kry om aan die landlope deel te neem, self vir die kompetisies ingeskryf – al was dit maar soms met onwilligheid. Hy het in 1917 by Arras in Frankryk aan die swemgala deelgeneem. By 'n ander geleentheid het hy 'n snipperjag georganiseer. Hy het een frank belowe aan elke man wat hom kon vang (hy was een van die „hase‟) en die hele bataljon moes deelneem (Croft, 1919:19, 135, 139-140).

In hierdie Wêreldoorlog het die verskynsel ontstaan dat die Britse offisiere vir die eerste keer van hulle dissiplinêre troon afgeklim en op 'n vriendskaplike wyse met die manskappe omgegaan het. Hulle het die lint gehou by atletieknommers, veldwerk gedoen by krieketwedstryde en selfs hul sportklere uitgeleen. Dit was 'n welkome verwikkeling in 'n weermag wat altyd so gesteld was op 'n skeidingsmuur tussen offisiere en manskappe (Fuller, 1990:91). Ondanks Gen. Douglas Haig, bevelvoerder van die 1ste Britse Leër Korps, se vroeëre nougesetheid, was bevelvoerende offisiere oor die algemeen gretig om sport te bevorder. Dit het hulle gedoen deur onder andere óf pryse te skenk óf wedstryde te inisieer. Nie-amptelike ondersteuning het ook van kapelane gekom wat gewoonlik ‟n belangrike rol in sportverenigings gespeel het. Daarby het die Christelike Jongmanne Vereniging (YMCA) voetbal ligas georganiseer. Sporttoerusting is nog grootliks deur die spelers self voorsien, of

so nie deur burgerlikes tuis. Dit was nietemin ‟n skaars kommoditeit (Mason & Riedi, 2010:88).

Deur middel van sport kon offisiere die karakter van hulle troepe beter oordeel. Hulle is derhalwe aangemoedig om ‟n persoonlike en aktiewe belang daarby te hê. Offisiere het soms sokker teen die ander range gespeel, alhoewel hierdie "ander range" dan amper altyd sersante was (behalwe in die krygsgevangekampe waar hulle soms teen die ordonnanse gespeel het) (Riedi & Mason, 2006:502, 504). Dit was hierdie offisiere wat uit die Britse privaat hoërskole gekom het, wat oorlog as ‟n vorm van sport beskou het. Hierdie privaat-hoërskool-etos was tipies Engels en het ook offisiere beïnvloed wat nié uit hierdie skole afkomstig was nie. Dit het berus op atletiese vermoëns, die konsep van ridderlike opgevoedheid, ‟n gees van selfopoffering en kameraadskap. Ten tyde van hierdie oorlog het soldate selde die opvatting bevraagteken dat daar 'n direkte verband was tussen die privaat-hoërskool-etos en die vermoë om soldate in oorlog te lei. Elite-skole het immers die ontwikkeling van karakter, fisieke en morele dapperheid, lojaliteit, samewerking en die vermoë om bevele te gee maar ook te gehoorsaam, beklemtoon.

Hierdie etos verklaar die voorval waar ene Kapt. Nevill sokkerballe aan sy kompanie gegee het om in Niemandsland in te skop om sodoende die aanval in te lei. Die sielkunde daaragter lê daarin dat die sokkerballe die nuweling-soldate se aandag van die verwagte geweervuur moes aflei (Sheffield, 2000:43-44, 48). Omdat die Britte en hul Dominiums meer sportief as ander nasies was, het dit 'n morele superioriteit uitgestraal (Fuller, 1990:140).

Aan die Wesfront was dit die Britse leër wat sport opgehemel het, want hulle het geglo dat dit nasionalisme sou bevorder (Ferro, 1973: 13). Die groot skares by sportbyeenkomste van die weermag het die soldate aan hul tuistes herinner. Hierdie ondersteuning was ook waardevol vir die simbolisering en versterking van die onderskeie eenheid se *esprit de corps* – wat toenemend nodig was soos nuwe soldate die gesneuweldes vervang het (Fuller, 1990:89-90).

WAS SPORT 'N INSTRUMENT VIR KULTURELE EN SOSIALE VERANDERING?

Die verhale van sokker wat tydens Kersfees-skietstilstande met die vyand gespeel is of balle wat in Niemandsland ingeskop is om ‟n offensief in te lei, is indrukwekkend en in die geheue vasgelê. Die werklike waarde van sport tydens die oorlog was egter minder dramaties en meer insiggewend (Riedi & Mason, 2006:486). So het *The Field* van 16 March 1918 die volgende gepubliseer:

> "The assiduous and organized cultivation of sport, and what is more important the spirit of sport, has become one of the most distinctive marks of the British Army, and it will be a task worthy of the greatest historians to record what this sporting spirit has done, not only for the British Army, not only for the British Empire, but for the whole civilized world during the present war." (Riedi & Mason, 2006:486)

Alhoewel sport al voor die oorlog gewild was onder die soldate, is dit eers in dié oorlog formeel in die militêre stelsel opgeneem – as "recreational training" en as die amptelike goedgekeurde vorm van ontspanning vir alle range. Dit het dus gegroei vanaf ‟n hoofsaaklik spontane en geïmproviseerde tydverdryf tot ‟n verpligte aktiwiteit. Dit het werklike voordele

vir die individuele soldaat én die leër in die geheel ingehou. Hierdie Britse voorbeeld is deur ander Geallieerde weermagte gevolg, selfs ook die Amerikaners en die Franse (laasgenoemde was aanvanklik baie skepties hieroor). Sport was nie net vir die individuele soldaat van waarde nie, maar ook vir die weermag in die geheel. Die Eerste Wêreldoorlog was die keerpunt waar sport, voorheen wydverspreid maar grootliks nie-amptelik in die Britse Leër, 'n integrale deel van die militêre stelsel geword het. Lesse wat uit hierdie oorlog geleer is, het die Britse Weermag in die Tweede Wêreldoorlog genoop om sport heelhartig te ondersteun (Riedi & Mason, 2006:486, 515).

Sportdeelname het in 'n belangrike hulpmiddel ontwikkel wat die soldaat se toewyding tot diens en gewilligheid om te veg, bevorder het. Die rede hiervoor was dat die weermag nou grotendeels uit die gewone man bestaan het en nie meer net vir die adel toeganklik was nie. Die laer klasse het hulle eie waardes gehad en is nie soseer aangevuur deur Koning, Land, Ryk en Regiment nie (Roberts, 2006:27). Nog ‟n historiese verwikkeling was dat offisiere en manskappe in Augustus 1916 vir die eerste keer in die geskiedenis saam aan militêre atletiek deelgeneem het (Mason & Riedi, 2010:84).

Aanvanklik kon die Franse nie verstaan hoekom die Britte so baie gespeel in plaas van geveg het nie (Fuller, 1990:135). In die dagboek van Marc Bloch (‟n Franse soldaat en later ‟n beroemde Franse historikus), bevestig hy dat hulle dikwels ledig was tydens hul rustydperke (Bloch, 1980: 108). Dit sou eers vanaf die 1920s wees dat die Franse moderne sport in hulle populêre kultuur opgeneem het. Die Eerste Wêreldoorlog het hierdie saadjie geplant (Fuller, 1990:135), want voor die oorlog was Franse sport nog in sy kinderskoene. Franse militêre sokker- en rugbyspanne het hulle beslag in 1917 gekry (Waquet, 2011:331-350).

