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MOTIVATION TOWARDS DANCE WITHIN PHYSICAL EDUCATION ACCORDING TO TEACHING TECHNIQUE AND GENDER

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ABSTRACT

This is qualitative study with the objective to analyse motivation towards dance by comparing two teaching methodologies within the education context, depending on gender. The self-report technique was applied with 47 students (29 girls and 18 boys) aged 14 to 16 years (14.84±0.48) from a secondary school in Extremadura (Spain) to explore the reasons that engage them in dance classes during Physical Education (PE) classes. Twelve dance-teaching sessions of 50 minutes, distributed across two days a week, were presented to each group. Twenty (20) students received the lessons that applied the Direct Instruction Technique and 27 students received instruction by means of the creative inquiry technique. Self-reporting was applied at three different assessments (sessions 4, 8 and 12), of the intervention with both groups. The results show important gender differences in the students' motivation towards participation in dance in the PE context when different teaching techniques were used. This suggests that teachers may need to apply a different treatment depending on gender.

Key words: Motivation; Teaching methodology; Gender; Dance; Physical Education.

INTRODUCTION

Positive experiences in PE may influence young people to create adherence to physical activity (PA) and to adopt a healthy lifestyle during their adult life, which can have a positive influence on public health (Sallis *et al.*, 2012). Therefore, motivation is an important variable to be considered in PE (Lonsdale *et al*., 2011), in order to understand the cognitive, emotional and behavioural processes that underpin engagement and adherence to physical exercise (Hagger & Chatzisarantis, 2012).

In this sense, the Self-Determination Theory approach (Deci & Ryan, 1985; Ryan & Deci, 2000), can be especially useful to study motivation, as it has been applied successfully within the context of PE (Hassandra *et al.*, 2003; Lonsdale *et al.*, 2009). The Self-Determination Theory points out that human behaviours are voluntary or self-determined and it proposes that motivation is multi-dimensional, evolving throughout a self-determination continuum that includes different types of motivation that have differing degrees of self-determination, from more to less (Deci & Ryan, 2000). These types of motivation are intrinsic motivation (where the person acts due to inherent interest in a

certain activity), extrinsic motivation

(where the person acts to achieve external consequences), and amotivation (where the person does not know exactly why he/she keeps practising the activity) (Deci & Ryan, 1985). Extrinsic motivation is divided into four types of regulation that vary depending on the degree of self-determination (from a higher to a lower level). These can be referred to as integrated regulation (behaviour that contributes to defining who one is), identified regulation (behaving in a way that is felt to be personally important), introjected regulation (behaving to avoid a sense of guilt or to prove something), and finally, external regulation being the least self-determined regulation (behaving to avoid punishment or gain some reward) (Deci & Ryan, 2000).

Along the same line, this theory indicates that the self-determination level of a person towards a certain activity, is directly influenced by the satisfaction of three basic psychological needs (Deci & Ryan, 1985): autonomy; competence; and relatedness. The perception of autonomy appears when the student is the driver of his/her behaviour; the perception of competence is the feeling of efficiently interacting with the environment; and the perception of relatedness is the positive interaction with other people, developing feelings of belonging. The satisfaction of these three needs increases the level of self-determination, so that within the context of PE, it has been shown that students who consider themselves to be more autonomous, competent and attached to their social environment, present more self- determined practise reasons (Moreno-Murcia *et al*., 2009; Zhang *et al*., 2011; Sánchez-Oliva *et al*., 2012).

Self-determined motivation has been associated in this field with effort, fun, usefulness and adherence within PE (Taylor *et al*., 2010; Granero-Gallegos *et al*., 2012). However, several studies have pointed out that frustration of basic psychological needs is associated with negative consequences on health and well-being (Adie *et al*., 2008; Hodge *et al*., 2008; Jang *et al*., 2009), as with non-self-determined motivation, which is related to boredom, unhappiness or negative effects (Standage *et al*., 2007; Lim & Wang, 2009; Sánchez-Oliva *et al*., 2014).

However, it should be noted that apart from motivation, gender is another aspect that has proved to be relevant to having a positive or negative effect on students' perceptions and attitudes towards PE (Lyu & Gill, 2011). Traditionally, girls in particular, have shown less joy, interest and pleasure during PE classes than boys (Fisette, 2011; Cairney *et al*., 2012; Goodyear *et al*., 2012). Some studies have analysed these disengaged girls and the results indicate that individual predisposing factors, such as perceptions of competence and identity in the PE classes along with the social context (peers and teachers), the competitive nature of activities often offered in PE (Mitchell *et al*., 2013), or the ineffectiveness of programmes proposed (With-Nielsen & Pfister, 2011), are some of the factors that contribute to the disengagement of girls' during PE.

A possible way to solve this lack of motivation and engagement of a proportion of the girls towards PE, could involve addressing the dance content within the corporal expression block, as dance is a form of PA that awakes greater interest among girls (Grieser *et al*., 2006; O'Neill *et al*., 2011). Thus, given that during adolescence there is a marked drop of PA levels in girls (Pate *et al*., 2009), it could be necessary to offer different content, such as dance, that could help to increase PA participation levels of girls.

The problem that might arise with respect to dance content in PE lies in the difficulties that teachers find when they present it (Fraile & Vizcarra, 2009; Lim & Wang, 2009). The main reason seems to be the lack of own experiences related to dance, which results in a lack of knowledge of the methodology to be applied (Pate & O'Neill, 2009; Sebire *et al*., 2013)

It is essential to study the teaching techniques that PE teachers can use to teach dance, mainly from the viewpoint of student motivation and gender differences. Two methodologies were used in this study, namely the *Direct Instruction Technique*, which is a traditional method where the teacher base his/her teaching on demonstrating the model and then the students copy the model (Kassing & Jay, 2003); and the *Creative Inquiry Technique*, where the students are the ones that initiate activity and assume responsibility for their learning, whilst the teacher acts as a mentor in the teaching process (Kassing & Jay, 2003). It is based on creativity or the ability to create different motor and expressive responses when a problem is set (Kassing & Jay, 2003).

Under the student motivation approach, studies have pointed out that the way in which the teacher organises the sessions, involves students in decision-taking, provides execution alternatives, recognises the students' feelings and provides quality feedback, are aspects that have important motivational implications (Hagger & Chatzisarantis, 2007; Hein & Koka, 2007; Standage *et al*., 2007; Koka & Hagger, 2010). Because of this, the creative teaching methodology has mainly been associated with the motivation of the students, because the teacher satisfies their preferences better. However, the problem that creative methodology may evoke in teaching artistic-expressive activities, lies in the insecurity and incompetence that not having a previous reference model may generate in the students, as occurs in the case of the direct instruction technique, which allows for self-regulation based on a given movement pattern (Sanchez-Ruiz *et al.*, 2011).

Finally, the importance of gender differences in motivation towards dance in the PE context should be highlighted (Cairney *et al*., 2012). Dance content has traditionally generated less motivation in the case of boys because they have been considered to have less qualities than their female counterparts who have to carry out this activity due to social and cultural reasons (Lyu & Gill, 2011; Chalabaev *et al*., 2013). The role granted to the learners in the methodological treatment must be taken into account, as there are differences between both genders regarding cognitive participation in the teaching-learning process (Chen & Darst, 2001), or the creativity work (Baer & Kaufman, 2008; Stoltzfus *et al*., 2011), as aspects associated with the teaching style of the teacher. With respect to the artistic-expressive content, the difficulty lies in the performances that learners must carry out with certain autonomy in front of their classmates via uncommon motor patterns (Learreta, 2009). Therefore, the way in which the teacher sets out the students' cognitive participation and creativity may be decisive for their experiences, impressions and emotions depending on gender.

PURPOSE OF STUDY

Based on the point of view of the Self-Determination Theory, the objective of this research was to analyse which of the two teaching methodologies, *Direct Instruction Technique* or *Creative Inquiry Technique*, may be more efficient, depending on the learners' gender, to

increase their motivation during the teaching of the dance content in PE. This should cast some light on the two main problems that many teachers encounter when they address artistic-expressive contents, namely which methodology to use and how to motivate the students.

METHOD

Participants

The selected sample consisted of 47 learners in their 4th year of compulsory Secondary Education (ESO), from 1 school of the Autonomous Community of Extremadura (Spain). The participants were girls (n=29) and boys (n=18), between the ages, 14 to 16 years (14.84±0.48). They were selected conveniently based on their placement 1 of the 2 classes provided. One class of 20 learners received dance teaching sessions where the *Direct Instruction Technique* was applied and the other class of 27 learners experienced dance teaching sessions employing the *Creative Inquiry Technique*. A PE teacher with dance training facilitated the application of both teaching techniques.

Ethical approval

The study was granted approval from the Ethics Committee of the University of Extremadura. All participants were treated in accordance with the ethical guidelines of the American Psychological Association with respect to consent, confidentiality and anonymity of their testimonies. Furthermore, written informed consent was obtained from parents and from the director of the school on behalf of under-aged children taking part in the study. All the children gave their assent and they committed to participate in the whole process until the end.

Measuring instrument

A qualitative research design was applied and the instrument used was the self-report method of personality assessment (Paulhus & Vazire, 2007), in order to understand the differences in the learners' perceptions and experiences, in accordance with the pedagogical proposals set out in each of the 2 dance teaching techniques.

The following premises were applied:

- The document was anonymous and the data would be treated confidentially.
- Students had to write down their thoughts and reflections, by answering to the following question: "Explain in detail all of the reasons that make you engage in the dance classes in PE and express your perception of the development of the sessions".
- The minimum length had to be 1 page, including extensive descriptions, expressing in depth what they had felt with each activity.

Variables

With reference to the variables used in this study, the application of the 2 dance teaching techniques served as intervention variables.

Firstly, the *Direct Instruction Technique* responds to the traditional methodology based on

the repetition of a model and, therefore, it is a technique where learners' creativity is nullified. The teacher plans the session, demonstrates the exercises, corrects the performance and takes all didactic decisions (Kassing & Jay, 2003).

Secondly, the *Creative Enquiry Technique* is a method, which allows learners to select the level of challenge in their skills, through the different options for the task performance presented by the teacher. The teacher plans a motor challenge, asking for different alternatives in the performance, with the aim to allow learners to respond creatively. Instead of showing the model of performance with the task presentation, the teacher asks questions or gives premises that require an original answer by learners, who must find a solution thereby choosing an individual and creative answer (Kassing & Jay, 2003).

The study variables were also associated with the analysis of motivation and they were measured with a category system drawn up in agreement with the definition of variables established by the Self-Determination Theory (Deci & Ryan, 1985; Ryan & Deci, 2000). Thus, 2 analysis levels were distinguished, *basic psychological needs* (autonomy, competence and relatedness), understood in terms of satisfaction or frustration and the *type of motivational regulation* or self-determination level (intrinsic motivation, identified regulation, introjected regulation, external regulation and amotivation) (Deci & Ryan, 2000). Each factor comprising this category system is explained below.

Basic psychological needs (Deci & Ryan, 2000)

Satisfaction with autonomy: When learners feel they are playing a leading role in their learning, because they can choose among the options proposed and, therefore, they feel responsible for their behaviour. Example:

In these classes, I feel that I have more freedom when I carry out the exercises.

Satisfaction of competence: When learners consider they are efficient in all the interactions that occur in the social environment and experience opportunities to express their skills and, therefore, they believe they are good or expert. Example:

I felt quite assured when I carried out the class exercises.

Satisfaction of relatedness: When learners feel integrated and connected with others from the social environment. Example:

I felt closer to my companions and that has transmitted a lot of confidence to me.

Frustration with autonomy: When learners do *not* feel they are playing leading roles in their learning, because they *cannot* choose among the options and, therefore, they do *not* feel responsible for their behaviour. Example:

I would like the teacher to consider my opinion more in class because we always have to do what he says.

Frustration of competence: When learners do *not* feel efficient in all the interactions that occur in their social environment and do *not* experience opportunities to express their skills and, therefore, they do *not* consider they are good or expert. Example:

I felt ridiculous when I saw what we were doing as I did not do it properly; I couldn't think of anything, I was nervous.

Frustration of relatedness: When learners do *not* feel integrated or connected with others from their social environment. Example:

During these activities that we have carried out, at one moment when we had to change partners to achieve interaction, I felt a bit lost because there was mistrust when we had to change and when you know that you do not like that class mate very much. Well, during the interaction, there was distance, the looks and contact were cold, and I felt a bit bad and uncomfortable.

Types of motivational regulation (Deci & Ryan, 2000)

Intrinsic motivation: When learners engage in the learning activities due to inherent reasons such as the pleasure caused by practising it. Example:

I liked those exercises a lot, my companion and I laughed a lot and we had a great time. I hope there will be more in the future.

Identified regulation: When learners place value on an activity because they consider it important for them. Example:

Dancing, for me, teaches some personal values that are not learnt elsewhere.

Introjected regulation: When learners have previously interiorised the external source of their motivation, but still have not accepted the behaviour. Example:

In class, I did it the best I could because that is what you are supposed to do; it is compulsory.

External regulation: When a learner's behaviour is controlled by external sources such as rewards, threats and punishments. Example:

These exercises are only useful to carry out the activities that the teacher asks us to do in the classes for the exams.

Amotivation: This refers to a lack of intrinsic and extrinsic motivation and represents total absence of free will or self-determination. Example:

I did not feel comfortable attending this class because it is a pain in the neck.

Procedure

All those involved in the study were contacted before the data were collected, obtaining the relevant permission, informing them that participation was voluntary and that the responses would be treated confidentially.

The data-collecting method used in this study was a case study design (Stake, 1995). The research was carried out during the 1st and 2nd terms of the school year in a compulsory secondary education centre, distributed into 2 weekly sessions that took place in the school gymnasium hall. 12 dance-teaching sessions were developed for each teaching technique for each of the groups. The dance content delivered in the sessions were related to 'movement factors' (body, weight, space, time, intensity and interaction), where 2 sessions were devoted to each movement factor, based on the basic principles of contemporary dance. The 2 groups worked with the same content during the research with the only difference being the teaching technique used by the teacher.

Related to the application of the creative technique, the teacher was trained during two teaching sessions about the characteristics of this type of teaching and its practical application, showing didactic examples of the creative technique, as well as the traditional direct instruction technique. The principal investigator (PI) supervised the application of the

teaching sessions with the scholars to ensure its correct application.

To collect the data, 3 situational measurements were carried out by the PI, at 3 different moments in time that coincided with sessions 4, 8 and 12 of both groups (phases 1, 2 and 3, respectively). Data collection consisted of administering a self-report questionnaire to the learners, which they completed in the classroom without the presence of the teacher and in a climate that enabled them to concentrate without any type of distraction for 40 minutes. The PI was present at all times to explain any doubts and make sure that the process was strictly followed.

Data analysis

Thematic analysis was used to analyse the self-report questionnaires of the learners. This analysis mainly comprised of 3 steps. A deductive approach was used in the 1st step (Quivy & Van Campenhoudt, 1997), that is, the generation and categorisation of the codes based on the theory established and on the results of previous research studies. The 2nd step consisted of creating and categorising new codes based on the data that did not fit into the predetermined categories.

In the 3rd step, the reliability of the codes and of the coding was determined. To achieve this, the coding process was carried out firstly by the PI and, later, by an external encoder familiar with qualitative research. They followed a training process to ensure clarity and understanding of the category system prepared with the members of the research group, bearing in mind the 2 analysis levels set out in the category system, namely basic psychological needs and type of motivational regulation. Regarding inter-rater reliability, the Cohen's kappa coefficient was used (Cohen, 1960). This coefficient was 0.72, indicating that the agreement between encoders was satisfactory according to the Fleiss scale (scores between 0.61 and 0.80, satisfactory agreement) (Fleiss, 1971).

RESULTS

The results of the motivation level reached are set out by analysing the satisfaction/frustration of basic psychological needs, on the one hand, and, on the other hand, the learners' type of motivation or self-determination level in agreement with the teaching technique used and on the gender of the learners.

Analysis according to teaching technique

Firstly, a comparative analysis was carried out between the *Direct Instruction Technique* (DT) and the *Creative Inquiry Technique* (CT) with respect to the motivational processes they trigger in learners in general, with no gender differentiation.

Table 1. **COMPARISON OF INSTRUCTION TECHNIQUES FOR SATISFACTION / FRUSTRATION: FREQUENCIES AND PERCENTAGES**

	Direct Instruction Technique			**Creative Inquiry Technique**		
Variables	Phase 1 F (%)	Phase 2 F (%)	Phase 3 F (%)	Phase 1 F (%)	Phase 2 F (%)	Phase 3 F (%)
Satisfaction BPN						

Competence	3 (20.00)	12 (52.17)	8 (42.10)	3 (37.50)	3 (23.08)	11 (25.58)
Autonomy	1 (6.66)	2 (8.69)	0	0	0	0
Relatedness	3 (20.00)	8 (34.78)	7 (36.84)	4 (50.00)	7 (53.85)	19 (44.19)
Frustration BPN						
No competence	7 (46.66)	1 (4.35)	4 (21.05)	1 (12.50)	3 (23.08)	8 (18.60)
No autonomy	0	0	0	0	0	0
No relatedness	1 (6.66)	0	0	0	0	5 (11.63)

BPN=Basic Psychological Needs Phase=Assessment F=Frequency

Table 1 shows the results of this comparison based on the satisfaction/frustration of basic psychological needs, where it can be observed that the *Direct Instruction Technique* produced an increase in the perception of competence and relatedness (P=Phase; nº= Learner number):

> *Thanks to the repetition of the movements, I was quite sure that I could do the class exercises, I knew at all times what I had to do and I believe that I did them well.* (DT, P3, nº 13)
>
> *It was a session where I felt very sociable, I felt very integrated and I had a really good time because I always knew what I had to do.* (DT, P3, nº 2).