The Daily Mirror het in die volgende berig, getitel “Teach cricket to the French”, voorspel dat die Britte die Franse tydens die oorlog krieket sou leer:

> “Wherever he has been, Lord Harris has taken his best-loved sport − cricket – with him. In India he did much to popularise the game, and if fate should send him to the Continent during the present campaign, according to a friend of mine who knows him well, he would start teaching the French troops to play cricket between the battles.” (Liddell Hart Centre for Military Archives, 1914:8)

Soos Arnaud Waquet in sy artikel uitstippel, het die Eerste Wêreldoorlog ‟n bloeityd van internasionale sport teweeg gebring. Internasionale wedstryde was, onder andere, wanneer Britse weermagspanne teen Franse spanne gespeel het. Die Franse leër het aanvanklik gedink sport tydens oorlogstyd is onvanpas. Hulle is op die ou einde deur die Britte oortuig dat dit wel waarde het. Met aanvang 1918 het die Britse owerhede die Franse van 15 000 voetballe voorsien en in die na-oorlogse tydperk het sport deel van die Franse weermagopleiding geword (Waquet & Vincent, 2011:372-392).

Die rol van sport in die Britse weermagspoging het selfs die vyand beïndruk. Die *Berliner Tageblatt* het berig dat die Duitsers beïndruk was met die Britse infanteriste se verdediging en die gebruik van die terrein (“use of the ground”). Dit was ‟n duidelike voordeel wat uit hulle sportagtergrond gespruit het (Waquet, 2011:341).

Rugby *per se* het 'n interessante deurbraak gemaak. Die rol wat dit in die oorlog gespeel het, het veel wyer gestrek as net die bekamping van verveeldheid en die opbou van moraal. Dit was net eietydse voordele. Ná die oorlog is rugby beskou as dié verdediger van Edwardiaanse imperiale ideale en dit het tot die styging daarvan as dominante sport in die privaat- en staatskole gelei (Collins, 2002:815).

Die nasionale waarde van rugby is soos volg deur "Headmaster" (pseud.) in *The Times* (1919a:2) beskryf: Hy noem dat voor die oorlog Brittanje oor die algemeen, en die privaat hoërskole in die besonder, gereeld aangeval is oor hulle oordrewe beheptheid met sport. Die oorlog het bewys dat sport tot die paraatheid van die Britse weermag bygedra het, maar ook dat rugby as ‟n instrument van ware opvoeding uitgestaan het … "it has proved itself to be unequalled by any other game as a school of true manhood and leadership". Die redes hiervoor was dat dit ‟n spanspel is waar individualiteit verdwyn het. As ‟n voorspeler moes hy te enige tyd in ‟n pak sak waar elke man sy posisie en plig het. Hulle moes saam swaai of opbreek of die bal dribbel en najaag. ‟n Agterspeler het meer vryheid geniet, maar weereens moes hulle perfek kombineer om suksesvol te wees. Dan vereis rugby van alle spele ook onmiddellike besluitneming. Kritieke keuses moet binne die kortste tyd gedoen word. Dit geskied te midde van groot geraas van die toeskouers en elke speler moet hard konsentreer om sy leier se bevele te hoor en dit in spanverband uit te voer. Hieraan is spoed en risiko gekoppel. ‟n Speler is altyd blootgestel aan die gevaar van liggaamlike beserings, maar dit mag nie sy besluitneming beïnvloed nie. Daar is nie ‟n groter toets van temperament nie. Die toets is om hard te kan speel, maar terselfdertyd binne die reëls te bly.

"Headmaster" sluit sy berig af met die stelling dat rugby die spel van die Leër was wat die strafste en afgryslikste van alle oorloë gewen het. Hy stel voor dat dit die universele spel van die nuwe Britse opvoedkundige stelsel moet word, aangesien dit ‟n man van deelnemers maak (*The Times*, 1919a:2). Die oorlog in Brittanje is nie verniet as ‟n voetbalwedstryd beskou nie. Rugby *per se* het ‟n hoër morele doel gehad as net ontspanning. Die doel daarvan was om jong mans as leiers in die Britse Ryk op te lei, asook om die Anglo-Saksiese ras se superioriteit ten tyde van vrede én oorlog te demonstreer. Daarom is dit deur baie as ‟n meer doeltreffende vorm van militêre opleiding beskou (Collins, 2002:797-798).

Baie van "Headmaster" se menings berus op die destydse bewuswording van die swak fisieke toestand van die Britse jeug tydens die Anglo-Boereoorlog. Dit is gevolg deur die groot nederlae in internasionale rugby (in 1905 teen die All Blacks en in 1906, 1910 en 1912 teen die Springbokke). Die toere deur die koloniale spanne het getoon hoe rugby ‟n gesonde en sterk nasie kon bou. Te midde van die rekonstruksie fase wat op die Eerste Wêreldoorlog gevolg het, is skole aangemoedig om rugby as wintersport te aanvaar, wat inderdaad ook gebeur het (Collins, 2009:50, 66). Dit het weliswaar voor die oorlog kopuitgesteek, maar dit was in die jare ná die oorlog dat spesialisasie in rugby ‟n werklikheid geword het. So byvoorbeeld het die haker in die skrum toe die belangrikste voorspeler geword (Sanderson, 1964:197-199).

Volgens die *South African Railways and Harbours Magazine* (1916:608) het daar sedert die uitbreek van die oorlog ‟n groot belangstelling in liggaamlike opvoeding ("physical culture") in Suid-Afrika ontstaan. Die paradigmaskuif was na krag en uithouvermoë. Almal wat belanggestel het om soldate van die koning te word, het met Sweedse gimnastiek ("Swedish

drill") kennisgemaak. In die proses het die twee manlike sportsoorte, naamlik stoei en boks,

ook ‟n oplewing ervaar.

SUMMARY

South African troops at play during World War I

In the light of the forthcoming centenary celebrations in commemoration of World War I, this study can be regarded as topical – especially as sport historians ignored this field until recently.

Sport protagonists claim that sport won the war, but even if this were not the case, it did play an important role in the experience of many service men in the period 1914-1918/19. It was a distraction from the terrors of the war, provided essential amusement and served as a link between the front and the respective civilian homes of the service men. Thus, sport helped to make the war bearable.

This obviously also applied to the prisoners of war. This wartime sport was based on two strong and converging traditions. On the one hand there was the well-known obsession with sport among the British civilian masses and on the other hand the sporting tradition adopted by the British forces since 1914. As Britain largely made use of a citizen army for the first time in this war, they introduced many civilian customs and habits to humanise the new life at the front. Sport did not benefit only the individual soldier, but also the army as a whole. World War I was the turning point for sport, which up until then had been pursued unofficially and widely but which now became formally integrated into the British military system. After the war, it was the army that initiated post-war sport in Britain. The British Empire and American Services Boxing Tournament of December 1918, and the international rugby tournament for the King‟s Cup in March and April 1919, serve as examples.

The present research attempted to find answers to the following questions:

(1) *To what extent did the troops and prisoners of war experience a need to participate in sport under conditions of war?* One of the main factors that contributed to the need for sport was boredom. Another factor was the common culture – the fact that the British and Dominion troops all shared a love of sport. A third factor was the troops‟ need for a morale booster and sport helped to fulfil that role. Sport also played an important role in the prisoner-of-war camps. As far as the prisoners were concerned, football (soccer and rugby), cricket, tennis and golf were great antidotes to the so-called barbed-wire disease.

(2) *Which sports and games were played?* Soccer was the most popular by far, followed by rugby, cricket, boxing, track and field athletics (“sports”), horse racing, hunting, fishing, card games, etc. The prisoners of war also engaged in a variety of sports and games, depending on the conditions in the camps in which they were interned. Soccer, rugby, cricket, boxing, athletics, tennis, gymnastics, chess, card playing and even golf occurred in certain camps.

(3) *What role did the relevant environments play in these activities?* In German South West Africa the heat, drought and sand (including sandstorms) were a restrictive factor, as were the

tropical diseases, dense vegetation and rainstorms in German East Africa. It would seem that the troops engaged in sport to a greater extent in North Africa and Europe, although this

could also be ascribed to the influence of the wider presence of British culture. It is evident in the study that whenever service men were near water, they greatly enjoyed bathing and fishing. Among the prisoners of war, the determining factor was the particular camp in which they were held captive. Certain camp authorities were more willing than others to allow sport, and some camps offered better facilities.

(4) *To what extent did the military authorities influence the sporting activities?* Military authorities played a significant role in the encouragement or promotion of sport during the Great War. The horror and unexpected duration of the war compelled military authorities to take measures to boost the soldiers‟ morale and improve their physical comfort. It was during the post-Somme period that the military authorities made sport and entertainment part of the soldier‟s life on the front in an institutionalised way. The military leaders in Europe in particular had long ago realised the restorative and recuperative value of sport for the trench-tired troops. Even the convalescent camps and hospitals that had to heal over strung nerves and injuries used sport such as football, hockey, athletics and cricket for that purpose. In the billets where the troops were meant to find some relief after spending time in the trenches, sport was deemed to be of the same value as route marches, refitting and square drill.

(5) *Was sport an instrument of cultural and social change?* Although sport had been popular among the troops prior to the war, it only became integrated in the military system during this war – both as recreational training and as the officially approved form of recreation for all ranks. Thus, it developed from a mainly spontaneous and improvised pastime into a compulsory activity. It had real benefits to both the individual soldiers and the army as a whole. Other Allied forces, even the Americans and the French, who were initially sceptical, followed the British example. Initially the French could not understand why the British played more than they practised warfare. Only from the 1920s would the French include modern sport in their popular culture. World War I had planted this seed, for before the war French sport was still in its infancy. French military soccer and rugby teams were established in 1917. A further development was that officers and men participated together in military sports for the first time.

In an era in which international sport in Europe came to a temporary halt (for example, the 1916 Olympic Games in Berlin were cancelled, as was the Tour de France), military sport enjoyed a major revival to the extent that within the framework of the war, competition on international level was stimulated.

Erkenning

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EFFECTS OF REGULAR AEROBIC EXERCISE ON PHYSICAL CHARACTERISTICS, BODY IMAGE SATISFACTION AND SELF-EFFICACY OF MIDDLE-AGED WOMEN

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ABSTRACT

This study examined the effects of regular aerobic exercise on physical variables, body image satisfaction and self-efficacy levels of sedentary women. An exercise group and a control group consisted of 25 and 20 middle-aged women respectively. The exercise group participated in a 14-week aerobic training programme, whereas the control group did not participate in any special kind of physical activity. In addition to administering the Body Image Satisfaction Questionnaire and the Self-efficacy Scale, anthropometric variables were assessed before the commencement of the study and again immediately afterwards. The data were analysed by a one-way ANCOVA. The main results revealed significant decreases in body mass, body fat, waist-to-hip ratio, as well as significant improvements in body image satisfaction and self-efficacy scores, with large effect sizes after the intervention for the exercise group. Regular aerobic exercise had a positive effect on body image satisfaction and self-efficacy of middle-aged women. This could possibly be due to improvements in their physical characteristics that resulted from the exercise programme.

Key words: Aerobic exercise; Body fat; Body Mass Index; Body image satisfaction; Self-efficacy.

INTRODUCTION

An effective way to deal with the physical and psychological problems caused by the frantic modern lifestyle is to exercise regularly (McDonald & Hodgdon, 1991; Hausenblas & Fallon, 2006). Among middle-aged women, there is a decline in both metabolic rate and activity levels. This causes deterioration in physical and functional capacity and increases body mass (BM) and total body fat (BF). It has been reported that regular exercise does not only improve body composition by reducing BM and BF (Forbes, 1991), but that it also reduces depression, anxiety and stress. In addition, exercise improves self-image, self-respect and self-confidence that lead to a positive effect on general well-being (Long, 1983).

A person's perception of his/her body is referred to as body image satisfaction (BIS), which is part of one's ego and affects a person's sense of self-efficacy (Atwater, 1990). Many studies have indicated that people who participate in sports have higher BIS than those who do not engage in sport (Cok, 1990; Asci *et al*., 1993; Martin *et al*., 2000; Asci, 2004a). For example, McDonald and Hodgdon (1991) conducted a meta-analysis of 37 studies that had investigated the effect of aerobic exercise and concluded that physical self-perception of

persons in a variety of age groups, changed positively after exercise interventions. Koksal *et al*. (2006) also reported that aerobic exercises has positive effects on physical self-perception, and concluded that these positive outcomes were not affected by whether or not people had previously participated in exercise programmes.

The concept of self-efficacy relates to a person's confidence to perform a specific task successfully (Bandura, 1982). According to Bandura (1997), people with a strong sense of self-efficacy do not avoid new experiences and are typically determined to complete any activity. Bandura (1982) believes the most important source of self-efficacy is experiencing success.

RESEARCH PROBLEM

The purpose of this study was to investigate the effects of participation in an aerobic exercise experience on the physical characteristics, body image satisfaction and self-efficacy of middle-aged previously sedentary women. The main hypothesis was that regular exercise would improve the body image satisfaction and self-efficacy levels of the participants. The second hypothesis was that there is a relationship between the changes in body composition and the scores of the two psychological variables.

METHODOLOGY

Participants

Healthy middle-aged female participants (N=45) volunteered to participate in the investigation. They had not engaged in any type of structured training programme for at least 10 months prior to the study. The exercise group (EG) consisted of 25 women (aged 40.5±12.1 years). The control group (CG) was randomly selected from the EG's friends of similar age (n=20; aged 36.3±8.5 years).

The EG participated in a 1-hour aerobic training routine 3 days per week for a period of 14 weeks. The CG did not perform any kind of structured physical activity. Participants gave written consent to take part in the study. They were informed of the experimental procedures and asked not to change their regular daily diet regimen throughout the study. Furthermore, the EG was instructed not to engage in additional exercises, while the CG was asked not to participate in any structured physical activity throughout the study period. The Body Image Satisfaction Questionnaire (BISQ) and the Self-efficacy Scale were administered and anthropometric measurements were taken prior to the start of the study and immediately after the completion of the 14-week training period. The study started with 50 participants. Because of health and family problems, 5 participants withdrew from the study. Missing more than 2 training sessions automatically disqualified participants from further involvement in the study.

Exercise programme

The aerobic training programme consisted of traditional step-aerobic type exercises that included dynamic leg and arm movements, step-ups with music and dynamic core-strengthening exercises (crunches, push-ups, sit-ups, lunges, squats, etc.). The heart rate (HR) of each EG participant was monitored continuously and recorded with a Polar Heart-rate Monitor during each 1-hour session of aerobic training for the 14 weeks. The exercise intensity of each participant was determined by using the target heart-rate method (Kenney *et al*., 1995). The target heart rate of participants ranged between 120 and 150 beats per minute.

Measures

Physical parameters

The same researcher carried out the anthropometric measurements on all subjects according to the *Anthropometric Standardization Reference Manual* (Lohman *et al*., 1988).

- The body mass index (BMI) was calculated by the formula: mass (kg)/height (m^2).
- The waist-to-hip ratio (W/H) was calculated by measuring waist and hip circumferences.
- Nine (9) skinfolds (triceps, biceps, subscapula, mid-axilla, suprailiac, abdomen, thigh, knee and calf), were taken with a Holtain skinfold calliper in triplicate on the right side of the body.
- Body density (Db) and the body-fat ratio (BF) were calculated using the following equations (Ratamess, 2012:457):
  $Db = 1.1422 – 0.0544 \times \log (\text{biceps} + \text{triceps} + \text{subscapular} + \text{suprailiac})$
  $BF = 100 \times (5.01 \times Db^{-1} – 4.57)$.

Body Image Satisfaction Questionnaire (BISQ)

Berscheid *et al*. (1973) developed the BISQ. The validity of the Turkish translation of the questionnaire, which comprises 25 items, was assessed and confirmed by Cok (1990). The BISQ was constructed to measure body satisfaction, somatic problems, general physical appearance and conformity with body mass and body height. The Cronbach's alpha value of the questionnaire was calculated to be 0.91.