However, under the *Creative Inquiry Technique*, a decrease in perception of competence took place, which was also accompanied by a slight increase in frustration of competence:

> *When I felt the worst was when we had to create our own choreographies because I got stuck and couldn't do anything.* (CT, P3, nº 10)
>
> *I felt ridiculous when I saw that I was not doing it right, nothing occurred to me, I was nervous.* (CT, P3, nº 8)

In Table 2, the comparison between the 2 teaching techniques regarding the learners' type of motivation is presented. With respect to *Direct Instruction Technique*, the importance that learners attached to intrinsic motivation must be highlighted. It was the most important category during all the assessment sessions, with no substantial modification during the application of this technique, whilst amotivation was reduced:

> *I found the class entertaining because we did different exercises and they were not boring.* (DT, P3, nº 13)
>
> *I thought that I was going to be very bored, but I was quite surprised because I was able to participate in the activities.* (DT, P3, nº 10)

Table 2. **COMPARISON OF INSTRUCTION TECHNIQUES FOR LEVEL OF SELF-DETERMINATION: FREQUENCIES AND PERCENTAGES**

	Direct Instruction Technique			**Creative Inquiry Technique**		
Motivation variables	Phase 1 F (%)	Phase 2 F (%)	Phase 3 F (%)	Phase 1 F (%)	Phase 2 F (%)	Phase 3 F (%)
Intrinsic motivation	29 (61.70)	12 (75.00)	16 (88.88)	7 (77.77)	14 (66.66)	23 (50.00)
Identified regulation	2 (4.25)	0	0	2 (22.22)	1 (4.76)	11 (23.91)
Introjected regulation	2 (4.25)	0	0	0	0	0

External regulation	0	0	0	0	0	1 (2.17)
Amotivation	14 (29.79)	4 (25.00)	2 (11.11)	0	6 (28.57)	11 (23.91)

Phase=Assessment F=Frequency

In contrast, the *Creative Inquiry Technique* produced a decrease in intrinsic motivation, a slight increase in identified regulation, accompanied by an increase in amotivation:

> *The classes are fun but I don't like having to invent the choreographies, I prefer not to have to think.* (CT, P1, nº 2)
>
> *I believe that these classes have been very useful to us.* (CT, P3, nº 2)
>
> *I am not interested in this type of exercises where I have to engage so much, and on top of that, with dance things, I prefer to do a sport.* (CT, P3, nº 8)

Analysis according to gender

An analysis was conducted to compare the motivational processes for the 2 teaching methods for gender, given the cultural differences that have traditionally been expressed between both genders. The comparison by gender (B=Boy; G=Girl) appears in Table 3. According to the satisfaction/frustration of basic psychological needs, it can be seen that girls perceive more competence than boys under the *Direct Instruction Technique* whilst, in the case of boys, the opposite occurred, showing greater competence than girls under the *Creative Inquiry Technique*:

> *I feel that I can do everything. There are no limits or frontiers.* (DT, P1, nº 1, G)
>
> *I liked this class a lot. I knew the choreography better and it was easier for me to do it because we had created it ourselves.* (CT, P2, nº 15, B)

Immediately afterwards, on analysing the frustration of basic psychological needs, it can be observed how girls consider their competence to be more frustrated under the *Creative Inquiry Technique*, whilst boys find this need more frustrated with the *Direct Instruction Technique*:

> *I felt embarrassed when people were looking at me and I did not know what to do to be able to do it well.* (CT, P3, nº 2, G)
>
> *I did not manage to do the steps well and I looked really flat-footed.* (DT, P1, nº 11, B)

Table 3. **GENDER COMPARISON OF INSTRUCTION TECHNIQUES FOR SATISFACTION/FRUSTRATION: FREQUENCIES AND PERCENTAGES**

	Direct instruction technique		**Creative inquiry technique**	
	Girl	Boy	Girl	Boy
Variables	F (%)	F (%)	F (%)	F (%)
Satisfaction BPN				
Competence	9 (40.91)	14 (40.00)	10 (19.61)	7 (53.85)
Autonomy	0	3 (8.57)	0	0
Relatedness	12 (54.54)	6 (17.14)	26 (50.98)	4 (30.77)

Frustration BPN				
No competence	1 (4.54)	11 (31.43)	10 (19.61)	2 (15.38)
No autonomy	0	0	0	0
No relatedness	0	1 (2.86)	5 (9.80)	0

BPN=Basic Psychological Needs F=Frequency

Finally, Table 4 reflects the findings related to the level of self-determination, where it can be seen that girls generally show greater intrinsic motivation than boys with both teaching techniques, whilst with amotivation the opposite occurs, as boys are the ones who show greater amotivation than the girls under both teaching techniques:

> *Dancing is the means I have got to feel free, to be released, to escape from the world to enter into another different one to my own.* (DT, P1, nº 3, G)

> *Personally, the class has not been at all special but that is my opinion and I don't like corporal expression very much but maybe the others like it.* (DT, P1, nº 12, B)

Table 4. **GENDER COMPARISON OF INSTRUCTION TECHNIQUES FOR SELF-DETERMINATION LEVELS: FREQUENCIES AND PERCENTAGES**

	Direct instruction technique		**Creative inquiry technique**	
Motivation variables	Girl F (%)	Boy F (%)	Girl F (%)	Boy F (%)
Intrinsic motivation	24 (92.31)	33 (60.00)	32 (71.11)	12 (38.71)
Identified regulation	2 (7.69)	0	11 (24.44)	3 (9.68)
Introjected regulation	0	2 (3.63)	0	0
External regulation	0	0	0	1 (3.22)
Amotivation	0	20 (36.36)	2 (4.44)	15 (48.39)

F=Frequency

DISCUSSION

The subject of PE has traditionally been linked to the prevailing movement culture, associated with paradigms that seek technical efficiency, the final product and competition (Kirk, 2010; Gard, 2011). Thus, artistic-expressive practices represent a conflict for the learners, as it affects the emotional dimension rather than technique. This negative attitude felt by the learners may be due to not being aware of the benefits it provides, as the teachers do not use the right method to teach this type of content (Pate & O'Neill, 2009; Sebire *et al*., 2013). However, the teacher is responsible to make sure the learners feel comfortable, not forgetting the clear gender differences in motivation towards artistic-expressive activities, as is the case of dance (O'Neill *et al*., 2011).

Thus, the intention with this study was to discover the most efficient teaching method, while considering the learners' gender, to increase their motivation during the teaching of the dance content during PE. To do this, 2 different teaching techniques were compared; the *Direct Instruction Technique* and the *Creative Inquiry Technique*, observing their effect on gender and the motivational processes that are triggered during the practise of the artistic-expressive

content in PE. Following the analysis of the results, it is worth highlighting that in general, the application of the *Direct Instruction Technique* for teaching dance content in PE produces more adaptive consequences for students from the motivational viewpoint, with respect to the *Creative Inquiry Technique*.

The *Direct Instruction Technique* triggers a progressive increase in the perception of competence and relatedness and a decrease in amotivation in learners. Furthermore, it must be noted that intrinsic motivation remains high from the first moment this teaching technique is applied until the end. In this regard, after taking into consideration the learners testimonies, it was observed that the repetition of movements and the acquisition of a motor experience, which brings about a lot of satisfaction despite the difficulty that the execution may entail. It allows learners to feel more competent, more integrated with their classmates and more motivated towards dance. In fact, some studies indicate that if the learners have a prior model of reference, as it occurs in the case of the *Direct Instruction Technique*, they master a task more quickly and thus experience greater motor competence (Runco, 2008; Sanchez-Ruiz *et al*., 2011). It has been reported that competence is associated with fun and satisfaction in PE (Cairney *et al*., 2012).

On the other hand, the application of the *Creative Inquiry Technique* brought about a decrease in competence in intrinsic motivation and identified regulation and an increase in amotivation. By the end of the teaching sessions, competence and identified regulation increased slightly whilst amotivation decreased slightly (Table 2). Based on the testimonies of the learners, the problems that arise from the use of this type of teaching technique are related to insecurity and discomfort. They have to think, contribute ideas and create a sequence of movements. They have doubts about their own competence and believe they are going to be judged and ridiculed by the rest of their classmates. This may be associated with the fact that they lack a model to follow with which they can self-regulate and receive feedback (Sanchez-Ruiz *et al*., 2011). However, with time the learners in this study felt more competent and they made better use of their resources. From that moment on, they started understanding and evaluating the usefulness of this type of procedure. Perhaps, through experiencing this creative method enabled the teacher to get closer to the students' preferences and connect them to their objectives, contents and procedures (Hong *et al*., 2009; Kousoulas & Mega, 2009).

When the data were analysed according to gender, the girls showed greater intrinsic motivation and the boys showed greater amotivation with both teaching techniques. This seemed to be related in all cases to the content. The girls usually expressed their interest, enthusiasm and satisfaction with participating in dancing, whilst the boys reported their lack of interest and dissatisfaction because they prefered to practise sport (Chalabaev *et al*., 2013). These findings are in line with similar research studies, which conveyed that the dance content is preferred to a greater extent by girls (Grieser *et al*., 2006; O'Neill *et al*., 2011), while generating greater amotivation in boys, because they consider they have less qualities to perform this type of activity for social and cultural reasons (Lyu & Gill, 2011; Chalabaev *et al*., 2013).

With reference to competence, there are also contrasts between genders. Girls perceive having greater competence under the *Direct Instruction Technique* and greater incompetence under the *Creative Inquiry Technique*, whilst exactly the opposite occurs with boys. More

specifically, the testimonies revealed that girls felt more secure under the *Direct Instruction Technique* because they considered that they had the necessary resources to perform the movements successfully. On the other hand, under the *Creative Inquiry Technique*, they felt more ridiculous when they saw what they were doing and they believed that they were not doing it efficiently. In fact, there are studies reporting that some learners experienced less mastery of the task, when they had to choose the execution creatively (Lykesas *et al*., 2009).

However, the boys felt more secure under the *Creative Inquiry Technique* because they considered that they knew what they were doing and it was easier for them because they adapted the choreographies to their level of performance. Whilst with the *Direct Instruction Technique*, they felt incompetent because, despite knowing the movements and repeating them, they believed that they were not efficient in their execution. These findings could be explained by greater or less cognitive participation of learners in the teaching-learning process, as some studies suggest that in PE, boys are more attracted by activities with high cognitive participation than girls are (Halpern, 2000; Chen & Darst, 2001). Perhaps the sessions under the *Creative Inquiry Technique* could make boys feel more comfortable and more competent, as this method requires the production of new and adequate ideas, where a high degree of cognitive engagement is required (Ghayas *et al*., 2012).

CONCLUSIONS

The main conclusions to be highlighted are, firstly, the efficiency of the *Direct Instruction Technique* regarding the motivation of the learners. It is effective for the treatment of dance content in PE in the initial stages, as it permits them to show greater competence and security in executing the activities based on repetition and shadowing the model provided. However, when the *Creative Inquiry Technique* is applied in these stages, the consequences at motivational level are negative at the start, resulting in a decrease in competence and in intrinsic motivation. Nevertheless, it would be appropriate in future studies to conduct a more prolonged monitoring in order to observe the effect of this technique over time. There have

been signs that, the longer this technique is applied, the learners begin to increase their competence and to understand the usefulness of creative dance in different areas of their lives (which can be verified with the increase in identified regulation).

Secondly, dance content in PE requires differentiated treatment depending on the learners' gender. The use of the *Direct Instruction Technique* is more effective with girls. To this end, it is suggested that when learners acquire adequate motor experience, both techniques should be alternated during all the sessions to favour the satisfaction of both genders. Thus, the teacher will focus more on reinforcing the competence of boys under the *Direct Instruction Technique* and on fostering cognitive participation and creativity of girls under the *Creative Inquiry Technique*.

This research is one of the few qualitative studies carried out under the Self-determination Theory approach to analyse learners' motivation towards dance, depending on the teaching technique used and on the learners' gender. The results reported could be considered and applied by PE teachers. It would be interesting to replicate the research in future studies, incorporating a greater number of centres and learners and even comparing different ages and groups in dance teaching, so that the results can be extrapolated to other contexts.

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UPPER EXTREMITY KINEMATICS OF FLAT SERVE IN TENNIS

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ABSTRACT

The purpose of the present study was to examine of the effects of upper body kinematics on the ball velocity at the impact phase of a tennis flat serve. 15 elite male tennis players were recruited to participate in this study (mean age 18.4±3.3 years, mean height 182.3±5.6cm, mean weight 72.2±7.9kg), of which five were from the Turkish National Team. Players performed flat tennis serves on a regulation indoor tennis court. Data were recorded digitally to computer hard drives on court using three Basler A602f cameras at 100Hz. The Radar gun (Sports Radar, Astro Products, CA), was used for velocity measurements of the tennis balls. The Spearman Rank Correlation procedure was used to determine the relationships between parameters and balls. Relationships between elbow angular velocity and trunk angular velocity, as well as between elbow angular velocity and wrist angular velocity were found. The ground reaction forces transmitted through the legs and trunk allowed for greater angular velocity of the elbow, which in turn provided a

favourable advantage by affecting the wrist speed and ultimately, the ball speed.

Key words: Tennis; Flat serve; Biomechanics; Kinematic analysis.

INTRODUCTION

The tennis serve is one of the most difficult of all techniques even though apparently its control and progression is fully manageable by the player. It is difficult to learn the most correct technique in view of the fact that the upper and lower extremity movements involved, require complex coordination (Bahamonde, 2000). Accordingly, the tennis serve is both the most important and the most difficult stroke to master and comes in three basic types, flat, topspin and slice (Elliott *et al.*, 1997). The flat kick (topspin), and slice (sidespin) serves employ similar upper body temporal and kinematic characteristics to produce large translational ball velocities (Sheets *et al.*, 2011). The flat serve is potentially the fastest, while the topspin serve is usually the most consistent. While velocity generation is critical to flat serve performance, the confines and dimensions of the service box necessitates the preservation of an accuracy component (Whiteside *et al*., 2014).

Serving at high velocity in tennis generally brings a great advantage (Chow *et al.*, 2003). Biomechanical research has helped to decipher the critical kinetic and kinematic contributors to racquet velocity in the first serve and many studies have been conducted to understand

these kinematics (Elliott *et al.*, 1995; Bahamonde, 2000; Marshall & Elliott, 2000; Fleisig *et al*., 2003; Tanabe & Ito, 2007). The important key factors of a serve are the racquet speed and its direction, height of the ball at stroke, weight of the racquet, the angle of the racquet at impact and the ball speed and its direction at this time.

PURPOSE OF STUDY

The serve is a sequence of motions referred to as a kinetic chain that begins with lower limb action and followed by rotations of the trunk and upper limb. This kinetic chain involves transfer of linear and angular momentum from the legs to the trunk and then to the arm and the racquet (Martin *et al*., 2012). Trunk rotation, lower limb movements and the upper limb segment rotation play an important role in the development of these critical factors (Elliott *et al*., 1997). The purpose of the present study was to examine the effects of upper body kinematics on the ball velocity at the impact phase of the flat serve.

METHODOLOGY

Ethical approval

This study was approved by the Human Ethics Committee, University of Marmara (MU) (MAR-YC-2004-0030) and was conducted in a manner consistent with the recommendations of the declaration of Helsinki.

Participants

Fifteen (N=15) elite male tennis players (mean age 18.4±3.3 years; mean height 182.3±5.6cm; mean weight 72.2±7.9kg), of whom 5 were from the Turkish National Team,

were recruited to participate. All participants had at least 8 years of experience at both national and international tournaments. They completed approximately 25 hours of training per week during the period in which measurements were conducted.

Procedures

Each subject arrived at the tennis court for the testing sessions after refraining from any formal exercise, alcohol or caffeine for 24 hours. They could consume a light meal of their choice that was advised by the researchers to include complex carbohydrates, a small amount of fat and protein and water 2 to 3 hours before test.

After an appropriate warm-up, players performed flat tennis serves on a regulation indoor tennis court. At least 5 maximal official serve trials were performed. Data were recorded digitally to computer hard drives on court using 3 Basler A602f cameras at 100 Hz. In addition, a radar gun (Sports Radar 3600, Astro Products, Ontario, CA, USA) was used for velocity measurements of the tennis ball. The accuracy of the radar was 0.1km/h (0.03m/s) for a field of 10 degrees wide. It means, the accuracy of processing the speed estimate is typically 2% of the actual ball speed for SR3600 (Gelen *et al.*, 2012).

The radar gun was placed at the opposite end at the baseline. All serves, from right-handed players were directed to the left service box, while all serves from left-handed players were directed to the right service box. The best of the 5 service tries were recorded in (km/h) as the max serve (Vmax) in this analysis. For performance recordings, 1 of the cameras was placed behind the player at approximately 45° and the other 2 cameras at the opposite side of the player, positioned approximately 120° relative to each other.

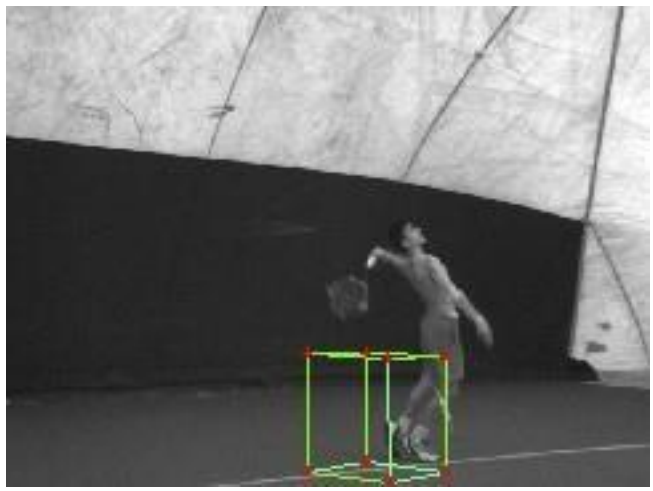

Figure 1. **CALIBRATION CUBE**

For field calibration, a Direct Linear Transformation technique, developed by Abdel-Aziz and Karara (1971) and Shapiro (1978), was used. Four calibration points were calculated by using 70cmx70cmx80cm calibration cube (Figure 1). Reflective markers were used for determining the anatomical points on body segments and the reference points on the racquet. These reflective markers were placed on the player's acromion, supra-iliac, the olecranon,

processus styleoideus, and at the caput phalange V point (Figure 2).