General Self-efficacy Scale

This scale was developed by Schwarzer and Jerusalem (1995) and adapted into Turkish by Luszczynska *et al*. (2004). Each of the 10 items has four possible answers. The Cronbach's alpha coefficient of internal reliability was calculated to be 0.82 (Schwarzer & Jerusalem, 1995; Luszczynska *et al*., 2004).

Statistical analysis

Shapiro–Wilk W-test and skewness-kurtosis values were used to test for the normality of the data. Assumption of homogeneity of variances was checked using Levene's test. According to test results, dependent variables were analysed with parametric tests, except sum of the skinfold measurement.

Baseline measures of dependent variables were compared between CG and EG by unpaired Student's t-test. Group (EG/CG) was the between-participant factor, and Time (0 Week/14 Week) was the within-participant factor. The main effects and the interaction effect of these

factors on dependent variables were assessed by 2 x 2 (Group x Time) two-factor mixed-design analysis of variance (ANOVA). After the verification of the homogeneity of regression slope assumption, a 1-way ANCOVA was performed to compare the percentage changes of the dependent variables between groups (controlling for the baseline measures of these variables). One-way ANOVA results were reported for variables that contradicted the homogeneity of regression slope assumption. The effect size of the difference (which is an important determinant of practical significance and post-hoc statistical power), was also reported. The relationships among variables were evaluated by means of the Pearson product-moment correlation coefficient. The significance level was set at $p \leq 0.05$ for all analyses.

RESULTS

A comparison of baseline measures of the dependent variables between exercise and control groups is presented in Table 1.

TABLE 1. **COMPARISON OF BASELINE MEASURES BETWEEN GROUPS**

Variables	EG (n=25)	CG (n=20)	p	ES	1–β
BM (kg)	69.0	63.6±9.2	0.040*	0.624	0.529
†SS (mm)	186 [129–235]^{M}	186 [129–235]^{M}	<0.001*	1.440	0.996
BF (%)	23.8	21.7	0.030*	0.610	0.511
W/H	0.794	0.743	0.010*	0.809	0.750
BMI (kg·m^{-2})	25.1	24.0	0.311	0.291	0.158
BIS	82.6	89.2	0.095	0.510	0.383
SE	30.1	31.7	0.417	0.252	0.130

Descriptive statistics: Mean±SD; CG= control group; EG= exercise group; * p<0.05; 1–β= post-hoc statistical power ES= unbiased effect size (Hedge's d:<0.2= trivial, 0.2≤d≤0.5= small, 0.5≤d≤0.8= medium, >0.8= large effect); †Analysed with Mann-Whitney U-Test; M= median [percentiles 25–75].

BM= body mass; SS= sum of 9 skin folds; BF= body fat %; W/H= waist-to-hip ratio; BMI= body mass index; BIS= body image satisfaction; SE= self-efficacy.

A significant main effect for Time was found in BM (p=0.038, η_p^2= 0.096, power= 0.551); BF (p=0.033, η_p^2= 0.101, power= 0.575); W/H (p= 0.012, η_p^2= 0.139, power= 0.732); BMI (p=0.046, η_p^2= 0.090, power= 0.521); BIS (p<0.001, η_p^2= 0.453, power= 1.000); and SE (p<0.001, η_p^2= 0.325, power= 0.994).

A significant main effect for the Group factor emerged only for W/H (p=0.028, η_p^2=0.108, power= 0.606). No significant main effect was detected for BM (p=0.086, η_p^2= 0.067, power= 0.403); BF (p= 0.088, η_p^2= 0.066, power= 0.401); BMI (p=0.506, η_p^2= 0.010, power= 0.101); BIS (p=0.550, η_p^2= 0.008, power= 0.091); and SE (p=0.135, η_p^2= 0.051, power= 0.319).

A significant Group x Time interaction effect was found in all dependent variables: BM (p<0.001, η_p^2= 0.249, power= 0.958); BF (p=0.004, η_p^2= 0.176, power= 0.842); W/H (p=0.012, η_p^2= 0.138, power= 0.728); BMI (p<0.001, η_p^2= 0.243, power= 0.953); BIS (p<0.001, η_p^2= 0.241, power= 0.951); and SE (p<0.001, η_p^2= 0.348, power= 0.997), indicating

that these variables showed different change patterns between the EG and CG over the course of the exercise intervention.

TABLE 2. **COMPARISON OF CHANGES IN DEPENDENT VARIABLES BETWEEN GROUPS**

Test & Group			Mean±SD	[1]Δ (Po−Pre)	[2]ΔEG−ΔCG	p	ES	1–β
BM (kg)	CG	Pre	63.6±9.2	1.00±3.42	2.87±0.87†	0.002*	1.190	0.972
		Post	64.1±8.2					
	EG	Pre	69.0±7.9	–2.54±2.45				
		Post	67.2±7.4					
¥ SS (mm)	CG	Pre	123±22	–0.180±4.424	5.56±4.47			
		Post	123±21					
	EG	Pre	185±58	5.93±5.62				
		Post	173±53					
BF (%)	CG	Pre	21.7±1.9	0.491±3.178				
		Post	21.8±1.9					

			<0.001*	1.170	0.968
			0.005*	0.929	0.857
			0.020*	0.738	0.671
	BMI ($kg \cdot m^{-2}$)		<0.001*	1.190	0.972
	BIS				
	SE				

CG = control group; EG = exercise group; *p <0.05.

[1] Mean±SD; [2] Mean±Std error of mean; ¥ Wilcoxon Signed Rank Test; †difference ANCOVA results; Δ=% change; ES=unbiased effect size (Hedge's d: <0.2= trivial, 0.2≤d≤0.5= small, 0.5≤d≤0.8= medium, >0.8= large effect); 1–β= post-hoc statistical power.

BM= body mass; SS= sum of 9 skin folds; BF= body fat %; W/H= waist-to-hip ratio; BMI= body mass index; BIS= body image satisfaction; SE= self-efficacy.

The exercise group demonstrated reductions in BM, BF, SS and BMI, whereas the control group experienced slight increases in these variables. These changes revealed significant overall differences. Among the exercise group, W/H decreased significantly to a greater extent compared to the control group. In addition, an increase in BIS among the exercise group was statistically greater than that in the control group. Similarly, the difference between the increase in BIS and the slight increase among the control group was statistically significant (Table 2). All of these significant differences also produced large effect sizes.

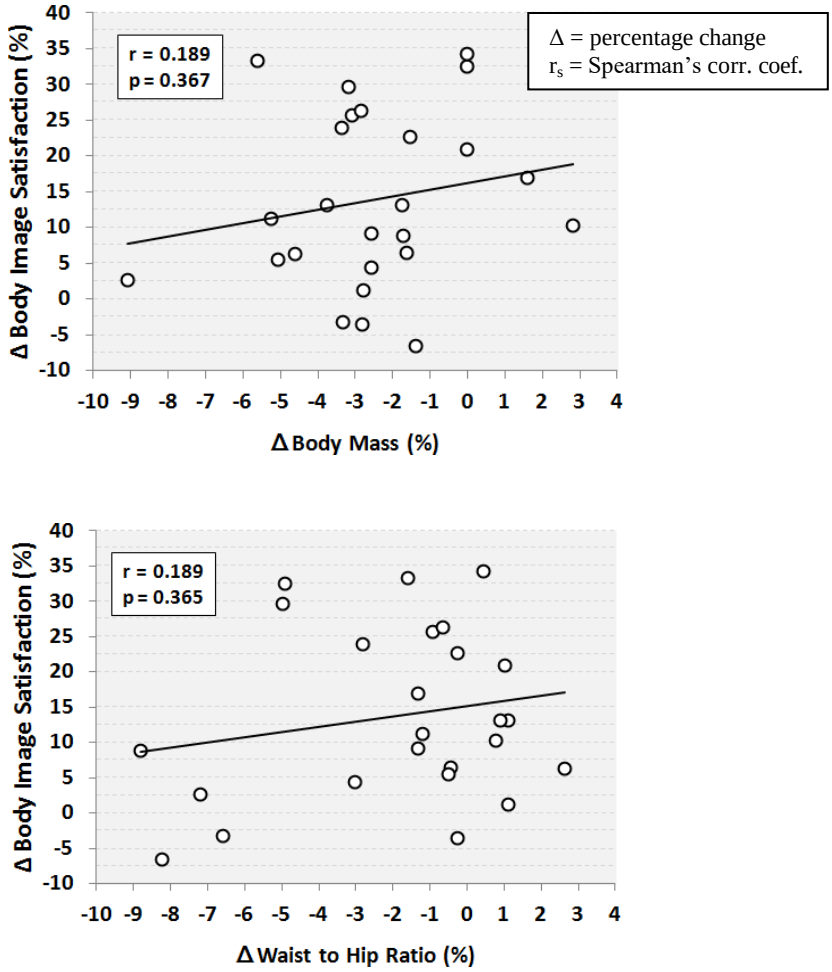

FIGURE 1. **EG: RELATIONSHIP BETWEEN PERCENTAGE CHANGE IN BODY IMAGE SATISFACTION & ANTHROPOMETRIC MEASURES**

Continued

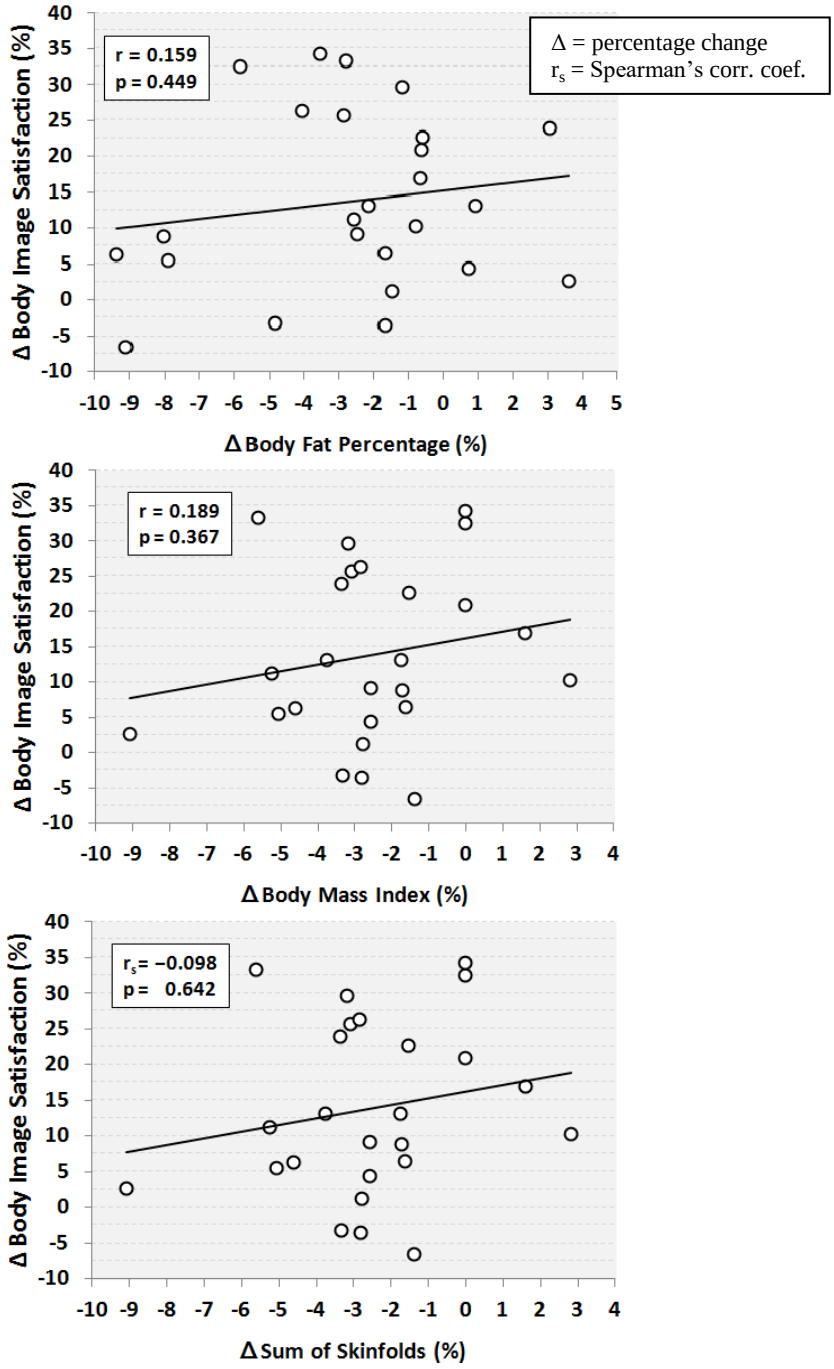

FIGURE 1. **EG: RELATIONSHIP BETWEEN PERCENTAGE CHANGE IN BODY IMAGE SATISFACTION & ANTHROPOMETRIC MEASURES *(cont.)***

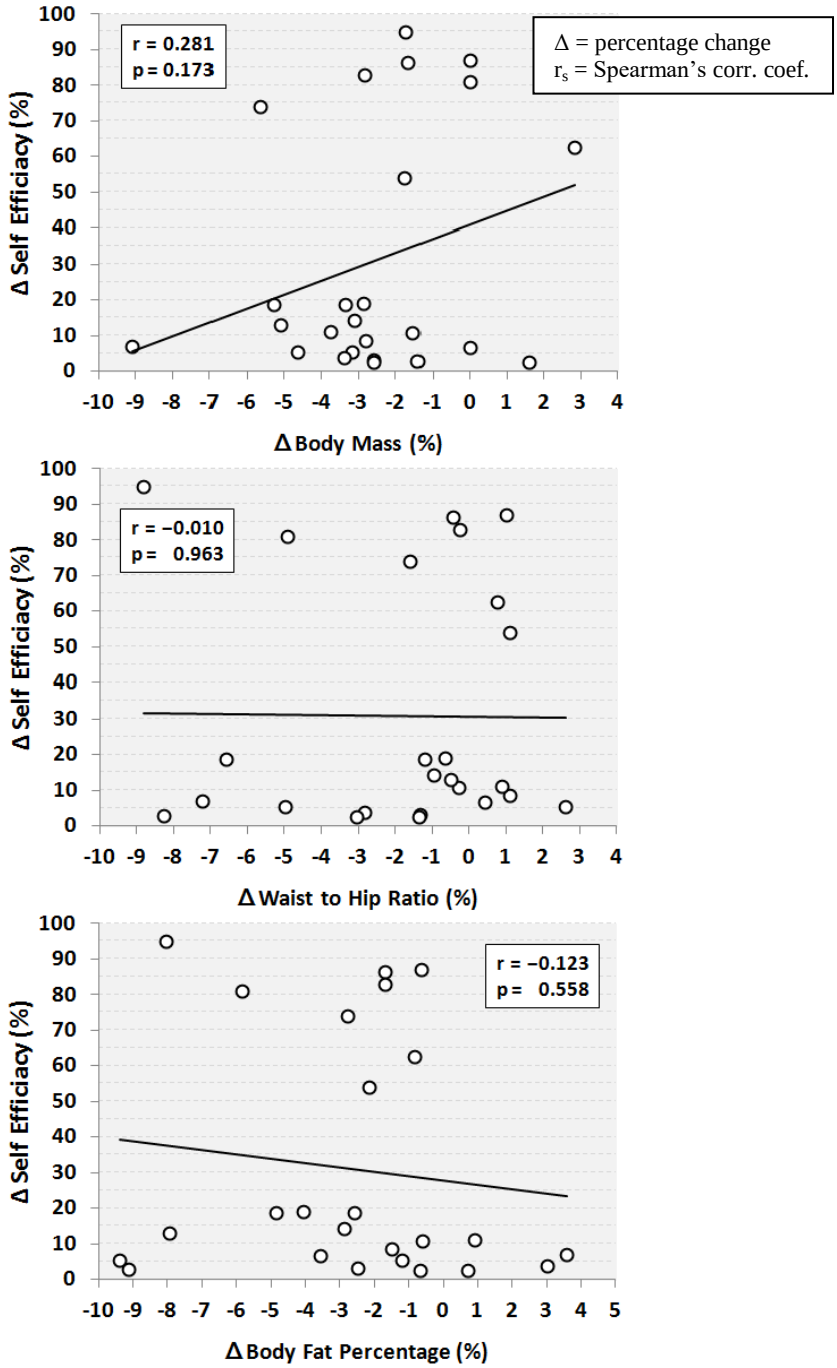

FIGURE 2. **EG: RELATIONSHIP BETWEEN PERCENTAGE CHANGE IN SELF-EFFICACY & ANTHROPOMETRIC MEASURES** ***(continued next page)***

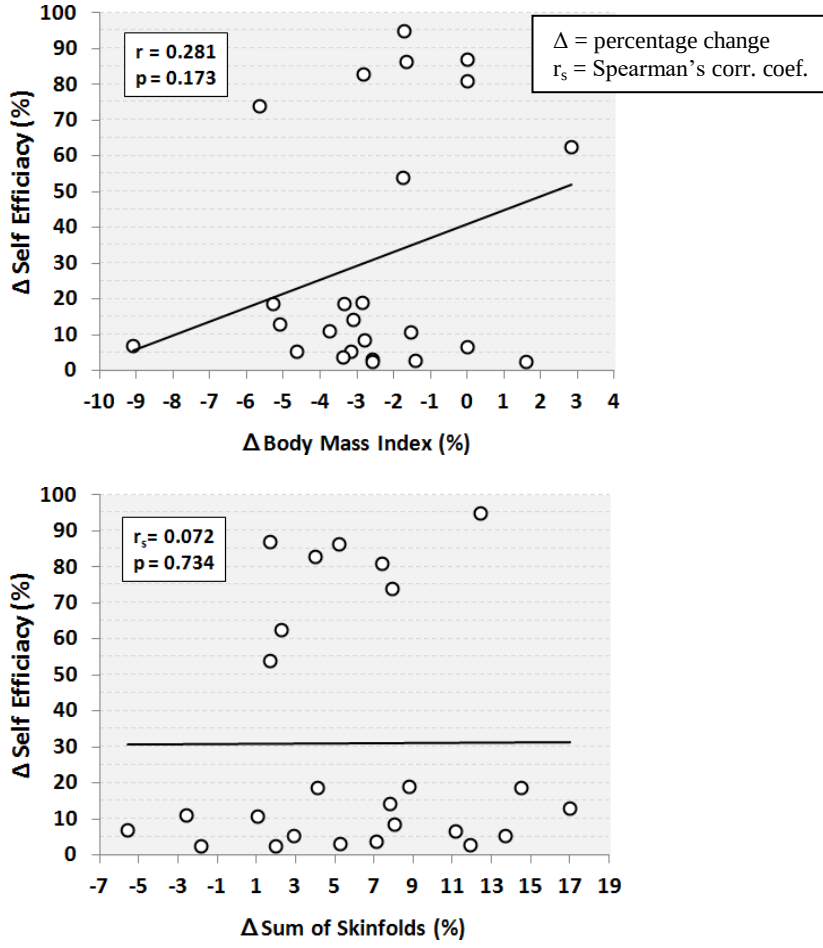

FIGURE 2. **EG: RELATIONSHIP BETWEEN PERCENTAGE CHANGE IN SELF-EFFICACY & ANTHROPOMETRIC MEASURES *(cont.)***

No statistically significant relationship was found between percentage change in the anthropometric measures and body image satisfaction or self-efficacy among the EG after the 14-week aerobic training period.

DISCUSSION

Regularly performed exercises help people attain their ideal body mass and play quite a significant role in helping them maintain their Body Mass Index at normal levels. The study by Kurt *et al*. (2010) of middle-aged women revealed a similar effect with an eight-week sub-maximal step-aerobic exercise programme. Significant improvements were observed in the participants' physical characteristics. Similarly, in another study, pre- and post-menopausal women showed a significant reduction of body fat after a 12-week aerobic regimen

(Imamoglu *et al*., 1999). Karacan and Colakoglu (2003) found a significant decrease in body mass, body fat percentage, body fat mass and body mass index after a 12-week jog-walk

exercise programme among middle-aged women.

When participants in the EG were compared with those in the CG during the initial measurements of the current study, those who intended to exercise were found to have greater BM and more BF compared to the other participants. This difference between these two groups might be considered as the reason why the group was willing to participate in a fitness intervention activity.

The willingness to adopt an exercise programme is influenced by an individual's self-efficacy (Dutton *et al*., 2009), self-perception and personal well-being (Asci *et al*., 1998; Daley & Buchanan, 1999; Fox, 2000; Asci, 2004b; Hausenblas & Fallon, 2006). Investigations have also revealed that exercising women are more satisfied with their body image compared to sedentary women (Snyder & Spreitzer, 1977; Lindwall & Lindgren, 2005). Furthermore, BMI was found to the strongest predictor of body satisfaction for female participants (Hausenblas & Fallon, 2002).