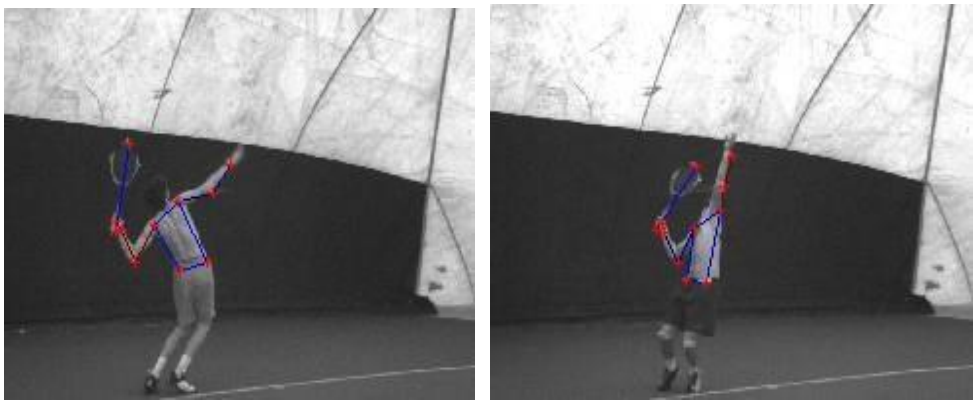

Figure 2. **MARKER POSITIONS**

The elbow angle was measured by combining the acromion, olecranon and processus styleoideus points. The shoulder angle was measured by combining the olecranon, the acromion and spina-iliaca anterior superior points. The wrist angle was measured by combining the caput phalange V, processus styleoideus points and the olecranon points. The body angle was measured by combining both the right and left spina-iliaca anterior superior and the acromion points (Figure 3).

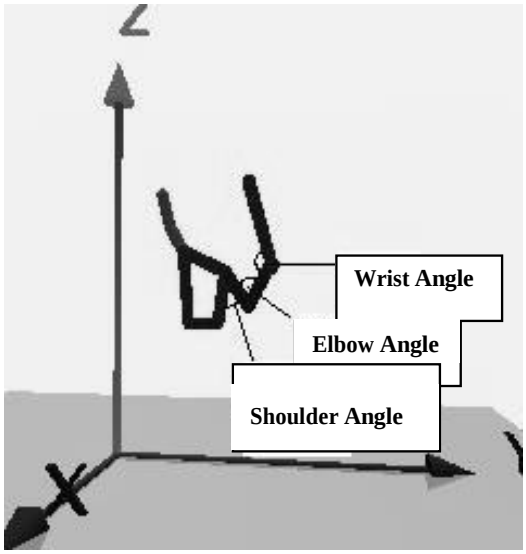

Figure 3. **JOINT ANGLES**

The serve that the radar detected at the highest velocity were analysed by using a Motion Analysis Software (Reality Motion System version 6.2, SIMI GmbH). The flat serve technique for each player was analysed by assessing the phase of the stroke determined as 5

frames before the ball leaves the racquet. The shoulder, elbow, wrist and body angular displacement were calculated in degrees (º), angular velocity in degrees/seconds (º/s) and angular acceleration values in degrees/seconds² (º/s^2) for the stroke phase.

Statistical analysis

All statistics were computed by using SPSS 11.5 (SPSS Inc., Chicago, IL) programme. Means and standard deviations were calculated for all variables. Spearman correlation coefficients were used to evaluate the relationships between the ball velocity and kinematic parameters (joint angles, velocities and accelerations). The level of significance was established at $p<0.05$.

RESULTS

The mean and standard deviation of shoulder, elbow, wrist, trunk angles, angular velocity and angular accelerations, as well as ball velocity parameters are summarised in Table 1.

Table 1. **UPPER EXTREMITY ANGULAR KINEMATIC PARAMETERS**

Kinematic parameters	Mean±SD
Shoulder angle (°)	104.74±8.79
Shoulder velocity (°/s)	-10.37±141.58
Shoulder acceleration (°/s^2)	-3104.58±918.19
Elbow angle (°)	140.24±7.42
Elbow velocity (°/s)	557.02±233.09
Elbow acceleration (°/s^2)	-18409.97±347.18
Wrist angle (°)	151.34±18.05
Wrist velocity (°/s)	105.45±363.61
Wrist acceleration (°/s^2)	3380.44±308.88
Trunk angle (°)	151.47±8.09
Trunk velocity (°/s)	-47.34±153.18
Trunk acceleration (°/s^2)	1392.88±311.99
Ball velocity (km/hr)	126.93±17.19

The relationship between the elbow angular velocity and trunk velocity about the transverse axis is presented in Table 2.

Table 2. **PEARSON CORRELATION BETWEEN PARAMETERS**

Parameters	r	p
Elbow angular velocity – Trunk velocity	0.546	0.03*

Elbow angular velocity – Wrist velocity	0.579	0.02*
Elbow angular velocity – Ball velocity	0.550	0.03*

*p<0.05

Significant correlations were found between elbow angular velocity and trunk velocity (r=0.546, p=0.03), between elbow angular velocity and wrist velocity (r=0.579, p=0.02) and between elbow angular velocity and ball velocity (r=0.550, p=0.03). However, there was no significant relationship between the ball velocity and the other kinematic parameters (p>0.05).

DISCUSSION

In tennis, the serve is one of the most important components of performance for scoring points. Because of this importance, a number of investigations have been conducted regarding the specific biomechanics of the tennis serve (Shim *et al*., 2006; Abrams *et al*., 2011; Sheets *et al*., 2011; Abrams *et al*., 2014; Whiteside *et al*., 2014).

In previous studies carried out on the tennis flat serve, the whole arm movement has been determined to be similar to the upper arm movement. The only difference between the techniques was found where the upper limb was at a different position (Lees, 2003). However, in later studies examining the tennis serve, the findings reported by Leeds (2003) were found to be wrong (Bahamonde, 2005). Elliott *et al*. (1995) determined that 90% of the linear velocity of the ball at stroke was because of the upper limb movement. In the current study, the upper extremity kinematics were analysed by considering this percentage.

Ball velocity

The ability to serve at high speed brings great advantages to the player (Chow *et al*., 2003). Elliott *et al*. (2003) determined the serve speed for male players to be 182.8km/h. In a more recent study by Sun *et al*. (2012), the ball serve velocity was recorded as 157.92km/h (42.64m/s). In the present study, the average velocity attained by the players was 126.93km/h. Although two of the players performed a serve velocity of 150km/h, the general speed results of the players in this study were slower than that reported in the literature. However, their movements were important in the study based on the effects of strike techniques on the speed of the ball.

Relationships between upper body angular velocity and ball velocity

Based on the statistical analysis, a significant relationship was found between ball velocity and the angular velocity of the elbow (r=0.550, p<0.05). The angular velocity of the elbow was 557.02±233.09°/sec. Due to the statistically significant relationship between trunk and elbow angular velocity, it may be inferred that trunk rotational angular momentum may contribute to increased elbow angular velocity. The elbow extension was the second greatest contributor to racquet speed at impact (Abrams *et al*., 2014). Although the present study did not find a significant correlation between trunk and ball velocities, other studies, such as that of Bahamonde and Knudson (1998), did find a significant correlation between these two variables.

Martin *et al*. (2012) found a relationship between maximal trunk angular momentum about the transverse axis and ball velocity in their study. The angular momentum created during the serve corresponds to a three-lever system comprising the trunk, the arm and the racquet

(Bahamonde, 2000). Martin *et al*. (2012) indicated that between maximal external rotation of the shoulder joint and impact, the trunk lost most of its forward angular momentum and in contrast, the arm holding the racquet gained most of its forward angular momentum during the same stage of the serve.

Relationships between upper body angles and ball velocity

Buckley and Kerwin (1988) in their study recorded the elbow extension angular velocity as 27.8±4.1rad/s and the elbow extension angle as 115.8°±9.6° just before hitting the ball.

Bahamonde (2005) reported that the elbow is not completely extended at stroke and the angle remains between 154 to 164°. In the present study, the average elbow angle was found to be 140.24°±7.42° indicating that the angle was less than findings reported in the literature. In any case, the low-ball velocity could be related to the decreased elbow angle considering that the velocity of the ball is affected by the elbow angle, as determined to be the only factor influencing velocity. The increase in the elbow extension angle would be advantageous in attaining higher levels of velocity.

Kinematic chain

During the power serve, a number of body segments must be coordinated in a sequence referred to as the "kinematic chain" (Kibler & Van der Meer, 2001), to produce optimal racquet position, trajectory and velocity upon impact with the ball. It begins with the lower limb action and then followed by rotations of the trunk and upper limb (Martin *et al*., 2012). Putnam (1993, cited in Abrams, 2014), reported that the proximal muscles of the scapula and trunk are mostly responsible for absorbing the forces generated earlier in the chain.

This chain involves a transfer of linear and angular momentum from the legs to the trunk and then to the arm and the racquet (Bahamonde, 2000). According to Bahamonde (2005), the tennis serve requires a coordinated transfer of momentum from proximal to distal segments in sequence and found the maximal extension angular velocity (of the elbow) to be approximately 1.230–2.527°/s in his study. In the present study, a significant positive correlation was found between the angular velocity of the wrist and the elbow angular velocity ($r=0.571$, $p<0.05$), which demonstrates the progressive movement from proximal to distal. Martin *et al*. (2012) found that the players with the highest values for upper body segmental angular momentum about the transverse axis are those with the highest ball velocity. The most important findings of their study were the significant correlations between mean trunk angular momentum and ball velocity values.

PRACTICAL APPLICATION

The tennis serve can be enhanced by performing the serve correctly and making use of the kinematic chain where forces may be transferred from the ground to the upper extremities. It is very effective to continue transmission correctly in the form of this chain (linear displacement, rotations, etc.), in the upper extremity. Coaches and teachers will be able to enhance the ball speed the tennis players attain by emphasising trunk rotation and implementing training programmes that improve the rotational velocity of the kinematic chain.

CONCLUSION

It can be concluded that the optimal body rotation is an important factor with regard to enhancing the whole body angular momentum and in turn transferring this from the elbow to the wrist, thereby ultimately leading to enhanced ball velocity at impact.

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IMPACT OF ONE-DAY ADVENTURE-BASED EXPERIENTIAL LEARNING (AEL) PROGRAMME ON LIFE EFFECTIVENESS SKILLS OF ADULT LEARNERS

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ABSTRACT

Despite positive claims made by advocates of adventure-based experiential learning (AEL), sceptics could be concerned that such claims are overzealous. Due to the expansion of AEL programmes into management training in business schools and the corporate world, ongoing empirical investigations relating to the efficacy of AEL in the workplace is necessary. The aim of this study was to determine the developmental impact of a one-day AEL programme on the life effectiveness skills of adult learners in a business school. A one-day ropes course programme was offered to 140 adult learners from the business school. The Life Effectiveness Questionnaire, Version H (LEQ-H), served as measurement tool and it was administered as a pre- and post-test measurement. The overall post-test scores of the experimental group (n=140) were significantly higher (p=0.0001) than the post-test scores of the control group (n=126). The post-test scores of four dimensions differed significantly (p<0.05) from the post-test scores of the control group. The findings indicate the potential efficacy of an AEL course for the development of life effectiveness skills in adult learners. It demonstrates the necessity of ongoing research directed at principles underlying the application of particular methodologies and other programmatic factors to maximise efficacy.

Key words: Adventure; Experiential learning; Life effectiveness; Adult learners.

INTRODUCTION

Adventure programmes have become a popular vehicle for developing life skills (Moote & Wodarski, 1997). Gillis and Speelman (2008), who found that challenge courses in particular are effective tools for influencing a variety of educational and psychological constructs, confirm this. These courses are applied, for example, in bereavement counselling (Swank, 2013), for enhancing university students' individual psychological and emotional skills (Cooper *et al*., 2009), and for developing resiliency in youth (Conley *et al*., 2007; Bloemhoff, 2012). Nearly two decades ago, Witt and Crompton (1996) identified adventure-based experiential learning (AEL) programmes as a globally recognised vehicle to develop life effectiveness in adolescents and adults. Neill *et al*. (1997:5) define life effectiveness as the "psychological and behavioural aspects of human functioning which determine a person's

effectiveness or proficiency in any given situation". Sibthorp and Arthur-Banning (2004) reason that life effectiveness can be defined as the extent to which an individual believes that he or she can be effective in various tasks of life and is similar to 'life skills'. In the current study life, effectiveness will be regarded as the belief of an individual that they possess the necessary psychological and behavioural proficiencies for effective human functioning in any given situation.

AEL is based on a belief that changes will occur when people are taken out of their comfort zones into a state of disequilibrium. To return to a state of equilibrium, clients must take actions (Priest & Gass, 2005) that result in learning through their experience. In contrast to traditional learning regimes, experiential learning (EL), being one of the earliest forms of education in the Western world (Breunig, 2008), is judged by Beard and Wilson (2006) as the strongest and most enduring of learning theories. Notable educational psychologists such as John Dewey, Carl Rogers and David Kolb have provided the groundwork of learning theories that focus on learning through experience (NIU, n.d.).

EL (also referred to as learning through action, learning by doing, learning through experience, and learning through discovery and exploration), is a client-focused, supported approach to individual, group or organisational development, which engages the young or adult learner, using the elements of action, reflection and transfer of learning (Beard & Wilson, 2006). Facilitators purposefully engage with clients to enhance the quality of the learning experiences, to assist participants in finding direction and sources for functional change, and to create changes that are lasting and transferable (Cilliers, 2000; Priest & Gass, 2005). The basic theory behind EL is active participation, which may lead to knowledge being acquired that is different from what it would be in the case of passive reception (Meyer, 2003).

The concept of impelling clients into adventurous situations as part of EL is not a recent development (Hunt, 1990), and it is escalating in contemporary societies. In AEL, which can be defined as an umbrella term for experiential programmes that utilise adventure activities to achieve programme outcomes (Weilbach, 2007), adventure forms the basis of the experiential milieu. Adventure requires an element of real or perceived risk for the participant (Beard & Wilson, 2006). This risk (the potential to lose something of value), can be physical, mental, social or financial (Priest & Gass, 2005).

Burke and Collins (1998) indicated an expansion in the use of the outdoors as a vehicle for managerial learning. This can be attributed to the many adventure opportunities that exist in the outdoors for actively engaging individuals in physical, emotional and intellectual experiences (Neill *et al*., 1997). Rhodes and Martin (2014) provide evidence of adventure education courses enhancing intra- and interpersonal skills in the workplace. It is thus, no surprise that Gangemi (2005) reports that business schools are indeed increasingly making use of the power of experiential learning in outdoor environments to bring students into direct contact with real, challenging teamwork and leadership situations.

From an anecdotal perspective, there is a body of evidence in the literature that suggests the positive impact of AEL interventions (Carioppe & Adamson, 1988; Bank, 1994; Burke & Collins, 1998; Neill, 2003; Gardner & Flood, 2006; Weilbach *et al*., 2010). More recently, Wu *et al*. (2013) found that participation in ropes course experiences yield intra- and

interpersonal benefits to various target groups. Despite the positive claims that have been made by advocates of AEL, sceptics could be concerned that such claims were overzealous

(Neill *et al*., 2003). Scientific demonstration of the effectiveness of AEL must be based on ongoing empirical investigations. Unfortunately, there is still a lack of well-organised, definitive and widespread knowledge about the efficacy of the diverse types of interventions in AEL. Gangemi (2005) indicated that the necessity of measuring developmental changes is emphasised by the expansion of AEL programmes into management training and the proliferation of AEL organisations worldwide.

PURPOSE OF THE STUDY

There is a need for ongoing empirical investigations relating to the efficacy of AEL and the expansion of AEL programmes into management training in business schools and the corporate world. Thus, the aim of this study was to determine the developmental impact of a one-day AEL programme (ropes course) on the life effectiveness skills of adult learners in a business school who are employed full-time in diverse corporate settings.

METHODOLOGY

A quasi-experimental pre- / post-test design was applied in this study. An experimental group and a control group served as subjects. All groups completed the same questionnaire as a pre- and again as a post-test.

Instrument

Table 1. **DIMENSIONS OF LIFE EFFECTIVENESS**

Dimensions	Definition
Achievement motivation:	The degree that an individual is driven to accomplish excellence.
Active initiative:	The degree that an individual will take charge or initiate an action in a new setting.
Emotional control:	The degree an individual is able to remain in control while perceiving to be involved in an emotionally stressful environment.
Intellectual flexibility:	The extent to which an individual is able to modify his/her pattern of thinking based on new/changing information being provided to them.
Self-confidence:	The belief of an individual in his/her abilities and how these abilities would contribute to his/her success.
Social competence:	One's ability to be confident and have the capacity to interact effectively socially.
Task leadership:	The degree to which an individual believes they can organise a group effectively given the task as the primary interest.
Time management:	The ability of an individual to make the best use of his/her time.

A critical challenge for researchers is to establish clear assessments of the relative efficacy of AEL programmes. The Life Effectiveness Questionnaire - Version H (LEQ-H), developed by

Neill *et al*. (1997) was employed to measure the life effectiveness skills of the subjects. This 24-item self-reported questionnaire use an 8-point Likert scale. Neill *et al*. (1997) indicated a Cronbach's alpha coefficient of 0.75-0.93 for the Life Effectiveness Questionnaire (H-format). 8 dimensions of life effectiveness identified by Neill *et al*. (2003) constituted the dependent variables for this study. Neill and co-authors posit that life effectiveness can be further explained using these 8 dimensions (3 items per dimension) as illustrated in Table 1.

The more effective an individual performs in the 8 dimensions, the more likely that individual is to accomplish personal achievements (Sibthorp, 2003). The experimental group received the pre-test in a lecture room directly before the intervention (ropes course). The post-test was administered in the same classroom, directly after completion of the ropes course. The control group completed the post-test 8 hours after the pre-test during normal lecture hours. The researcher distributed the questionnaires.

Participants

The sample population of this study was comprised of adult learners, at least 23 years of age with a permanent work appointment, who were enrolled for the Bachelor in Management Leadership (BML) at the Business School of the University of the Free State, South Africa. The minimum age and a permanent appointment are prerequisites for enrolment on the BML course. This qualification is based on experiential learning. The programme is aimed at part-time students and the recommended duration of study is 4 years. The objective of the BML is to deliver a new generation of formally qualified and innovative managerial leaders equipped to excel in and add value not only to today's corporate and business environment but also to the public sector (UFS, n.d.). After the necessary consent was obtained from the Programme authorities and the Ethics Committee of the Faculty of Humanities, all the students who enrolled for the BML programme between 2011 and 2014 were recruited to participate in this research project. Respondents in their first year of study were randomly assigned to a control (CG) and an experimental group (EG). The experimental group consisted of 140 respondents and the control group of 126 respondents.

Ethical clearance

An ethical clearance application was submitted to the Ethics Committee of the Faculty of the Humanities, University of the Free State. Clearance was granted and the following clearance number was allocated to the research project: UFS-HUM-2013-007.

Experimental treatment

A growing number of private and public adventure programmes are utilising artificial environments such as ropes courses to conduct adventure activities and experiences offering developmental opportunities to participants. These programmes or interventions are not generic. Programmes or interventions vary regarding content and format directed at desired outcomes and the key to increasing transfer-of-learning lies either in the design of appropriate learning activities or in the teaching methodology (Gass, 2008). The traditional sequencing of a programme as describe by Rohnke (1989) was followed in the current research project. This one-day ropes course programme included icebreakers, 'deinhibitisers', trust/spotting, initiative challenges and low and high ropes course elements. The elements require individual

participants to perform tasks while receiving emotional support from the remainder of the group. Group sizes varied between 15 and 20 participants per intervention. It was a first-time experience for all the participants. The same programme was presented to all the respondents at the same venue. The author, who has 20 years of experience in ropes course instruction, acted as the head instructor and facilitator.

Statistical analysis

Data were analysed using procedure MIXED of the SAS software system (SAS, 2009). The overall score of the LEQ questionnaire was calculated as the average of the 8 domain scores. Both the overall scores and the individual domain scores of each questionnaire were statistically analysed as follows: The post-scores of subjects in the experimental and control groups were compared using analysis of covariance (ANCOVA) fitting the factor group (experimental / control) and the corresponding pre-score as covariate. From this ANCOVA model, estimates and 95% confidence intervals for the "experimental – control" difference in mean post-scores were obtained, as well as p-values associated with the null-hypothesis of no difference between groups in post-scores.

RESULTS

The results of the ANCOVA are reported in Table 2.

Table 2. **COMPARISON OF EXPERIMENTAL AND CONTROL GROUPS ON VARIABLES OF LEQ QUESTIONNAIRE**

	Group		**Diff.: Experimental – Control**		
Dependent variables	CG	EG	Estimate	95% CI	p-Value
Overall	6.50	6.70	0.19	0.10 - 0.29	0.0001
Time management	5.84	6.11	0.27	0.11 - 0.43	0.0012
Social competence	6.15	6.40	0.26	0.08 - 0.43	0.0048
Achievement motivation	7.04	7.06	0.02	-0.10 - 0.14	0.7426
Intellectual flexibility	6.64	6.83	0.19	0.04 - 0.35	0.0153
Task leadership	6.59	6.70	0.11	-0.03 - 0.26	0.1235
Emotional control	6.27	6.47	0.20	0.02 - 0.39	0.0276
Active initiative	6.51	6.66	0.15	-0.00 - 0.31	0.0525
Self-confidence	7.07	7.16	0.09	-0.07 - 0.25	0.2535

Estimate and 95% Confidence Interval (CI) for difference between means "Experimental – Control" from ANCOVA of post-test scores with pre-test score as covariate.

The overall post-test scores (that is, the average calculated from the 8 dimensions of life effectiveness), of the EG were significantly higher ($p=0.0001$) than the post-test scores of the CG. The post-test scores of 4 dimensions (achievement motivation, task leadership, active initiative and self-confidence), did not differ significantly from the post-test scores of the CG. The post-test scores of the remaining 4 dimensions (time management, social competence, intellectual flexibility and emotional control), were significantly higher ($p<0.05$) than the post-test scores of the CG.

DISCUSSION

The positive impact of a one-day AEL programme (ropes course) on the life effectiveness skills of full-time employed adult learners is clearly illustrated in the research results of the current study. The results validate some of the claims of AEL proponents, but also differ from similar research. Although the overall life effectiveness scores increased significantly ($p<0.05$), only four of the eight life dimension scores increased significantly. In contrast, Gardner and Flood (2006) reported significant differences ($p<0.05$) of the overall life effectiveness score, as well as in all eight LEQ domains after participation in a one-day challenge course by college students. An analysis of corporate programmes by Richards and Neill (1993) demonstrated similar outcomes. Louw *et al*. (2012) found beneficial short- and long-term changes in life effectiveness of high-school learners. Stoltz (1992), however, found no significant differences in the eight LEQ domains after participation in a one- to two-day professional development programme.

Despite the growing body of literature suggesting the likelihood of reporting positive personal outcomes from adventure programmes (Shellman & Ewert, 2010), it is clear that research results differ. The question can be posed why four of the eight LEQ-domains did not change significantly in this research and why results differ. This may be attributed to programmes that vary regarding content and format. Gass (2008) suggests that transfer-of-learning is determined by programme design (appropriate learning activities), or by the teaching methodology. Sibthorp (2003) confirms this view and maintains that programmatic factors are the best predictors of targeted outcomes. This necessitates research directed at the link between programme content and methodology on the one hand, and programme outcomes on the other (Ewert & McAvoy, 2000; Holman & McAvoy, 2005).

The identified need for research on the impact of programmatic factors on outcomes is emphasised by the increased demand that *bona fide* interventions deliver measurable, positive impacts on clients (Neill, 2003). Adherents of AEL believe that there is a good return of investment (ROI) in such programmes. Although Williams *et al*. (2003) suggested a model by which the ROI can be calculated, it remains difficult to demonstrate that AEL is a prudent investment and to calculate the return of investment. Scientific rigor must be improved (Ewert & Sibthorp, 2008), and the documentation of observed changes as suggested by Rhodes and Martin (2014), as opposed to the documentation of self-reported changes, should be investigated.

The possibility of various biases is acknowledged in these results. It must be noted that artificially high post-intervention scores remain a measurement concern, especially in adventure programmes. Sibthorp (2003) identified the Hawthorne effect (the tendency of some individuals to change their behaviour due to the attention they are receiving from researchers rather than the manipulation of independent variables), demand characteristic (a subtle cue that makes participants aware of what the experimenter expects to find or how participants are expected to behave), social-desirability response bias (Nederhof, 1985), and post-group euphoria (Marsh *et al*., 1986) as problems in the measurement of adventure programme outcomes.

PRACTICAL APPLICATION

AEL programmes have become a popular vehicle for developing life skills. Research suggests that the expansion of AEL programmes into management training in business

schools and the corporate world will add value. This is also applicable for one-day courses that are less costly with regard to time and money spent.

CONCLUSIONS

Despite the methodological limitations noted, it can be argued that conclusions are tenable. The efficacy of AEL and more specifically a one-day ropes course for the development of life effectiveness skills in adult learners in a business school is evident. The results of this study and the bulk of similar research demonstrate the potential of AEL programmes to corporate development. The increased demand that bona fide interventions deliver measurable and positive impacts on clients necessitates ongoing research directed at principles underlying the application of particular methodologies and other programmatic factors to maximise efficacy. Without ongoing rigorous scientific research, AEL may become based on perceived benefits and anecdote.

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SPORT PARTICIPATION OF IMMIGRANTS: ANTECEDENTS AND CONSEQUENCES OF ORGANISATIONAL COMMITMENT AND ETHNIC IDENTITY AMONGST KOREANS IN USA

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ABSTRACT

In spectating sports, many studies have observed the impact of ethnic identity. Regarding sport participation, however, questions still linger about its impact. Key to predicting the sport participation of an immigrant group are their ethnic identity and commitment to the sport organisation. The main purpose of this study was to see how the sport participation of immigrants is affected by ethnic identity and commitment to a sport organisation. Using self-administered questionnaires, the study surveyed a sample of 229 Korean immigrants in the greater Dallas area. The immigrants were conveniently recruited at soccer and softball tournaments hosted by ethnic sport organisations. The collected data were analysed by structural equation modelling. The results suggest that the organisational commitment of participants was affected by their event satisfaction and perceived benefits. As such, commitment affected their ethnic identity and influences their ethnic peers. The peer influences affected ethnic identity. Finally, ethnic identity had an impact on sport participation. This study suggests that an ethnic sport organisation should aim at providing a quality sport experience.

Key words: Ethnic identity; Organisational commitment; Ethnic sporting events; Sport participation; Immigrants.

INTRODUCTION

Today, Asian immigrants constitute 6% of the entire American population, a total of 18.2 million Asians (Pew Research Centre, 2012). The involvement in sport of immigrants is determined by their cultural traits and their interactions with such antecedents of sport participation such as motivations, attitudes or imposed restraints (Stodolska & Alexandris, 2004; Kang, 2011). Amongst these, researchers have been inclined to look at ethnic identity as they examine how sport-related behaviours of immigrants are determined by ethnicity-specific traits (Pons *et al*., 2001; Bradley, 2006). It is striking that little information is available on how the sport participation of immigrants is affected by their ethnic identity in the context of recreational sports. Such a gap might be a result of the common premise that the behavioural outcomes of immigrants are a result of the cultural mobilisation of the group in a host society (Walter & Brown, 1991; Stodolska & Yi, 2003). That is, the ethnic identity of immigrants is viewed as a developing characteristic, as well as a pre-existing trait in them.

While this perspective provides a more comprehensive framework to understand the multi-dimensional characteristics of immigrants, identifying ethnic identity as a sole influence becomes a demanding task.

Another premise for explaining the shortage of this kind of research is based on the wide spectrum of concepts revolving around immigrants and ethnicity (Phinney *et al.*, 2001). When immigrants come to reside in a host society, they bring with them their traditional culture and lifestyles. The extent to which they develop their culture depends a good deal on the context they inhabit, as well as on the socio-economic circumstances of each individual

(Nguyen *et al*., 1999). Thus, some immigrants and groups are characterised to be homogeneous in terms of their ethnicity and culture, and others relatively heterogeneous. Given this, studying ethnic identity without considering the origin and cultural background of the immigrants may limit predicting their behaviours. This has resulted in the necessity of target-specific approaches when examining immigrants. To date, few studies have investigated the relationship of ethnic identity and sport participation.

An ethnic sport organisation refers to an umbrella organisation that provides ethnic sport teams or clubs with organised recreational sporting leagues and games across different sports. The members of a particular ethnic group manage such organisations and most participants of their events are members of the same ethnic group. The growing participation of immigrants in recreational sporting events hosted by ethnic sport organisations has raised an important question – what shapes the ethnic identity of immigrants in the context of sport participation?

A key to answering this question might lie in the level of commitment of immigrants to a sport organisation. Commitment refers to the voluntary willingness of a consumer to remain in a relationship and to make and effort toward maintaining it (Morgan & Hunt, 1994; Dagger & O'Brien, 2010; Dagger *et al*., 2011). According to the Social Identification Theory (Tajfel & Turner, 1986), people seek the social category with which they identify. Immigrants will therefore, gravitate to an organisation run by immigrants of the same ethnic background and they are more likely to identify themselves with the ethnicity of such organisations. This tendency of the commitment of immigrants also plays a role in making them more socialised to the values and beliefs prevalent amongst their ethnic peers (Phinney, 1990; Phinney *et al.*, 2001). Through the dynamics of the commitment and these ethnicity-related consequences, the commitment of immigrants result in their behavioural outcome manifested in their participation in the sport programme of the organisation.

One might wonder what forces and elements cause sport participants to commit to a sport organisation. Green and Chalip (1998) found that, in a sport context, the satisfaction of parents with youth programmes and the perceived benefits, affected their commitment to children's sport organisations. The commitment of immigrants to ethnic sport organisations tends to be determined by the quality of experience they have when participating in one of its events.

PURPOSE OF THE STUDY

Sporting events hosted by ethnic sport organisations are an easy and salient entry by which immigrants begin playing sport and socialising with ethnic friends. The purpose of this study

was to test a model in which the commitment of immigrants to an ethnic sport organisation and their ethnic identity, affect sport participation. The study also investigated how the satisfaction of participants and their perceived benefits affect their commitment, while also observing how ethnic peers mediate the relationship between commitment and ethnic identity. By revealing what dynamics these factors go through for sport participation, the results could be implemented in such a way that would provide immigrants with a quality sport experience and create more opportunities to take part in sport activities. This need for deeper information becomes more obvious when one considers the extent to which a sport organisation can affect the quality of the sport experience of the participant.

THEORETICAL BACKGROUND AND HYPOTHESES

Perceived benefits, satisfaction and commitment

When deciding to participate in sport, would-be participants consider the potential benefits. Green and Chalip (1998) revealed, for instance, that along with other antecedents, the commitment of parents to their children's sport organisation was affected by the benefits they perceived being bestowed on their children by their sport participation. For sporting events hosted by ethnic sport organisations, the participants are driven by social benefits (Artinger *et al.*, 2006), and by health benefits (Lee, 2005). Taken together, social and health benefits are what sport participants perceive as being the psychological benefits (Stodolska & Yi, 2003). Based on this, the *first hypothesis* of this study is that *the benefits of participating in sporting events as perceived by immigrants will have a positive effect on the degree to which they commit themselves to the organisation*.

The commitment of sport participants is substantially affected by satisfaction (Green & Chalip, 1997; 1998). For the sport participants, satisfaction with their commitment to a sport organisation is determined by a number of components associated with sport programmes, such as the facilities, equipment, programme administration and the coach. In addition, the level of satisfaction of participants is affected by how well an event is managed. For example: Does it start on time? Do the referees make good calls? Is the staff qualified and friendly? Taking this into account, the *second hypothesis* of this study is that *the satisfaction of immigrants with ethnic sporting events will have a positive effect on their commitment to the organisation.*

Commitment, ethnic peers and ethnic identity

According to Ashforth and Mael (1989), consumers' commitment produces a number of psychological characteristics. These include member cohesion, cooperation and identification. What characterises immigrants well is their ethnic identity. Ethnic identity refers to the degree to which one views oneself as a member of a particular ethnic group (Tsai *et al.*, 2002). Because of their immigrant status, it is natural to assume that their higher commitment is related to the greater identity they have with their own ethnic group (Phinney *et al.*, 2001). Therefore, this study posits the *third hypothesis* that *the commitment of immigrants to an ethnic sport organisation will have a positive effect on their ethnic identity*.

Commitment also allows organisation members to socialise (Ashforth & Mael, 1989). Participants who are committed to ethnic sport organisations become socialised into sets of values and beliefs particular to the sport and ethnicity. In such processes, ethnic peers take on a crucial role. The importance of these ethnic peers becomes greater in a sport context in which the excitement of playing sports increases when one is taking part with others of the same ethnicity. Thus, the *fourth hypothesis* is that *the commitment of immigrants will have a positive effect on their ethnic peer influences*.

In forming an ethnicity-based network, the values and attitudes of significant others are easily transmitted. The specific identity an immigrant forms and the degree to which he or she develops that identity is substantially affected by such socialisation factors as ethnic friends (Peñaloza, 1994; Xu *et al.*, 2004). Knowing the effect of peer influences on ethnic identity

would become relevant to the sport participation of immigrants because teammates are a major factor in determining the sport experience of the participant. Hence, this study puts forward the *fifth hypothesis* that *ethnic peer influences of immigrants will have a positive effect on the degree to which they identify themselves with an ethnic group*.

Ethnic identity and sport participation

In sport, the great impact of ethnic identity has been found at the level of spectating national competitions or that of cheering a sportsperson of a certain ethnicity or from a particular country (Cronin & Mayall, 1998; Pons *et al.*, 2001; Bradley, 2006). For example, Pons and colleagues (2001) suggested that Italian immigrants gravitated toward soccer, a sport they associated with their homeland, as an emblem of Italian identity, while their tendency to acculturate to a dominant society made no impact on their identification with soccer.

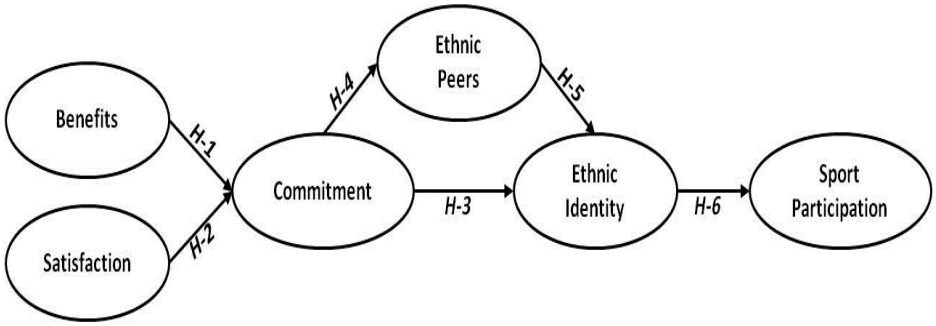

Figure 1. **PROPOSED MODEL**

The role of ethnic identity in sport participation as opposed to sport spectating is, in contrast, still in question. A number of studies have suggested a conflicting relationship between whether ethnic identity is a psychological characteristic derived from sport participation and whether it causes immigrants to participate in sport (Stodolska & Yi, 2003; Harrolle & Trail, 2007; Vermeulen & Verweel, 2009). Despite these results, the participation of immigrants in an event hosted by ethnic sport organisations can be considered as an ethnicity-related behavioural outcome. Thus, the *sixth hypothesis* of this study is that *the ethnic identity of immigrants will have a positive effect on the degree to which they participate in the events of ethnic sport organisation*. All the proposed hypotheses are represented in Figure 1.

METHODOLOGY

Research context

Korean immigrants in the United States (US) are widely known for their ethnic lifestyles and strong attachment to their ethnicity. They are found to be homogeneous in terms of Korean ethnicity (Kim & Wolpin, 2008). In 2014, the largest Korean immigrant community, totalling about 86 000, resided in greater Dallas, Texas (Fleck, 2014). Two strong Korean neighbourhoods provide a wide range of ethnic businesses from grocery markets to medical and legal services. In addition, six Korean ethnic schools facilitate children's education and many Korean churches serve the Korean immigrant communities.

A number of Korean sport organisations have hosted sporting events in which Korean immigrants living in Dallas utilise their ethnic networks to assemble and register teams for the games. Existing Korean sport clubs and teams also participate, resulting in a number of Korean teams taking part in the tournaments or seasonal leagues. These sporting events are developed, marketed and maintained by such ethnic sport organisations as the Dallas Korean Softball Association and the Korean Soccer Association of Dallas. Considering these contextual factors, sampling Korean immigrants in the Dallas area would support the purpose of this study.

Survey procedures

The first survey (n=73) was conducted during a regional-level softball tournament and a week later a second survey (n=156) was performed during a regional-level soccer tournament. When a team finished its game, the investigators distributed self-administrative questionnaires and remained available until all members of each team completed the questionnaire. Based on the determinants of the generations of the immigrants (US Census Bureau, 2010), the study recruited only first-generation immigrants (born in Korea and immigrated to the US as adults), and first-half generation (born in Korea and immigrated to the US as children or adolescents). It was quite reasonable to set such criteria when considering that these groups appear to be more likely to associate themselves with Korea and its ethnicity than do the second and following generations. The average age of the final sample was 32 years and most of them were males (98.7%). About 39% of them had a bachelor's degree and 31% held master's and doctorate degrees. They had been living in the US for approximately 10 years.