Initially in the current study, there were no significant differences between the two groups regarding body image satisfaction and self-efficacy. However, the body image satisfaction and self-efficacy of the exercise group changed positively. Their more favourable perception of their bodies (after benefiting from the exercise programme), might be the reason for their improved sense of self-efficacy. This supports the findings of Berscheid *et al*. (1973) who showed that regularly performed physical activities have physical, psychological and social benefits. They also reported a positive relationship between these benefits and body image satisfaction. Similarly, Tok *et al*. (2007) also found that women exercising regularly have a higher body image satisfaction score than sedentary women.

Moreover, in the study of Utku *et al*. (2006), with a similar objective, the effect of eight weeks of fitness exercise on the women's body image and self-efficacy beliefs was investigated through surveys. They found links between body satisfaction and somatic characteristics. In contrast to the current study, their exercise programme did not produce any significant change in the self-efficacy of the participants. The fact that these researches used a survey, instead of an intervention, might account for their different findings.

In another study, Williams and Cash (2001) examined the effect of a six-week weight-lifting programme on the body images of university students. Their results showed that the lower and upper extremity power of students increased along with their assessments of appearance and their scores of satisfaction with their body characteristics. Their scores were also found to be significantly higher when compared to the scores of control group.

In the present study, the change in self-efficacy among the participants of the EG could be ascribed to the effect of the 14-week exercise programme. In contrast, possible changes among the participants in the CG were so minimal that they did not have any observable impact body image or self-efficacy of the non-exercising women in the study.

Despite the expectation of a significant correlation between percentage change in the body composition variables and the BIS or SE variables in this study, it was not the case. Although it was concluded that the 14-week intervention increased the self-efficacy of the participants, it is not clear whether it was due to *participation* in physical activity or *change in physical fitness*.

Some research (Kaplan *et al.*, 1994) supports the role played by exercise interventions in influencing self-efficacy, as well as efficacy being an important correlate of physical health. In related studies, elderly patients suffering from coronary artery disease (Gulanick, 1991) and chronic obstructive pulmonary disease (Kaplan *et al.*, 1994) or young obese women (Annesi, 2010), completed self-efficacy measures and exercise testing at baseline, before and after a training regimen. The results showed that self-efficacy increased significantly among the exercise group participants at the end of intervention.