Measurement

The items of perceived benefits, satisfaction and organisational commitment of the participants were adopted from Green and Chalip (1998). Ethnic peer influences and ethnic identity were employed from a study by Xu *et al*. (2004). Sport participation was examined through their behavioural patterns of participating in ethnic sporting events. Every item of each construct was assessed using a 7-point Likert-type scale ranging from 1 (*not at all*) to 7 (*very much*). A translation/back-translation was employed to maintain linguistic equivalence between Korean and English (Su & Parham, 2002). Slight word changes were made to fit into the context of a recreational sporting event. All the item-to-total correlations of the measures ranged from 0.55 to 0.85, and the average of inter-item correlations ranged from 0.56 to 0.75. The Cronbach's α ranged from 0.79 to 0.90. The details of the measures are presented in Table 1.

Table 1. **DESCRIPTION OF ITEMS**

Construct (Mean±SD)	**Items** ***To what degree***…
Perceived benefits 5.51±1.93	do you perceive health benefits of participating in this event? do you perceive social benefits of participating in this event? do you perceive psychological benefits of participating in this event?
Event satisfaction	are you satisfied with this event's facility? are you satisfied with this event's operation?

5.13±1.93	are you satisfied with the overall attendance?
Organisation commitment 4.94±2.09	do you intend to pay continuous attention to their business? do you intend to offer word-of-mouth referrals? are you pleased about participating in their event?
Peer influences 5.63±2.05	are your Korean friends on a team? do you share things with your Korean friends playing on a team? do you tend to hang out with Korean friends who are on a team?
Ethnic identity 6.00±1.55	are you proud of being a Korean? do you feel you belong to a Korean group? are you proud of Koreans' achievement?
Sport participation 5.52±2.93	do you play the sport in ethnic sporting event (ESE)? do you choose playing the sport for your recreation in ESE? do you choose ESE to play the sport?

Data analysis

Confirmatory Factor Analysis (CFA) was performed first to check if all the variables were loaded on the desired factors, as well as to see if the factors were correlated with one another. The study then conducted structural equation modelling to find the overall fit of the hypothesised model, as well as the magnitude and significance of each causal path amongst latent variables.

RESULTS

Measurement model

As per absolute fit of the model, the results of the χ^2 test were found to be significant (χ^2=298.88, df=120, p<0.001). The selected absolute fit indices suggested an acceptable fit of

the model for the population (Normed χ^2=2.49, RMSEA=0.08). The model's incremental fit was also achieved by the selected fit indices (CFI=0.93, IFI=0.93, TLI=0.91). The convergent validity of the model showed acceptable levels with the average variance extracted (AVE), ranging from 0.62 to 0.76 (Fornell & Larcker, 1981). In addition, composite reliability ranged from 0.66 to 0.82 (Nunnally, 1978). Regarding discriminant validity, the largest squared correlation was 0.51 between perceived benefits and organisational commitment, lower than the smallest AVE of 0.61 on satisfaction (Fornell & Larcker, 1981).

Structural equation modelling (SEM)

First, the results of the χ^2 test were found to be significant (χ^2=348.79, df=129, p<0.001). However, the selected fit indices suggested an overall fit of the comprehensive model to the data (CFI=0.92, IFI=0.92, TLI=0.90, RMSEA=0.09). As per the hypotheses on the effects of perceived benefits and event satisfaction on organisational commitment (H_1 and H_2), perceived benefits and satisfaction were significantly related to organisational commitment (γ_1=0.45, p<0.001; γ_2=0.44, p<0.001, respectively). Regarding the hypothesis on the effects of commitment on ethnic identity (H_3) and peer influences (H_4), commitment significantly affected ethnic identity and peer influences (β_3=0.34, p<0.001; β_4=0.19, p<0.01, respectively). Peer influences were found to have a significant impact on ethnic identity (H_5: β_5=0.39,

$p<0.001$). Finally, ethnic identify significantly affected sport participation (H_6: $\beta_6=0.24$, $p<0.001$). All the hypotheses were thus supported. Table 2 describes the results of the structural equation modelling.

Table 2. **RESULTS OF STRUCTURAL EQUATION MODELLING (SEM)**

Paths	**Loadings**	**Significance**
H1: Benefits → Commitment	0.45	$p<0.001$
H2: Satisfaction → Commitment	0.44	$p<0.001$
H3: Commitment → Ethnic Identity	0.34	$p<0.001$
H4: Commitment → Peer Influences	0.19	$p<0.010$
H5: Peer Influences → Ethnic Identity	0.39	$p<0.001$
H6: Ethnic Identity → Sport Participation	0.24	$p<0.001$

DISCUSSION

What really boosts the participation of immigrant groups in recreational sporting events? The major predictors to explain their participation were found to be their commitment to an ethnic sport organisation and ethnic identity. Questions remain regarding how ethnic sport organisations can spark a commitment in participants and, once that happens, how to kindle it into a steady flame. In taking part in the programmes of sport organisations on a continuous basis, the participants tended to develop their commitment to the organisation according to the quality of the sport experience and choosing the programme based on the reputation of the organisation. Nonetheless, researchers paid substantial attention to developing commitment of the participants to the sport, not to the sport organisation (Kwon & Trail, 2003; Casper *et al.*, 2007). By highlighting the importance of sport experiences of participants, this study has revealed what causes Korean immigrants to commit to sport organisations in the context of the recreation of immigrants (Green & Chalip, 1998).

Many sport organisations have already implemented ethnic bonding to market their programmes. This strategy has proven fairly successful. In spite of this, neither scholars nor practitioners have made ethnic identity the main question to be solved. It is of course to be expected that there is little information on the role of ethnic identity in the sport participation of immigrants. Ashforth and Mael (1989) argued that the behavioural outcomes of organisational commitment could be mediated by the psychological status of members. In the current study, ethnic identity achieved a successful transition that made immigrants participate in sport activities based on their commitment to ethnic sport organisations.

A number of studies regarding the sport participation of an ethnic group indicated that traditional cultures are the main barrier to explaining the low degree of sport participation (McGuire & Collins, 1998; Hyun, 2001; Lee, 2005; Kay, 2006). Traditionally, Asian groups show little appreciate for the positive values of sport participation (Bhalla & Weiss, 2010). Farver *et al*. (1995) found a tendency of Korean American parents to regard their children's play activities as mere amusement although understanding the educational value of sport activities increased as they acculturated. In spite of this, the positive association of ethnic

identity and sport participation is compatible with the findings of previous studies (Walter & Brown, 1991; Xu *et al.*, 2004). For example, Xu *et al.* (2004) reported a positive effect of ethnic identity on culture-specific consumption of daily necessities such as ethnic food, media or apparel among Asian college students.

Immigrants, regardless of their attitude to their mother culture, consume these ethnicity-oriented products daily. In this consumption, their ethnic identity controls the degree of consumption. However, sport participation may follow a different process, something quite different from consuming daily necessities. Immigrants who may be considering sport participation have to take into account a range of constraints and available resources – following specific and context-oriented protocols – before making a decision (Tsai & Coleman, 1999; Kang, 2011). Unlike the unconditional consumption of ethnic daily necessities, culture-specific characteristics affect whether or not immigrants actually participate in a sport programme. While the current study found the effect of the ethnic identity of Korean immigrants on softball and soccer participation in ethnic sporting events, such culture-specified behaviours might become more distinct for the participants of a Korean traditional sport, such as Tae-Kwon-Do that requires its participants to learn Korean manners and etiquette (Huh & Reid, 2000).

As further studies try to reflect the different features of ethnic sport programmes and ethnic daily necessities, they should develop a sport context-applicable theory to grasp the effect of ethnic identity on sport participation (Walter & Brown, 1991; Phinney, 1992; Cronin & Mayall, 1998; Vermeulen & Verweel, 2009). Identifying this could reveal how the cultural values and beliefs of an ethnic group facilitate (or prevent) their involvement in sport activities (McGuire & Collins, 1998; Lee, 2005; Kay, 2006).

PRACTICAL IMPLICATIONS

Most ethnic sporting organisations have designed events in which ethnic members can socialise with other ethnic peers. Given the results of the powerful role of organisational commitment to ethnic identity, sport organisations should strive harder to create a quality sport experience for participants. In addition, it is suggested that ethnic sporting events be held in the form of cultural festivals, by augmenting cultural events with sporting competitions, through which immigrant communities maintain their ethnic heritage and promote their culture (Ziakas & Costa, 2011). This is possible by creating diverse strategic partnerships with not just mainstream constituents, but with varied ones in ethnic communities as well (Van Acker *et al.*, 2011). It would seem sensible, then, to manage the activities of sporting events in such a way that develops these factors. After all, immigrants seek out ethnic organisations to nourish a sense of belonging in their immigrant life, making such a strategy appear to be well targeted for an immigrant (Farrer, 2004).

CONCLUSION

The salient factors that appear to determine participation by immigrants in recreational sporting events are their commitment to an ethnic sport organisation and their ethnic identity. Nonetheless, no systemic approaches have yet been made to know the dynamics of these factors in predicting the sport participation of immigrants. To fill such a gap, the current study has examined Korean immigrants in the US, regarding the antecedents and consequences of organisational commitment and ethnic identity.

Powerful factors that helped shape the commitment of the participants to ethnic sport organisations were perceived benefits of participating in sport and the satisfaction with the sport event. The commitment had an impact on ethnic identity and the influences of ethnic peers on the immigrants. Ethnic peers substantially affected their ethnic identity and then the identity in turn affected sport participation. The focus of event management should be on providing participants with a quality experience and on creating ethnic festivals beyond mere sporting competitions. Further study should examine the role of the organisational commitment and ethnic identity in sport participation of immigrants across more diverse contexts and ethnic groups.

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PREVALENCE AND EFFECT OF DEVELOPMENTAL COORDINATION DISORDER ON LEARNING-RELATED SKILLS OF SOUTH AFRICAN GRADE ONE CHILDREN

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ABSTRACT

Physically awkward children face a host of difficulties, which include difficulties in the school environment. Therefore, it is important to identify Developmental Coordination Disorder (DCD) early in a child's life to allow for proper and timely intervention and support. The objective of this study was to determine the prevalence of DCD and examine the relationship of the degree of motor difficulties on learning-related skills. This comparative study made use of quantitative data. Three hundred and forty-seven (N=347) Grade 1 children took part and were between the ages of five and eight years (mean age=6.58±0.4). There were 190 girls and 157 boys. The Movement Assessment Battery for Children-2 (MABC-2 Test) was used to identify DCD. In addition, each participant was evaluated with the Aptitude Test for School Beginners (ASB). Learning-related skills of children with DCD were compared to those without DCD. The prevalence of DCD (severe motor difficulties) was 6% and the at-risk group constituted another 6%. Motor difficulties had a significant effect on five of the eight learning-related subtypes, namely reasoning, numerical skills, gestalt, coordination and memory. Children with DCD experienced more learning-related problems compared to their peers without DCD.

Key words: Developmental Coordination Disorder (DCD); Movement Assessment

Battery for Children-2; Learning-related skills; Aptitude Test for School Beginners questionnaire.

INTRODUCTION

Children with Developmental Coordination Disorder (DCD) experience considerable difficulties in motor learning and in the performance of functional motor tasks that are critical for success in the school environment (APA, 2013). These children demonstrate poor motor performance that is not accounted for by their age, intellect or neurological disorders, and the impact can be found in both their daily living activities and academic performance (APA, 2013).

Research indicates that DCD affects 5 to 6% of school-age children (Gaines & Missiuna, 2007; APA, 2013). According to Hamilton (2002), as well as Wilmut *et al*. (2007), the prevalence of DCD might be even higher (5 to 15%), and the research indicates that a large percentage of school-aged children have coordination difficulties serious enough to interfere

with social integration and academic performance. In South Africa (Bloemfontein, Free State Province), the results indicated that 15% of children between the ages of 6 to 8 years have moderate to severe motor difficulties (De Milander *et al*., 2014). This study involved 559 children, 321 girls and 238 boys, however, the majority of the sample consisted of Caucasian children indicating a high socio-economic status (SES). Alarmingly, a study reported a significantly higher (61.2%) prevalence of DCD in the North-West Province of South Africa (SA), according to Pienaar (2004). The study consisted of 688 children (338 boys and 350 girls), between the ages of 10 to 12 years. The majority of the sample consisted of black children (74%) and at least 60% of the sample fell in a low SES.

A study undertaken by Wessels *et al*. (2008) found the prevalence to be 52% of a sample of 99 children, consisting of 47 boys and 52 girls, with a mean age of 83.33 months. This sample was proportional according to the various populations in SA. This clearly indicates that South African children appear to have more motor difficulties than children in other parts of the world. Pienaar (2004) concluded that the norms of the Movement Assessment Battery for Children (first edition), should be adjusted for South African children, although it was not implemented in her study. However, after the completion of the study by Pienaar, the second edition of the MABC was established where some of the items were changed. The norms according to Pienaar (2004), for a South African population was not used in the current study, since it is a standardised test and changing the norms would not provide the researchers with accurate results in addition to using the MABC-2. Besides, the real prevalence of DCD among children might even be higher, as medical and educational systems frequently fail to identify this disorder in young children (Hamilton, 2002; Missiuna, 2003; Miyahara *et al*., 2008).

A gender difference also occurs with regard to DCD. The literature indicates that boys experience more problems than girls with a boy:girl ratio of 2:1 (Wright & Sugden, 1996). According to Rivard *et al*. (2007), it has been estimated that the gender difference could even be as high as 3 to 4:1. These findings are supported by Hoare and Larkin (1991), who stated that more boys than girls are attending remedial programmes (9:1). South African researchers have found boy:girl ratios of 2 to 3:1 in a study conducted with 99 children with an average age of 83.33 months. Furthermore, the study included 47 boys and 52 girls and had a

proportional distribution of the various populations in SA (Wessels *et al*., 2008). In addition, De Milander *et al*. (2014) established a 1 to 6:1 ratio on a sample of 559 children between the ages of 6 and 8 years. There were 321 girls and 238 boys in the study. However, the majority of the population consisted of Caucasian children (57.4%).

According to Schoemaker *et al*. (2003) and Sudgen and Wright (1998), cited in Iversen *et al*. (2005), the major concerns relating to DCD are the considerable harmful effects associated with this disorder. DCD influences children's daily activities at home (self-care tasks), normal play (running, riding a bike, swimming and ball games), and school activities (writing and cutting activities). A problem found amongst children with DCD is that they are often not formally diagnosed, but rather described by their teachers as lazy or awkward (Zwicker *et al*., 2012). These children are not diagnosed due to the lack of awareness of the disorder (Wilmut *et al*., 2007; Zwicker *et al*., 2012).

Children with DCD share a common feature, namely having trouble in executing motor skills necessary for progress in formal and informal learning in a school environment (Sugden & Chambers, 2003). The impaired ability to control functional movements often continues throughout the school years, with evidence showing that children do not outgrow this disorder (Henderson & Henderson, 2002; Sugden & Chambers, 2003). Thus, without early identification and intervention, the difficulties experienced in the school environment will persist into later life (Losse *et al*., 1991).

Secondary problems associated with DCD are physical health issues, such as obesity and lower aerobic capacity due to lower activity levels (Cantell *et al*., 2003; Tsiotra *et al*., 2009), social problems along with emotional problems due to withdrawal or exclusion from peers, as well as academic problems related to aspects such as tracing, writing and learning difficulties (Piek & Edwards, 1997; Hamilton, 2002; Cantell *et al*., 2003). Other co-occurring problems linked to DCD are speech and language disorders (Missiuna, 2003; Wilmut, 2007), visual-motor deficits (Hamilton, 2002), and Attention Deficit Hyperactivity Disorder (ADHD) (Watemberg *et al*., 2007; Wessels *et al*., 2008). It is clear from the literature that the DCD child experiences countless problems associated with the learning process.

PURPOSE OF THE STUDY

Limited research findings specifically with regard to the Movement Assessment Battery for Children-2 (MABC-2) and the Aptitude Test for School Beginners (ASB) were available with reference to the effect of DCD on learning-related skills amongst children in SA (Wessels *et al*., 2008). Thus, the purpose of this study was to determine the prevalence of DCD and the effect of DCD on learning-related skills amongst Grade 1 children in the Bloemfontein area, Free State Province, SA.

METHODOLOGY

Participants

The selection of the 7 mainstream schools was part of a larger randomly selected sample of 13 schools who were invited to participate. The participating schools were located within a 30km radius of the University of the Free State. The ASB is not a compulsory test for schools to use due to the financial implications associated with the test. However, the ASB still

provides valuable information with reference to children's learning-related skills and for determining the effect of DCD. Due to the financial aspect, only 4 of the 7 schools that took part in this study still made use of the ASB.

Scores on the MABC-2 Test and the ASB were obtained for 347 Grade 1 children (190 girls and 157 boys). The children in this study were between the ages of 5 and 8 years. The minimum age was 5.67 years and the maximum age was 8.0 years (mean age of the children=6.58±0.4 years). All the children in the participating primary schools were considered for inclusion in the study. Exclusion criteria included a child in the age group outside the expected range of 5 to 8 years, parental permission not obtained or the informed consent not completed fully or because the parents indicated that they would be relocating during the study.

Additionally, the Diagnostic and Statistical Manual of Mental Disorders, fifth edition, (DSM-V) (APA, 2013), was used to exclude children who had associated symptoms according to the criteria for DCD as stated in the DSM-V. Children with motor difficulties should meet criterion C (disturbance is not due to a general medical condition, for example, cerebral palsy, hemiplegia, or muscular dystrophy, and does not meet criteria for a pervasive developmental disorder), or criterion D (if mental retardation is present, the motor difficulties are in excess of those usually associated with it). None of the children met the criteria and, therefore, all of them were included for further data analysis.

Ethical consideration

The Free State Department of Education and the principals of each school gave permission for the research to be conducted on the school premises during the Life Orientation periods. Approval was obtained from the Ethics Committee of the Faculty of Health Sciences, University of the Free State (ECUFS57/2012). The participants were treated in accordance with the ethical guidelines outlined by the Ethics Committee of the Faculty of Health Sciences. The parents of the participants completed an informed consent form for each child participating in this study. In addition, the children signed an assent form. Recruitment was targeted at children with and without DCD via the 4 participating schools.