In a healthy population, the effects of exercise on self-efficacy were assessed in several studies but the results were vague. For example, in a two-year study, Elavsky (2010) examined the exercise–self-esteem relationship among middle-aged women and reported increases in physical activity and self-efficacy and reductions in BMI. On the other hand, in a similar study (Utku *et al.*, 2006), the effect of an eight-week exercise programme on women's self-efficacy beliefs was investigated through surveys and found no significant changes in self-efficacy. It is speculated that the conflicting results were due to the different types of study populations, duration and type of the physical activity or using a survey instead of field application.

Consequently, it is difficult to compare the results of the current study with those of other investigations. Notwithstanding, it is well known that body image is related to attractiveness and self-esteem. At the same time, it is an evaluation tool for physical power and attractiveness. It is reasonable to expect that women who exercise regularly would perceive their bodies positively.

LIMITATIONS

The small and unequal sample size of the two groups was the most important limitation of this study. Although this issue generally limits the statistical power of the parametric tests, the post-hoc power analysis indicated a high level of statistical power and effect sizes that were also large. Studies with larger sample sizes could provide future related studies with more refined findings. Therefore, well-structured similar studies should be conducted on large samples as well as on different populations (for example, elderly people, adolescents, males, etc.).

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ASSOCIATION BETWEEN LEISURE-TIME PHYSICAL ACTIVITIES AND OBESITY IN A SELECTED SAMPLE OF KOREAN ADULTS

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ABSTRACT

The aim of this study was to determine whether leisure-time physical activities (PAs) affect obesity in Korean adults. The participants included 505 men and 1,061 women (>20 years) who visited a public health centre in Seoul during 2010-2011. They completed the International Physical Activity Questionnaire and their Body Mass Index was calculated. Obesity was defined according to the current World Health Organization criteria. The association was assessed using multivariate logistic regression analysis after adjustment for sex, age, smoking/drinking, sleep duration, mental stress, education and economic status. Odds ratios (95% confidence interval) for the association between obesity and vigorous, moderate, and light PA compared to those who do not participate in any PA were: 0.931 (p=0.691), 0.893 (p=0.531) and 0.815 (p=0.302) for once/week, respectively; 0.940 (p=0.789), 0.690 (p=0.129), and 0.787 (p=0.342) for twice/week, respectively; 1.031 (p=0.897), 1.375 (p=0.137) and 1.180 (p=0.473) for three times/week, respectively; 1.109 (p=0.759), 0.804 (p=0.491), and 0.907 (p=0.763) for four times/week, respectively; and 0.357 (p=0.006), 0.509 (p=0.034), and 0.641 (p=0.038) for >five times/week, respectively. Vigorous, moderate, and light PA >five times/week may reduce or prevent obesity in Korean adults.

Key words: Physical activity; Prevalence of obesity; Body Mass Index; Korea.

INTRODUCTION

According to the Fifth Korea National Health and Nutrition Examination Survey, the prevalence of obesity in people aged >19 years was 36.5% for men and 26.4% for women in Korea and has been increasing annually (Korea Centres for Disease Control and Prevention, 2012). The data indicate that obesity is already a serious social problem in Korea. Moreover, it is a major risk factor for many serious health conditions and chronic diseases (Yusuf *et al.*, 2005; Pischon *et al*., 2008; Luppino *et al*., 2010).

Excessive food energy intake is an independent risk factor for obesity (Thomas & Albert, 2002; Schröder *et al*., 2007). Physical inactivity and a sedentary lifestyle also contribute to the increasing prevalence of obesity (Hill & Wyatt, 2005; Hamilton *et al*., 2007; Chaput & Tremblay, 2009). For this reason, many obese people try to increase energy expenditure by increasing physical activity (PA) or exercise and reduce energy intake by controlling diet. Increasing PA is strongly recommended because it has associated health benefits such as better weight control, improved bone and muscle strength, and improved mental health and mood (US Centres for Disease Control and Prevention, 2011). Additionally, PA is associated with increased ability to perform activities of daily living, a longer life span, and a reduced risk of cardiovascular diseases, Type 2 diabetes, metabolic syndrome and some forms of cancer. PA has also been shown to decrease the risk of falling (US Centres for Disease Control and Prevention, 2011).

Worldwide, many studies have previously reported that increased PA is associated with decreased obesity (Hill & Wyatt, 2005; Hamilton *et al*., 2007; Chaput & Tremblay, 2009; US Centres for Disease Control and Prevention, 2011). In Korea, although there are several studies that have examined the relationship between PA and obesity, previous studies were limited in that they did not analyse the details of PA, such as the vigorousness or frequency

per week (Kim & Jeon, 2011; Kim & Han, 2012; Hwang & Kim, 2013).

RESEARCH PROBLEM

Since detailed PA patterns are an important component of physical education or exercise prescription, the purpose of the present study was to examine the association between participation in PA (physical activity) of various intensities and obesity in Korean adults.

METHODS

Subjects

The subjects consisted of 505 men and 1,061 women, aged >20 years, who visited a public health promotion centre in Seoul, Korea during 2010-2011. All subjects signed a written consent form before participating in this study, and S-gu Community Health Centre approved all study procedures. The characteristics of the subjects are shown in Table 1.

TABLE 1. **CHARACTERISTICS OF SUBJECTS**

Variables	Categories	Men (n=505)	Women (n=1061)	Total Gr. (n=1566)
Body mass index	Healthy weight (<25)	288 (57.0)	820 (77.3)	1108 (70.8)
	Obese (≥25)	217 (43.0)	241 (22.7)	458 (29.2)
Age	20s	16 (3.2)	26 (2.5)	42 (2.7)
	30s	73 (14.5)	147 (13.9)	220 (14.0)
	40s	136 (26.9)	230 (21.7)	366 (23.4)
	50s	157 (31.1)	430 (40.5)	587 (37.5)
	Over 60s	123 (24.4)	228 (21.5)	351 (22.4)
Smoking frequency	Non-smoking	416 (82.4)	1049 (98.9)	1465 (93.6)
	Ex-smoking	51 (10.1)	3 (0.3)	54 (3.4)
	Current smoking	38 (7.5)	9 (0.8)	47 (3.0)

Data presented as: Frequency and (%)

continued

TABLE 1. **CHARACTERISTICS OF SUBJECTS *(cont.)***

Variables	Categories	Men (n=505)	Women (n=1061)	Total Gr. (n=1566)
Drinking frequency	Non-drinking	412 (81.6)	900 (84.8)	1312 (83.8)
	Once per month	21 (4.2)	106 (10.0)	127 (8.1)
	2–3 times per month	38 (7.5)	40 (3.8)	78 (5.0)
	Over 4 times per month	34 (6.7)	15 (1.4)	49 (3.1)
Sleep duration	Under 5 hours	13 (2.6)	50 (4.7)	63 (4.0)
	6 hours	30 (5.9)	97 (9.1)	127 (8.1)
	7 hours	22 (4.4)	82 (7.7)	104 (6.6)
	Over 8 hours	440 (87.1)	832 (78.4)	1272 (81.2)
Mental stress	Very low	422 (83.6)	794 (74.8)	1216 (77.7)
	Low	50 (9.9)	177 (16.7)	227 (14.5)
	High	31 (6.1)	77 (7.3)	108 (6.9)
	Very high	2 (0.4)	13 (1.2)	15 (1.0)
Level of education	Elem. school or lower	31 (6.1)	79 (7.4)	110 (7.0)
	Middle school	19 (3.8)	102 (9.6)	121 (7.7)
	High school	111 (22.0)	288 (27.1)	399 (25.5)
	College or higher	344 (68.1)	592 (55.8)	936 (59.8)
Economic status	Very poor	89 (17.6)	276 (26.0)	365 (23.3)
	Poor	58 (11.5)	133 (12.5)	191 (12.2)
	Rich	336 (66.5)	567 (53.4)	903 (57.7)
	Very rich	22 (4.4)	85 (8.0)	107 (6.8)

Data presented as: Frequency and (%)

Anthropometric measures

The subjects' height and weight were assessed using InBody 720 (Biospace, Seoul, Korea), and their Body Mass Index (BMI; kg/m^2) was calculated. According to the World Health Organization Asia-Pacific standard, people with a BMI of <25 were defined as healthy-weight, and people with a BMI of ≥25 were defined obese (WHO/IASO/IOTF, 2000).