Measuring instruments

Movement Assessment Battery for Children-2 (MABC-2 Test)

The MABC-2 Test requires children to perform a series of motor tasks in a specified manner (Henderson *et al*., 2007). In addition to age-related norms, the test also provides qualitative information on how children should approach and perform the tasks. The MABC-2 Test is used to assess the motor proficiency levels of the subject and to diagnose DCD in children. The first assessment component of this test battery contains 24 items organised into 3 sets of 8 tasks. Each set is designed for use with children of a different age band. For the current study, age band 1 and age band 2 were used.

The 8 tasks are grouped under 3 headings, namely manual dexterity (MD), balance (B) and aiming and catching (AC). Age-adjusted standard scores and percentiles are provided, as well as a total test score for each of the 3 components of the test. The total test score can be interpreted in terms of a "traffic light" system. The green zone indicates performance in a normal range of a score above 67 (>15^{th} percentile), while the amber zone indicates that a child is at risk, between 57 to 67 and needs to be carefully monitored (5^{th} to 15^{th} percentile).

The red zone is an indication of definite motor impairment, up to and including 56 ($\leq 5^{th}$ percentile). Thus, high standard scores on the MABC-2 Test represent good performance. The MABC-2 (performance test) was used instead of the Checklist, since it is only used for screening purposes of bigger groups by means of a teacher or parent. The MABC-2 Test is a valid and reliable tool to use with a reliability coefficient for the total test scores of 0.80 (Henderson *et al*., 2007).

Aptitude Test for School Beginners (ASB)

Qualified teachers administered the ASB to all participating children during the first 2 months of the school year. A requirement of the ASB is that it must be presented and completed in the mother tongue of a child. The ASB is a norm-based instrument and consists of 8 sub-items, which include perception, spatial skills, reasoning, numerical skills, gestalt, coordination, memory and verbal comprehension (Olivier & Swart, 1996; Van Zyl, 2004). Each sub-item is evaluated by means of a standard score out of 5. An evaluation score of 1 is regarded as below average and an evaluation score of 5 as above average. The aim of the ASB is to obtain a differentiated picture of certain aptitudes of Grade 1 children. The ASB is a valid and reliable tool with a reliability coefficient for the total test of 0.80 (Olivier & Swart, 1996).

Procedure

This comparative study made use of quantitative data. The study involved 1 testing procedure by means of the MABC-2 Test in order to identify DCD among Grade 1 children. Kinderkineticists in training, who had been trained in the use of the measuring instrument, tested the participants at their schools during the Life Orientation periods. Each Kinderkineticist was responsible for 1 subtest in order to have consistency across the study. In addition, each participant was evaluated with the ASB that was conducted and interpreted by qualified teachers. Teachers, psychologists and occupation therapists need to obtain this qualification from Mindmuzik Media [Pty] Ltd Service Provider Accreditation Number: UP/SP/0735 (University of Pretoria) (Mindmuzik Media, 2015), or from Mind Moves. In the current study, 4 teachers were used to gather the information required. Learning-related skills (determined with the ASB) of children with DCD (as identified by the MABC-2 Test), were compared to the learning-related skills of children without DCD.

Analysis of data

The principle researcher using Microsoft Excel captured data from the MABC-2 Test and the ASB electronically. A statistician performed the data analysis using the Statistical Package for the Social Sciences (SPSS) for Windows (SPSS version 16.0, SPSS Inc., Chicago, IL). Descriptive statistics, namely frequencies and percentages were calculated for categorical data. Medians and percentiles were calculated for numerical data. Median differences were tested by calculating p-values using the Signed-Rank Test. The chi-squared statistics was used to test for proportional differences. A probability level of 0.05 or less was accepted to indicate statistical significance.

RESULTS

The distribution of the children in terms of the traffic light system (degree of motor difficulty) according to the MABC-2 Test is illustrated in Figure 1.

The green zone indicates no motor difficulties (88%), amber zone indicates moderate motor difficulties (6%) and the red zone indicates severe motor difficulties or DCD (6%) amongst children in Bloemfontein, Free State province, SA.

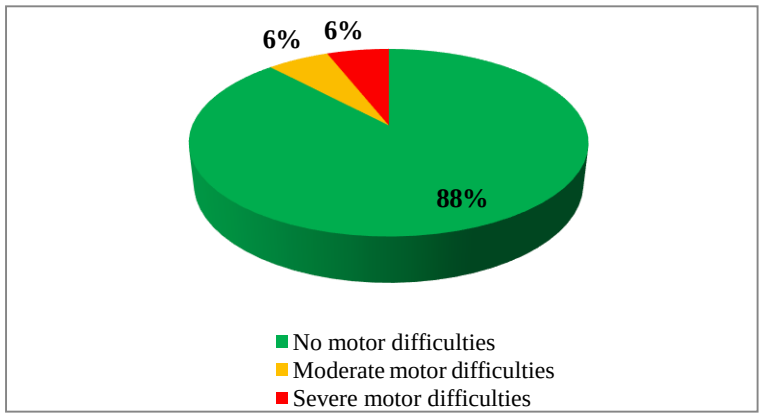


Figure 1. **PREVALENCE OF DCD IN CHILDREN IN GRADE 1**

The distribution of the girls and boys in terms of the traffic light system (degree of motor difficulty) according to the MABC-2 test is shown in Figure 2 and 3.

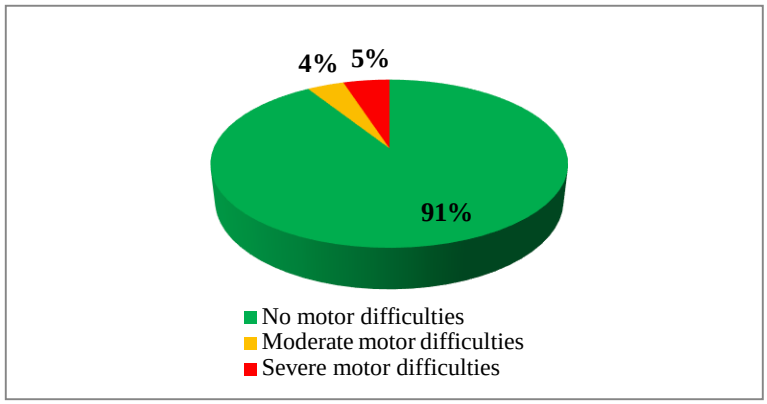


Figure 2. **PREVALENCE OF DCD AMONG THE GIRLS**

As expected, Figure 2 and 3 indicate that 91% of the girls fell in the green zone compared to 84% of the boys. With reference to the amber zone, 4% of the girls had moderate motor difficulties in contrast to 9% of the boys. The red zone indicates that 5% of the girls had severe motor difficulties compared to 7% of the boys. However, there was no significant difference (p=0.115) between the genders.

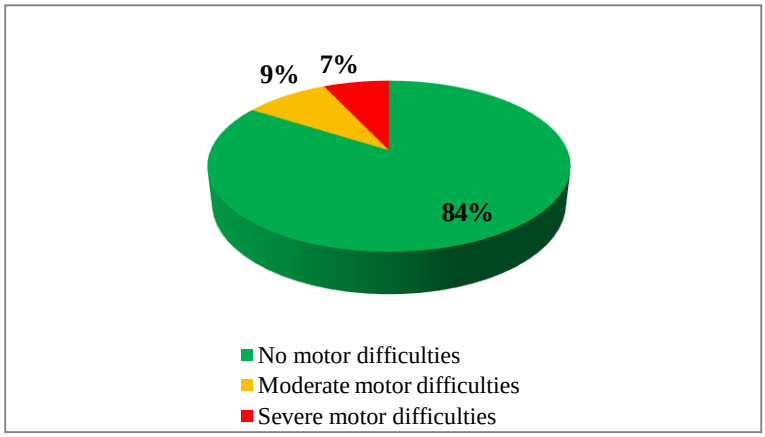


Figure 3. **PREVALENCE OF DCD AMONG THE BOYS**

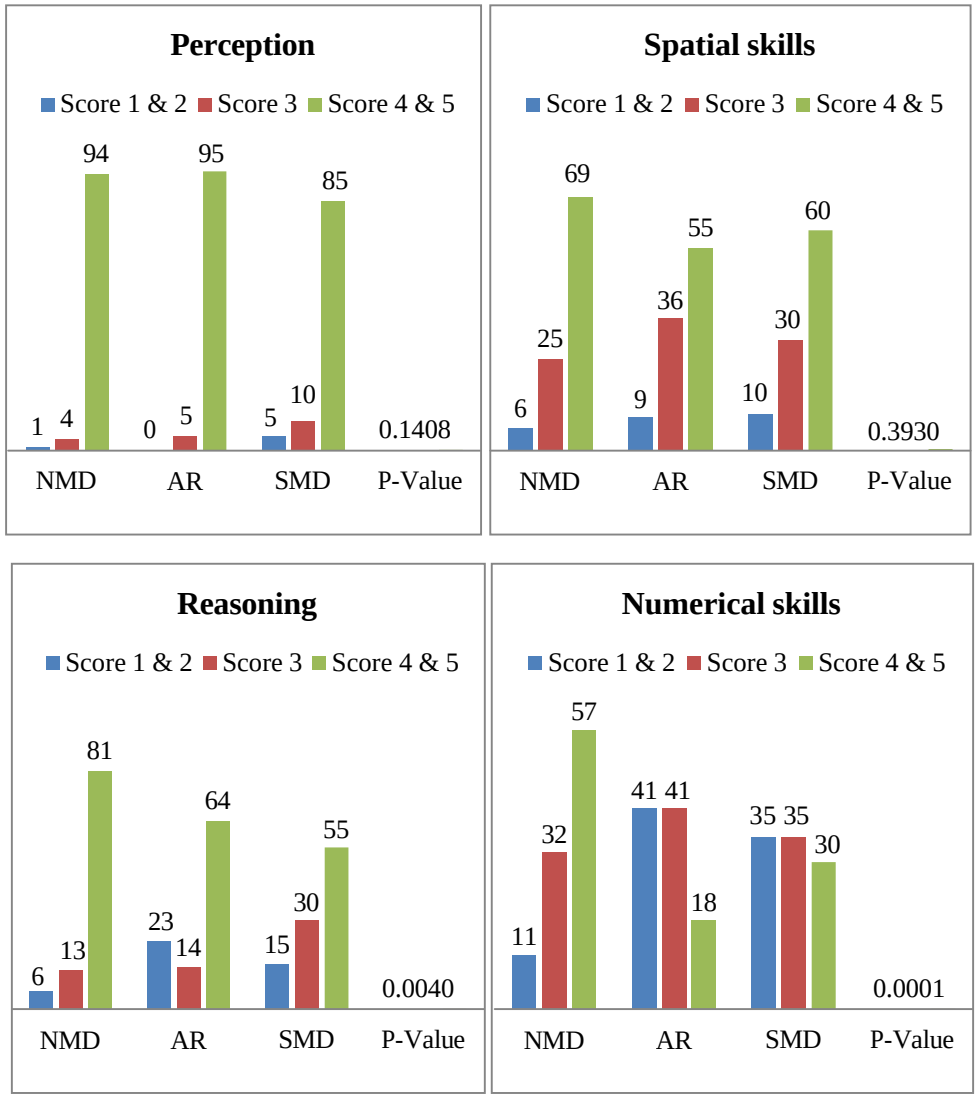
Figure 4, presented on the next page, indicates the results of the various learning-related skills according to the ASB in the different categories of degree of motor difficulty (at risk and severe), and no motor difficulties. It can be observed that for 3 of the 8 learning-related skills, namely perception (p=0.141), spatial skills (p=0.393) and comprehension (p=0.074), there were no significant differences between children with DCD and those without DCD. Furthermore, for the remaining learning-related skills, significant differences were indicated for reasoning (p=0.004) and memory (p=0.024). However, there were highly significant differences between the children with different degrees of motor difficulty and those with no motor difficulties for numerical skills (p=0.0001), gestalt (p=0.0001) and coordination (p=0.0001), where children without DCD significantly outperformed their peers with DCD.

In summary, it would appear that children at risk for motor difficulties and those with severe motor difficulties may struggle more with the domains of reasoning, numerical skills, gestalt, coordination and memory, as illustrated by the sub-tests of the ASB.

DISCUSSION

The research set out to determine the prevalence of DCD in Bloemfontein, Free State Province, SA. In addition, the study aimed to provide possible answers regarding the effect of DCD on specific learning-related skills amongst children aged five to eight years.

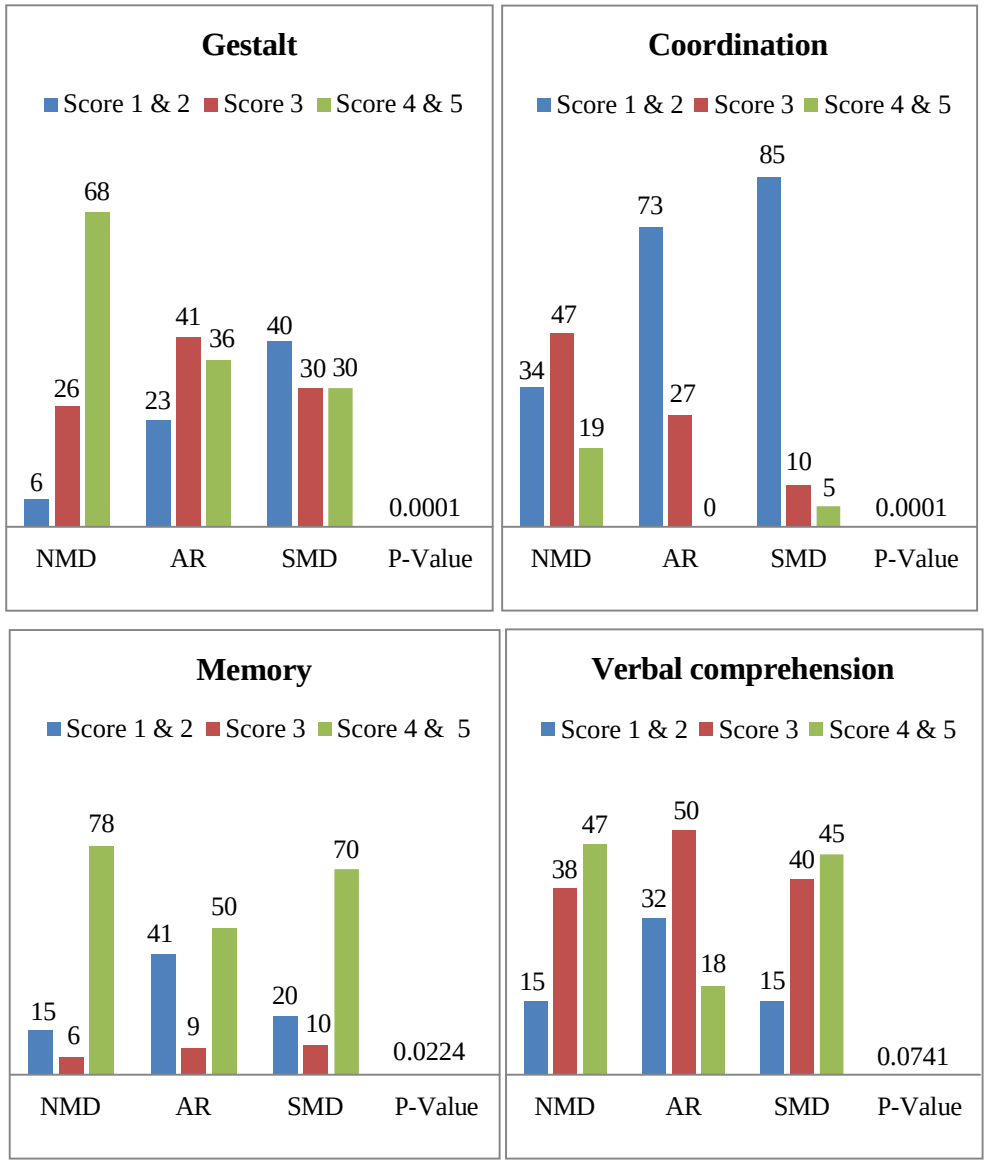
Literature clearly indicates that DCD affects children all over the world, but the prevalence differs considerably between various countries (Lingam *et al*., 2009; Prado *et al*., 2009). The results of the current study indicate that at least 12% of the sample had moderate to severe motor difficulties. These results are in contrast to various findings reported in the literature where the researchers state that DCD affects more or less 5 to 6% of school-age children (Prado *et al*., 2009; APA, 2013).



NMD = no motor difficulties AR = At Risk SMD = Severe Motor Difficulties
Score 1 & 2 = Below average Score 3 = Average Score 4 & 5 = Above average

Figure 4. **LEARNING-RELATED SKILL SCORES OF ASB EXPRESSED AS A PERCENTAGE BY DEGREE OF MOTOR DIFFICULTY IN EACH SUBCOMPONENT**

Continued ...



NMD = No Motor Difficulties AR = At Risk SMD = Severe Motor Difficulties
Score 1 & 2 = Below average Score 3 = Average Score 4 & 5 = Above average.

Figure 4. **LEARNING-RELATED SKILL SCORES OF ASB EXPRESSED AS A PERCENTAGE BY DEGREE OF MOTOR DIFFICULTY IN EACH SUBCOMPONENT** *(continued)*

Researchers reporting on the prevalence of DCD in the United Kingdom estimate that 4 to 5% of children struggle with motor difficulties (Lingam *et al.*, 2009), which is much lower than the 12% found in the present study. The findings of research conducted on Canadian children correlate the best with the findings of the current study. These researchers found

approximately 8 to 15% of Canadian children to have some form of coordination problems (Junaid *et al*., 2000). Studies in America and Europe found an even higher prevalence of DCD, estimated at 5 to 19% (Miller *et al*., 2001). It is interesting to note that more children are experiencing motor difficulties than previously indicated in the literature.

The current study found that boys did not exhibit significantly (p=0.1150) more moderate to severe motor difficulties than girls, with a boy:girl ratio of 1 to 6:1. However, this ratio is smaller than the ratio found in other research. The literature indicates that boys experience more problems than girls, with reported boy:girl ratios of 2 to 3 (Wessels *et al*., 2008) and 3 to 4:1 (Wright & Sugden, 1996). Although gender differences do occur, researchers need to take into consideration that gender differences are a normal phenomenon in the attainment of motor skills among children. Literature indicates that girls perform better in fine motor skills, whilst boys are better at gross motor skills (Gallahue & Ozmun, 2006). Furthermore, research reported that girls outperformed boys with regard to the manual dexterity items of the MABC and boys were superior with regard to the ball skills items (Junaid & Fellowes, 2006). No differences were established between boys and girls for balancing skills and the researchers argue that these differences were due to the disparity in the acquisition of motor skills between boys and girls (Junaid & Fellowes, 2006).

Research reported on the effect of DCD on specific learning-related skills such as reasoning, numerical skills, gestalt, coordination, memory perception, spatial skills and comprehension amongst children are limited. The results of the current study indicate that the different degrees of motor difficulty do have a significant differential negative effect on the subtypes of specific learning-related skills such as reasoning, numerical skills, gestalt, coordination and memory. This may be because children who are at risk, as well as children with severe motor difficulties, could have deficits due to their diagnosis that may influence these different domains negatively.

Children with DCD struggle to organise tasks, since the DCD child needs to plan the movement repeatedly. This could influence their gestalt and reasoning abilities. The findings of the current study correlate with a number of other studies indicating that children with DCD struggle with academic skills such as writing and tracing, which forms part of gestalt and numerical and coordination abilities (Hamilton, 2002; Missiuna, 2003; Tsiotra *et al*., 2009). Since children with DCD struggle with coordination activities in general, it is obvious that they will experience significant difficulties with regard to the coordination domain of the ASB. This result correlates with a previous study done in Potchefstroom, North-West Province, SA, where the researchers established that boys with DCD struggled more with the coordination domain of the ASB (Wessels *et al*., 2008). In contrast to the current study, the same researchers did not find any significant correlation between learning-related skills and DCD with regard to the remaining seven domains in 52 children with DCD (Wessels *et al*., 2008).

There were no significant differences between the different categories of motor difficulties for the domains of perception, spatial skills and verbal comprehension. The results of the current study indicate that being at risk for or having severe motor difficulties did have an effect on learning-related skills. Similar to the results of this study, the majority of research reported that there is a strong relationship between DCD and learning-related skills and that many children with DCD experience difficulties with learning and academic performance (Hamilton, 2002; Henderson & Henderson, 2002; Rivard *et al*., 2007; Wilmut *et al*., 2007;

Tsiotra *et al*., 2009).

The current research showed that children who are at risk for or who have severe motor difficulties are potentially at risk of struggling more with specific learning-related skills. These findings of this research can be drawn upon to evaluate, manage and possibly improve the specific domains of weakness for the degrees of motor difficulty in order to improve these children's prognosis for their learning-related skills.

LIMITATIONS AND RECOMMENDATIONS

This study had some limitations. It should be recognised that the current study only recruited children from the Bloemfontein metropolitan area, while excluding children from the rural regions. Furthermore, since this was a population-based sample, criterion B of the diagnostic criteria for DCD, which states that the academic performance of the children should also be considered (APA, 2013), was not used. Hence, a replication of this study in the different provinces and regions in SA is recommended so that more generalizable and robust results can be provided. The researchers are of the opinion that an equal distribution of various populations and schools from lower socio-economic backgrounds should be included in future research. Furthermore, the authors concur with Pienaar (2004) who stated that the norms of the MABC-2 should be adapted for the South African population.

CONCLUSIONS

The results of this study are important for teachers who work with young children, as children who start formal school with a motor deficit may also have problems with a variety of learning-related skills necessary for school success. Thus, teachers can take these limitations into consideration and address these problems by means of new preventative strategies. It would also be necessary to present motor programmes by professionals who are familiar with motor development, to attend to the motor difficulties experienced by children with DCD. It is important to view development in a holistic manner (Van Zyl, 2004), thus, motor difficulties and difficulties with learning-related skills should be addressed in order to minimise problems associated with academic performance.

As indicated in the current study, children with DCD in a Bloemfontein, Free State Province, South African sample, struggle more with learning-related skills than children without motor difficulties. The researchers, therefore, conclude that it is critical that early identification of DCD should take place by means of parent and teacher questionnaires, as well as professionals such as Kinderkineticists, since these children do not outgrow their motor difficulties. Appropriate interventions such as a combination of the bottom-up- and top-down approaches, which could improve their motor abilities and scholastic performance by

professionals at an early age, are crucial. Results with regard to the learning-related skills can offer teachers a better understanding of difficulties experienced by children with DCD. Thus, the researchers propose that teachers should consider these difficulties to help children excel in their academic performance.

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SELF-PERCEIVED PHYSICAL FITNESS AND PHYSICAL ACTIVITY DEMAND IN THE SPANISH ELDERLY

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ABSTRACT

The importance of establishing how the elderly subjectively perceive their physical fitness has been studied so that future action plans may be established to improve their quality of life. The main goal of this research was to evaluate how Spanish people aged 65 years and over, perceive their level of physical fitness and the relationship this has with the different types of demands (established, latent, absent), for physical activity. Cross-sectional research was conducted involving face-to-face interviews using a standardised questionnaire and involving 907 elderly persons (male=428; female=479), aged over 65 years (74.12±6.55). The results suggest that the majority of the elderly perceived their fitness as good or very good, with this variable being most positively perceived among people who exercise, the males and the younger persons among those interviewed. However, nearly half of the participants perceived their physical fitness as being somewhat poor and considered that they should start participating in physical activity.

Key words: Elderly; Physical activity; Fitness; Self-perception; Established, latent, absent demand; Spain.

INTRODUCTION

A slow and unavoidable process of demographic ageing of the population is currently being witnessed on an international level, especially in developed countries (Weinert & Timiras, 2003; Giannakouris, 2008). This is indicative of a special interest in the field of research on the elderly as a population group. One of the main goals of aging-related research is to promote 'active ageing' (Denk & Pache, 2003; Martínez del Castillo *et al*., 2010), where the aim is to ensure that the elderly enjoy an adequate quality of life. Many studies have shown the benefits of physical activity (PA) and sport for the elderly, not only physically, but also psychologically, emotionally and socially (Laurin *et al*., 2001; Strawbridge *et al*., 2002; Lemmens *et al*., 2008).

Despite the fact that the elderly regard PA as very important according to research conducted by the Centre for Sociological Research [Centro de Investigaciones Sociológicas] (CIS, 2010), the rate of inactivity within this population is still very high (Nelson *et al*., 2007; CIS, 2010). This is of great concern because of the positive relationship between PA and fitness in the elderly (Van Heuvelen *et al*., 1998; Kinugasa *et al*., 2003; Kazuo, 2006). In this regard, Castillo *et al*. (2005) state that there is a progressive structural deterioration over the years, as well as a slow and inevitable decline in functional capacity, which influences fitness and constitutes the main feature of the ageing process. It should be considered that PA could slow down this functional decline by improving fitness (Kinugasa, 2003).

In a South Korean study, Misook and Kiyoji (2011), showed a positive relationship between fitness and health as perceived by the elderly, and Huang *et al*. (1998) observed a relationship between physical fitness and the functional independence of the elderly. Castillo *et al*. (2005) pointed out that research has highlighted the interest in learning more about physical fitness among the elderly, as it is an excellent predictor of life expectancy and, more importantly, quality of life, with a clear and direct relationship between longevity and fitness. Additionally, different epidemiological studies and predictions have shown a clear association between physical fitness and the morbidity and mortality index of the population (Blair *et al*., 2001).

After reviewing the scientific literature, Chodzko-Zajko (1996) reported a positive relationship between fitness and cognitive processing among the elderly, although he suggests that this relationship may be secondary to improvements in cerebral circulation, nerve cell regeneration and/or changes in neurotransmitter synthesis and degradation. Furthermore, Schwartzmann (2003) and Fernández-Mayoralas *et al*. (2007) point out the importance of including people's subjective perception in scientific research to predict future situations and needs, like health problems, and to serve as a basis for designing and assessing intervention programmes.

PURPOSE OF THE RESEARCH

The goal of the present study was to evaluate physical fitness as perceived by the elderly in Spain and to determine potential differences depending on the group's demand status for PA. To this end, the definition of Jiménez-Beatty *et al*. (2007) of the three 'types of demand' applies. The levels of present and potential participation that differentiate the population are Established Demand (ED) [individuals who currently engage in some PA], Latent Demand (LD) [individuals who do not engage in any PA but would like to do at least one activity and are interested in becoming active] and Absent Demand (AD) [individuals who do not engage in any PA and are not interested in doing so].

METHODOLOGY

Ethical clearance

All the participants gave their consent to take part in this study. Additionally, a protocol was followed in which it was stated that the project submitted did not pose any ethical or bio-security implications. The main researcher of the project also had to sign an affidavit in which he committed to respecting all current legislation about human rights, ethics and bio-security. Furthermore, the University Committee and the Ministry of Education and Science in Spain (UPM05-C-11203) approved this research.

Participants

A cross-sectional, descriptive quantitative study was conducted via face-to-face interviews with a random sample (N=933). The final number of participants was 907 (loss of 26). The study sample included persons aged 65 years and older (74.12±6.55) that were legal residents in Spain (males=428; females=479). According to the Municipal Electoral Roll, this population, aged 65 or over, consisted of 7,484,392 people, with males comprising 42.28% and females 57.72%.

Sampling

The sampling type was multistage probability (Miquel *et al*. 2000; Rodríguez-Osuna, 2000; Bryman, 2004), because, as stated by Fowler (1988:27), "When there is no adequate list of the individuals in a population and no way to get at the population directly, multistage sampling provides a useful approach".

In this sampling type, the sample units are selected in successive stages (Bryman, 2004). In Stage I, 8 municipalities were chosen at random and 2 were specifically chosen for each of the following demographic sizes: fewer than 10,000 inhabitants; 10,001 to 50,000; 50,001 to

100,000; and more than 100,001. The National Statistics Institute provided these demographic sizes.

In Stage II, the neighbourhoods in each of the municipalities, where the questionnaires would be administered, were chosen by a simple random system without replacement. In each of the selected neighbourhoods, the units of Stage III were the streets at the start of the route (group of 10 interviews to be conducted in this zone). This selection was performed at random using the local street map. In stages IV, V and VI, each interviewer selected the front door, floor number and door of the apartment block respectively, using the provided random route criteria procedure (Fowler, 1988:33). Finally, the units of the last stage were the elderly who were interviewed.

Sample size

Given the large population and working with a 95.5% confidence interval, a ±3.08% permitted sampling margin error and supposing the least favourable case of p in population variance equals 50, hence q=50, the sample size needed to be 1056 elderly people (Sierra-Bravo, 1999).

$$n = \frac{Z^2 \, c.P.q}{e^2}$$

During and after the fieldwork an appraisal of the questionnaires were carried out to check and verify that all of them had been completed correctly (Miquel *et al*., 2000; Cea D'Ancona, 2004). A total of 123 questionnaires were cancelled because they had been completed incorrectly. For this reason, the final sample ±3.08% consisted of 933 elderly people and the permitted sampling margin error was increased to ±3.27%.

With regard to the *sample allocation*, it was decided to opt for an allocation proportional to the distribution according to the gender of the population being researched and a simple allocation for each demographic size. With reference to the sample ages, 54.75% (494) of the elderly were aged between 65 to 74 years and 45.75% (413) were 75 years or older. In other words, the distribution was very similar to that observed in the population (National Statistics Institute).

Measurement instrument

The instrument used was the *Standardised Questionnaire on Physical Activity and the Elderly* designed by Graupera *et al*. (2003) to measure the demand for PA in the elderly and other related variables. This instrument includes 5 dimensions, namely socio-demographic variables, the type of demand for PA, lifecycle variables, socialisation agents and a provision of PA variable (Graupera *et al*., 2003). The variables from the questionnaire used for this research were perceived fitness and type of demand for PA and sport (Established demand, Latent demand and Absent demand). For the perceived fitness variable, the instrument presents a Likert-type scale from 1 to 4 in which 1 is poor, 2 is somewhat deficient, 3 is good and 4 is very good.

This questionnaire has been administered and validated in a number of studies, some of which have been published in high impact journals (Jiménez-Beatty *et al*., 2002; Jiménez-Beatty *et al*., 2007; Martínez del Castillo *et al*., 2010). Four experienced sociologists who were not members of the research team validated the questionnaire. In a subsequent pre-test, before the fieldwork was done, the questionnaire was administered to 30 elders from the

target population to test its comprehensibility. All the subjects understood the questions and response alternatives and there were no missing values. With regard to tests for convergent validity and given that the variables were categorical with different survey response alternatives, the phi coefficient was used (Latiesa, 2000).

A retest procedure was employed to determine the stability and reliability of the survey question items. Two weeks after completing the fieldwork, 63 (10%) respondents were asked the same survey questions by different interviewers under the same conditions as in the first interview. Given that the variables are categorical, the alternative responses were compared using Cramer's V correlation coefficients (Cea D'Ancona, 2004). The estimated values ranged from 0.83 to 1.0. According to Cea D'Ancona (2004), when the correlation coefficient between the 2 sets of responses is 0.8 or greater, the question or indicator can be accepted as reliable.

Procedure

The interviewers were chosen and then trained in the administration of the standard research questionnaire. The routes or itineraries that had to be followed to contact potential interviewees and the selection criteria to choose the elderly subjects to be interviewed (to be 65 or older and to be resident in Spain), were explained. The interviewers administered the questionnaire in structured personal face-to-face interviews in the home of the subjects. If the person was not at home or did not consent to be interviewed, the following house was chosen, until the sample units were completed, following the methodology of sampling with replacement (Fowler, 1988).

On the planning sheets, the interviewers recorded the steps followed until the sample subject was located. They included the interview number, the home address, the selection of the house, the time of the interview, as well as the gender and age of the interviewee. In the cases where conducting the interview was not possible, the reason was noted (Cea D'Ancona, 2004).

Statistical analysis

A univariate and bivariate descriptive analysis, and an inferential analysis for processing the survey data, was applied. With regard to inferential statistics, the Kolmogorov-Smirnov test was used to confirm the normality of the distributions. It was found that the variables used in this study did not conform to a normal distribution, hence the Kruskal-Wallis H test was used as an inferential test for more than 2 independent samples, as well as contingency tables, including the phi coefficient and Pearson's Chi-squared value of $\propto<0.05$ for significance. Windows SPSS (V 15.0) software was used to do the calculations.

RESULTS

Interviews were conducted with 933 Spanish people aged 65 years and older. The results of the Kruskal-Wallis H test for more than 2 independent samples determined that there were significant differences between the perception of physical fitness and the 3 groups of PA demand (p=0.000).

Table 1 indicates that 51.6% of the elderly considered their fitness to be good, 27.9% perceived it to be somewhat deficient, 11% said it was very good and 9.5% considered their

fitness to be poor. When considering the variables, fitness and gender, it can be seen that in general males perceived themselves to be more physically fit than females, although it should be noted that there was no significant statistical relationship between the 2 variables.

Table 1. **FITNESS AS PERCEIVED BY THE GROUP OF SPANISH ELDERLY**

Perceived fitness	Whole population N(%)	Gender Male n(%)	Gender Female n(%)	Age <=74yrs n(%)	Age >=75yrs n(%)
Very good	100(11.0)	52(12.1)	48(10.0)	64(13.0)	36(8.7)
Good	468(51.6)	232(54.2)	236(49.3)	274(55.5)	194(47.0)
Somewhat deficient	253(27.9)	109(25.5)	144(30.1)	121(24.5)	132(32.0)
Poor	86(9.5)	35(8.2)	51(10.6)	35(7.0)	51(12.3)
Total	*907(100)	428(100)	479(100)	494(100)	413(100)

Gender: [χ^2 (3)=5.161; p=0.1600; Φ=0.07] Age: [χ^2 (3)=17.879; p=0.000; Φ=0.14]
*=26 invalid questionnaires

The analysis of the relationship between age and fitness as perceived by the elderly (Table 1) indicates that the group of people aged 74 years or less were more likely to consider their fitness to be good than people aged 75 years and older. The relationship between these variables was significant, although it is low or slight.

Table 2. **FITNESS AS PERCEIVED BY THE ELDERLY IN ESTABLISHED DEMAND (ED) GROUP (n=157)**

Perceived fitness	ED group N(%)	Gender Male n(%)	Gender Female n(%)	Age <=74yrs n(%)	Age >=75yrs n(%)
Very good	31(19.7)	10(15.6)	21(22.6)	22(19.3)	9(20.9)
Good	107(68.2)	46(71.9)	61(65.6)	80(70.2)	27(62.8)
Somewhat deficient	17(10.8)	6(9.4)	11(11.8)	11(9.6)	6(14.0)
Poor	2(1.3)	2(3.1)	–	1(0.9)	1(2.3)
Total	*157(100)	64(100)	93(100)	114(100)	43(100)

Gender: [χ^2 (3)=3.215; p=0.36; Φ=0.16] Age: [χ^2 (3)=1.119; p=0.77; Φ=0.09]
*=5 invalid questionnaires

In relation to fitness as perceived by the elderly in the Established Demand (ED) group, 68.2% consider it to be good, 19.7% said it was very good, 10.8% perceive their fitness as somewhat deficient, and 1.3% considered their fitness to be poor (Table 2). The females scored higher than the males in perceiving their fitness to be very good (22.6 and 15.6%, respectively), and the latter scored higher percentages in perceiving it to be good (71.9% males and 65.6% females). It is also important to note that in the Established Demand (ED) group, no woman considered her fitness to be poor and only 3.1% of males did. Despite this, no significant relationship was found between these variables.

The results obtained after relating fitness as conceived by the elderly with their age in the ED group, people aged 75 years or over had similar percentages to people aged 74 years or younger in perceiving their fitness as very good (20.9 and 19.3%, respectively). However, the people in the latter group were more likely to perceive their fitness as good (70.2%). Additionally, people in the older age group scored higher than their younger counterparts in perceiving their fitness as somewhat deficient or poor, 14 and 2.3% respectively, in the older group, compared to 9.6 and 0.9% among people aged 74 years or younger in the ED group. In this case, there was no significant relationship between the 2 variables.

Considering the perception of fitness by the elderly in the Latent Demand (LD) group, Table 3 shows that more than half of the group perceived their fitness as good, 32% as somewhat deficient, 8.5% as very good and 6.8% as poor.

The males and females scored similar percentages in the LD group with regard to the perception of their fitness as good (54.4% males and 50.8% females), and very good (7% males and 9.8% females). Greater differences were found between the genders in relation to the perception of their fitness as somewhat deficient (28.1% males & 36.1% females) or poor (10.5% males and 3.3% females), with a low percentage of females who perceive their fitness as poor within the LD group is of particular note. Despite this, there was no statistically significant relationship between these 2 variables.