Questionnaire

PA was evaluated for each participant based on the responses to 3 questions from the self-administered International Physical Activity Questionnaire (Craig *et al.*, 2003). The questions and their choice of responses are:

(Q1) "Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do *vigorous* physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time?" Response options

[1] no vigorous PA, [2] once, [3] twice, [4] 3 times, [5] 4 times and [6] over 5 times per week;

(Q2) "Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do *moderate* physical activities like bicycling at a regular (moderate) pace, swimming at a regular (moderate) pace, and doubles tennis in your leisure time?" Response options [1] no moderate PA, [2] once, [3] twice, [4] 3 times, [5] 4 times and [6] over 5 times; and

(Q3) "During the last 7 days, on how many days did you *walk* for at least 10 minutes at a time in your leisure time?" Response options [1] no walking, [2] once, [3] twice, [4] 3 times, [5] 4 times and [6] over 5 times.

The covariate variables included: Sex (male/female); Age (self-reported); Smoking frequency: (non-smoking/ex-smoking/currently smoking); Drinking frequency (non-drinking/once per month/2–3 times per month/over 4 times per month); Sleep duration (under 5 hours/6 hours/7 hours/over 8 hours); Mental stress (very low mental stress/low mental stress/high mental stress/very high mental stress; Level of education (elementary/middle school/high school/college or higher; and Economic status (very poor/poor/rich/very rich.

Statistical analysis

All results are presented as mean±standard deviation. Multivariate logistic regression analyses were conducted to determine whether PA patterns and PA frequency per week were related to obesity after adjustment for sex, age, frequency of smoking or drinking, sleep duration, mental stress, education level and economic status. Statistical significance was set at $p<0.05$ and all analyses were performed using SPSS version 18.0 (SPSS, Chicago, IL, USA).

RESULTS

The results of multivariate logistic regression analyses of leisure-time PA for the healthy-weight and obesity groups of Korean adults are shown in Table 2. The odds ratios (ORs) and the 95% confidence interval (CI) are reported for the association between obesity and vigorous PA, moderate PA and light PA as compared to no vigorous PA, moderate PA and light PA. The ORs (CI) were:

For *once per week* the ORs (CI) were 0.931 (0.656-1.322, p=0.691), 0.893 (0.627-1.272, p=0.531) and 0.815 (0.553-1.201, p=0.302), respectively;

For *twice per week* the ORs (CI) were 0.940 (0.599-1.476, p=0.789), 0.690 (0.428-1.114, p=0.129), and 0.787 (0.481-1.289, p=0.342), respectively;

For *3 times per week* the ORs (CI) were 1.031 (0.645-1.649, p=0.897), 1.375 (0.903-2.093, p=0.137), and 1.180 (0.750-1.857, p=0.473), respectively;

For *4 times per week* the ORs (CI) were 1.109 (0.573-2.146, p=0.759), 0.804 (0.432-1.496, p=0.491); and 0.907 (0.482-1.707, p=0.763), respectively;

For over *5 times per week*, the ORs (CI) were 0.357 (0.171-0.747, p=0.006), 0.509 (0.273-0.950, p=0.034), and 0.641 (0.421-0.977, p=0.038), respectively.

TABLE 2. **MULTIVARIATE LOGISTIC REGRESSION ANALYSES: PATTERNS OF COMPLIANCE WITH PHYSICAL ACTIVITY ACCORDING TO OBESITY** (n=1566)

Intensity	Regularity	ß	SE	OR	95% CI	p
No PA				1.000		
Vigorous physical activity (PA)	1 x pw	-0.071	0.179	0.931	0.656-1.322	0.691
	2 x pw	-0.061	0.230	0.940	0.599-1.476	0.789
	3 x pw	0.031	0.239	1.031	0.645-1.649	0.897
	4 x pw	0.104	0.337	1.109	0.573-2.146	0.759
	5+ x pw	-1.029	0.376	0.357	0.171-0.747	0.006**
Moderate physical activity (PA)	1 x pw	-0.113	0.181	0.893	0.627-1.272	0.531
	2 x pw	-0.371	0.244	0.690	0.428-1.114	0.129
	3 x pw	0.319	0.214	1.375	0.903-2.093	0.137
	4 x pw	-0.218	0.317	0.804	0.432-1.496	0.491
	5+ x pw	-0.676	0.319	0.509	0.273-0.950	0.034*
Light physical activity (PA) [walking]	1 x pw	-0.204	0.198	0.815	0.553-1.201	0.302
	2 x pw	-0.239	0.251	0.787	0.481-1.289	0.342
	3 x pw	0.166	0.231	1.180	0.750-1.857	0.473
	4 x pw	-0.097	0.323	0.907	0.482-1.707	0.763
	5+ x pw	-0.444	0.215	0.641	0.421-0.977	0.038*

SE= standard error; OR= odds ratio; CI= confidence interval; **p<0.01 *p<0.05; pw= per week

DISCUSSION

The results from this study show that obesity was inversely associated with increased PA. Many previous studies have reported that PA is strongly associated with obesity (Hill & Wyatt, 2005; Wareham *et al*., 2005). The results of this study reveal that, in the case of Korean adults, only a high frequency of PA is associated with a reduction in obesity. Prevalence of obesity was decreased only when PA was performed over 5 times per week, regardless of intensity. All three types of PA (vigorous PA, moderate PA, and light PA) performed >5 times per week, were associated with a marked decrease in the prevalence of obesity. This risk was decreased by 64.3% with vigorous PA, 49.1% with moderate PA, and 35.9% with light PA in the group that performed PA over 5 times per week, compared with the groups that did no vigorous, moderate or light PA, respectively.

To prevent obesity, the American College of Sports Medicine's guidelines recommend over 3500kcal/week of energy expenditure with increased PA and a decreased sedentary lifestyle (American College of Sports Medicine, 2010). This figure of represents a high amount of energy expenditure, which may be most closely associated with frequency of PA more than five times per week, as reported in the this study. Thus, to prevent obesity, the authors strongly recommend that obese adults perform some type of PA at least five times per week.

LIMITATIONS

This study had several limitations. Firstly, it was a cross-sectional, retrospective study. Therefore, the authors could not confirm a causal relationship between PA and obesity. Secondly, even though the self-administered International Physical Activity Questionnaire is valid and reliable (Craig *et al*., 2003), lifestyle habits such as frequency of smoking and drinking were categorised based on self-reported data. Consequently, data regarding these measures may be limited. Thirdly, this study did not investigate and adjust for the amount, quality, and variety of food eaten, all of which affect obesity. Lastly, since the participants of this study were recruited from a public health promotion centre, the participants may not be a true representation of the Korean population. Therefore, in the future, further well-designed studies are needed to confirm the relationship between obesity and PA. Nevertheless, the large number of participants included in this study is one of its greatest strengths.

CONCLUSION

In conclusion, vigorous PA, moderate PA and light PA performed more than five times per week is associated with reduction or prevention of obesity in Korean adults, after adjusting for sex, age, frequency of smoking/drinking, sleep duration, mental stress, education level and economic status.

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The authors declare that there was no conflict of interest.

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