Table 3. **FITNESS AS PERCEIVED BY THE ELDERLY IN LATENT DEMAND (LD) GROUP (n=118)**

		Gender		Age	
Perceived fitness	**LD group** N(%)	Male n(%)	Female n(%)	<=74yrs n(%)	>=75yrs n(%)
Very good	10(8.5)	4(7.0)	6(9.8)	7(9.1)	3(7.3)
Good	62(52.7)	31(54.4)	31(50.8)	38(49.4)	24(58.5)
Somewhat deficient	38(32.0)	16(28.1)	22(36.1)	27(35.1)	11(26.8)
Poor	8(6.8)	6(10.5)	2(3.3)	5(6.4)	3(7.3)
Total	*118(100)	57(100)	61(100)	77(100)	41(100)

Gender: [χ^2 (3)=3.215; p=0.36; Φ=0.16] Age: [χ^2 (3)=1.119; p=0.77; Φ=0.09]
*=1 invalid questionnaire

For fitness, according to age of the LD group, the group aged 75 years and older had higher percentages with regard to perceiving their fitness as good or poor (58.5% and 7.4% respectively), although in the latter item the results were very similar to the younger age group. The group of people aged 74 years or younger had higher percentages concerning the perception of their fitness as somewhat deficient or very good (35.1% and 9.1%, respectively). Once again, no significant relationship between these 2 variables was observed.

Table 4. **FITNESS AS PERCEIVED BY THE ELDERLY IN ABSENT DEMAND (AD) GROUP (n=632)**

Perceived fitness	AD group N(%)	Gender Male n(%)	Gender Female n(%)	Age <=74yrs n(%)	Age >=75yrs n(%)
Very good	59(9.3)	38(12.4)	21(6.4)	35(11.5)	24(7.2)
Good	299(47.3)	155(50.5)	144(44.3)	156(51.5)	143(43.5)
Somewhat deficient	198(31.3)	87(28.3)	111(34.2)	83(27.4)	115(35.0)
Poor	76(12.1)	27(8.8)	49(15.1)	29(9.6)	47(14.3)
Total	*632(100)	307(100)	325(100)	303(100)	329(100)

Gender: [χ^2 (3)=14.079; p=0.000; Φ = 0.15] Age: [χ^2 (3)=11.000; p=0.01; Φ=0.13]
*=20 invalid questionnaires

Regarding fitness as perceived in the Absent Demand (AD) group (Table 4), almost half of the elderly people perceived their fitness as good, 31.3% as somewhat deficient, 12.1% as poor and 9.3% as very good. Considering the gender variable, males in the AD group perceived their fitness as good or very good (50.5% and 12.4%, respectively), while 44.3% and 6.4% females respectively, had the same perception. There was a low relationship between these variables, yet this relationship was statistically significant. Table 4 also shows that in the AD group, people aged 74 years or younger were more likely to perceive their fitness as good or very good (51.5% and 11.5% respectively), compared to people aged 75 years and older (43.5% and 7.2% respectively). There was a low relationship between these variables and yet again, this relationship was statistically significant.

DISCUSSION

In relation to physical fitness, as perceived among the population as a whole, around 60% of people perceived their fitness to be good or very good, and about 40% as somewhat deficient or poor. These figures are similar to those obtained in the survey on the sport habits of Spaniards (CIS, 2010), where 63% of the elderly considered their fitness to be acceptable or good (35.5% acceptable; 27.5% good), and around 33% as deficient or poor (26.3% deficient; 6.7% poor). It is important to mention that just 3.1% perceived their fitness as excellent in this research. In another study, Lanning *et al.* (2004) found that people aged 60 years or older, perceived their level of fitness to be average or above average.

In terms of the relationship between fitness and gender, Spanish men in general perceive themselves to be more fit than females, with both presenting fairly similar percentages, although the relationship was not statistically significant. Similarly, in a study conducted in Japan with (apparently healthy) males and females aged between 65 and 84 years, where the PA taken over the course of a year was measured using accelerometers, Aoyagi *et al.* (2009) found that the physical fitness variable was greater for males than females. The relationship between these variables was significant, although low. Similar results were obtained by Van Heuvelen *et al.* (1998), who suggests that older persons get worse results in all variables related with physical fitness than younger persons. Aoyagi *et al.* (2009) also reported that fitness was better in the 65- to-74-year age group than the 75- to-84 age group.

It should be remembered that physical fitness, being an ability or aptitude of the individual, which is determined according to the development of their physical or motor capabilities, can

be modified through PA and make it possible for people to undertake their daily activities without excessive fatigue (Castillo *et al*. 2005). This may explain why the people in the ED group scored higher percentages in terms of perceiving their fitness as good or very good, compared to the figures obtained from the population as a whole and the other groups of demand for PA.

These results also corroborate the research by Van Heuvelen *et al*. (1998), Blair *et al*. (2001), Denk and Pache (2003), Kinugasa *et al*. (2003) and Kazuo (2006), who suggest that the fitness of active elderly people is better than the fitness of sedentary people. The processes of loss, typical to old age, affect the active person less than inactive people of the same age. Blair *et al*. (2001) support this by saying that PA and fitness are closely related. However, it is important to keep in mind that PA is not the only aspect that influences fitness and health. Cochrane *et al*. (1998) and Seguin *et al*. (2010), found that people who take part in PA programmes improve different components of fitness and the perception of their health.

Regarding the relationship between the socio-demographic variable *gender* and the variable *type of demand*, unlike what occurs in the population as a whole and in the Absent Demand (AD) group, the females in the Established Demand (ED) and Latent Demand (LD) groups scored higher percentages than the males when perceiving their fitness as very good, with a larger difference between the two in the ED group. However, in both cases males had a higher percentage for considering their fitness to be good, as occurred at the general level and in the AD group too, although this relationship was not statistically significant. In the group who exercised, and those who want to, the differences with regard to perception of fitness between males and females were smaller.

Furthermore, research has reported that people who exercise not only improve their physical fitness, but also their functional capacity compared to people with poorer fitness levels (Kinugasa *et al*., 2003; Kazuo, 2006). Considering the socio-demographic variable of *age*, similar to what happened when analysing the overall figures, people aged 75 years and older in the ED group, scored similar percentages to people aged 74 years and younger in perceiving their fitness as good or very good with 83.7 and 89.5% respectively. These percentages for the ED group were higher than the percentages scored for the other groups. It is worth noting that in the LD group, 65.8% of the older age group perceived their fitness as good or very good, compared to 58.5% for the younger age group. Scientific literature reports that the difference in fitness of active and non-active persons in the younger and older groups is greater in the latter group (Van Heuvelen *et al*., 1998).

In relation to the PA undertaken by the elderly, it should be noted that the results in relation to fitness would be much better if qualified professionals supervise the activity (Campos *et al*., 2011). In a study with a control group conducted in Finland over a two-year period, Mänty *et al*. (2009), found that those who were advised about the PA they should do, increased their levels of PA (at least keeping themselves moderately active), and improved their mobility, thus improving their fitness. This suggests the importance of considering the needs of each individual.

PRACTICAL APPLICATION

Most elderly people in Spain perceive their fitness as good or very good. Because of the

relationship between fitness and functional capacity and the demographic ageing of the population, they are potential customers for businesses and institutions that run PA programmes. Furthermore, people who perceive their fitness as somewhat deficient or poor should be made aware that it could be improved by doing PA. Institutions should, therefore, promote and implement PA programmes for the elderly.

CONCLUSIONS

By addressing the variables *fitness* and *types of demand*, it was found that people who engage in PA and sport (ED) had the most positive perception of their fitness, while people who did not pursue PA and did not wish to (AD) were more likely to perceive their fitness as somewhat deficient or poor. This could be one of the reasons why they did not want to participate in PA. These persons could fall prey to a dangerous 'vicious circle' where their fitness declines, further reducing their desire to exercise. This would negatively influence their quality of life.

Finally, although males in general and the elderly perceived their fitness as being good or very good, the *gender* variable and the *age* variable recorded lower percentages in this regard

in the group of the elderly who exercised (ED), and those who want to (LD), but who for some reason were unable to exercise.

LIMITATIONS

Due to following the criterion of random selection, it was a limitation of this study that the size of the sample for each of the three types of demand groups was different, with the Established Demand and the Latent Demand groups being smaller. It would be interesting in the case of further research to conduct a study, with an equal number of subjects in the three types of demand groups, which could deliver results that are more significant.

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NETWORKS AND CENTROID METRICS FOR UNDERSTANDING FOOTBALL

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ABSTRACT

This study aimed to verify the network of contacts resulting from the collective behaviour of professional football teams through the centroid method and networks as well, thereby providing detailed information about the match to coaches and sport analysts. For this purpose, 999 collective attacking actions from two teams were analysed, including passes completed, passes received and crosses, involving a total of 2 335 intra-team interactions (1 160 passes and crosses performed and 1 175 ball receptions). Amisco® software was used to characterise the collective behaviour of professional football teams. The results showed that the interaction of the centroid players in the offensive phase of the game occurred, preferably, through the formation of vertices that were connected by links, which were mainly orchestrated by the action of centroid players. It was concluded that the interactions of the professional football teams tended to occur preferentially on the offensive phase of the game, and the network of contacts was controlled, mainly, in ball possession, through passes performed in the central and lateral areas of the field. The herein presented findings may help coaches and sport scientists to understand better, how self-organisation emerges and how collective behaviour is orchestrated.

Key words: Football; Centroid players; Interpersonal interactions; Network analysis; Collective behaviour.

INTRODUCTION

Researchers, such as Frencken and Lemmink (2008) and Folgado *et al*. (2014), have been

describing the usefulness of the centroid method and its practical applications in the context of Sport Science. Following the same line of thought, Lames *et al*. (2010) indicated that similar principles might underpin the collective organisation of teams' centroids in invasion games. However, it seems that the centroid metric, supported only by the position of players in the field, may not be sufficient to show the true essence and dynamics of the football game (Bartlett *et al*., 2012). Therefore, to resist this "limitation", the network methodology might be useful to shed light on the contributions of a key individual performer to team performance. Additionally, provide insights on how creative and organised individuals might act to orchestrate team strategies (Gama *et al*., 2014). Moreover, network analysis can support

the investigations of continuous interactions between players and teams during competitive performance. This methodology can be used to characterise the collective behaviours that emerge through cooperation and competition between players during competitive football matches (Duch *et al*., 2010).

PURPOSE OF THE STUDY

Bearing these ideas in mind, the aim of this study was to decode the network of interactions resulting from the collective behaviour of professional football teams by benefiting from both centroid and network approaches, to provide more detailed information about game events and situations that precede the game to coaches. Therefore, this study sought to record and characterise the offensive effectiveness of professional football teams using centroid and network analysis.

METHODOLOGY

Selection of teams and matches

Two matches between the top 2 teams from the Portuguese Premier League, 2010/2011, were selected. Additionally, 999 collective attacking actions (involving ball possession) from both teams were analysed, including passes completed, passes received and crosses, involving a total of 2 335 intra-team interactions (1 160 passes and crosses performed and 1 175 ball receptions). The data was analysed using the *Match Analysis Software Amisco*® (version 3.3.7.25), which is a specialised programme that allows to characterise the activity profiles of the team (Gama *et al*., 2014).

Procedures for analysis of data

Using the Amisco® software, the networks and intra-team connectivity matrices were constructed, displaying and measuring the interpersonal relationships established by the players. A major focus of this study was to analyse which areas of the field were occupied by centroid players during the football matches (Gama *et al*., 2014). For the purpose of quantifying the frequency of relevant events, such as collective actions like passes, crosses and passes received, a notational analysis of competitive performance of the team during offensive phases was performed. An interaction was established whenever a player with the subsequent reception of the ball performed a pass or a cross by a teammate (Gama *et al*., 2014).

The football field presented in Figure 1 was validated using Amisco® software, which

automatically divides the field into 24 areas, composed of 4 corridors and 6 sectors. The average positioning was calculated by recording the total number of ball contacts achieved by each player (player position was calculated each time he touched the ball). Thus, the average positioning of each player was related to the number of times and the field location where he contacted the ball (Duch *et al*., 2010; Gama *et al*., 2014).

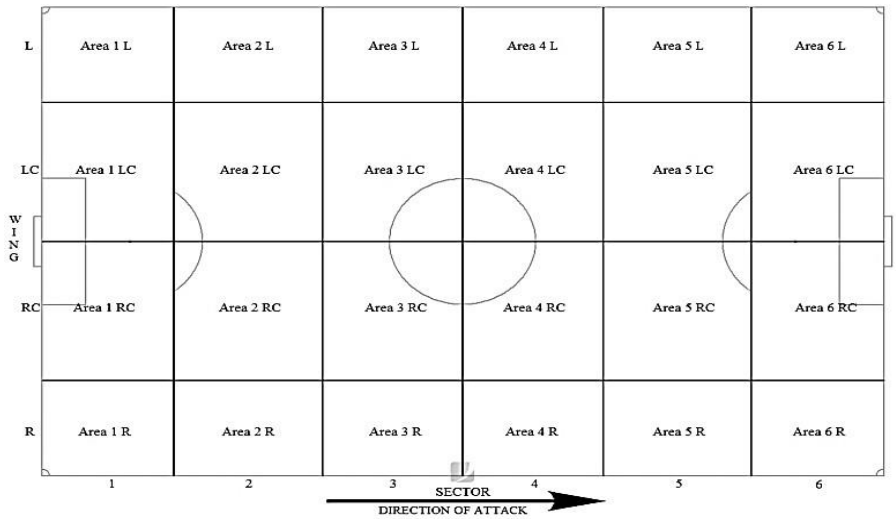


Figure 1. **FOOTBALL FIELD DIVIDED INTO 24 AREAS**

(Adapted from Amisco® and Gama *et al*., 2014:696).

The data was represented by a non-symmetrical weighted adjacency matrix $A_w = [w_{ij}] \in \mathbb{R}^{n \times n}$, where n is the number of players in the team. The upper-triangle of A_w corresponds to the number of pass actions made, while the lower-triangle corresponds to the number of pass actions received (the diagonal that subdivides the matrix is ignored, that is the values are undefined for $i = j$). As an example, the number of pass actions Player i does with Player j is represented by w_{ij}, which may, or may not, be the same as the number of pass actions Player j did with a player, namely, $w_{ij} \neq w_{ji}$ (Clemente *et al*., 2014). To understand better the network of interactions, which emerge from players of the same team, the relative frequency probability method was considered (Peebles, 2001):

$p(w_{ij}$

$$) = \frac{w_{ij}}{\sum_{i \neq j} w_{ij}}$$

(1)

wherein $p(w_{ij})$ is the probability of a given interaction w_{ij} to occur between Player i and Player j. It should be noted that the probability of an interaction to occur results in a relative frequency of occurrence, such that $0 \leq p(w_{ij}) \leq 1$. Besides the probability of interaction between pairs of players, an intra-player network concept (network property of a node), denoted as the *centroid players*, was also considered. To compute this network concept, one can create a new relative weighted adjacency matrix $A_r = [r_{ij}] \in \mathbb{R}^{n \times n}$, defined as:

$r_{ij} = \{$

$$\frac{w_{ij}}{\max_{i \neq j} A} \qquad w$$

$, i \neq j$

(2)

$$undefined \quad , i = j$$

where $0 \leq r_{ij} \leq 1$ for $i \neq j$, with $i\, j = 1, \ldots, .$ Note that for matrix A_w, matrix A_r is undefined when $i = j$ as a given player cannot interact with itself.

The denominator $\max_{i \neq j} A_w$ corresponds to the larger connectivity between players, namely the pair of players interacting the most together. Note that, as the weighted adjacency matrix A_w, A_r is also not symmetrical. Afterwards, one needs to compute a widely used concept for distinguishing or classifying a vertex of a network (Horvath, 2011), called the *connectivity* (also known as degree). The connectivity of Player i can be defined by:

$$k_i = \sum_{i \neq j} r_{ij}$$

(3)

such that $k = [k_i] \in \mathbb{R}^{1\times n}$ is the vector of the connectivity of players. Note that there will be a vector for the pass actions made and another for the pass actions received. In other words, Player i may present a high connectivity with the team due to the actions he makes, but may not present a high connectivity with the team regarding the pass actions he receives. The most cooperative player or players, can be found by finding the index/indices of the maximum connectivity for pass actions made and received as:

$$k_{max} = \max_j k_j \tag{4}$$

Therefore, one can define a relative connectivity, known as *scaled connectivity*, of Player i as:

$$s_i = \frac{k_i}{k_{max}}$$

(5)

such that $s = [s_i] \in \mathbb{R}^{1\times n}$ is the vector of the relative connectivity of a player. In team sport contexts, one could interpret the scaled connectivity as a measure of cooperation level of a given player in which high values of s_i(as s_i tends to 1) indicate that the i^{th} player works with most of the other teammates. However, a player may present a high connectivity with other players but may still be unable to produce consensus among his non-direct teammates. Therefore, the *clustering coefficient* of Player i offers a measure of the degree of inter-connectivity in the neighbourhood of Player i, being defined as:

$c_i =$

$\underline{\sum_{k\neq i}\sum_{j\neq k,j\neq i,} r_{ik}r_{kj}r_{ji}}$ $(\sum_{k\neq i} r_{ik})^2 - \sum_{k\neq i}(r_{ik})^2$

(6)

such that $c = [c_i] \in \mathbb{R}^{1\times n}$ is the vector of the clustering coefficient of a player (Ravasz & Barabási, 2003). As a team sport modality, a weighting distribution of the cluster coefficient and the connectivity between players should be taken into account. Therefore, a weighting function, denoted as *global rank*, was defined as:

$$g_i = \rho_s s_i + \rho_c c_i \quad (7)$$

where $\rho_s + \rho_c = 1$, such that $g = [g_i] \in \mathbb{R}^{1\times n}$ is the vector of the global rank of players. Note that there will be a vector for the pass actions made and another for the pass actions received. Furthermore, the scaled connectivity s_i was chosen over the unscaled k_i, since it lies

between 0 and 1 as the clustering coefficient $0 \leq g_i \leq 1$. Taking into account that the main objective of the football team, as any other collective sport, is to give priority to the collective performance (the overall interaction between players), one can contemplate a balanced consideration of $\rho_s = \rho_c = 0.5$. The top-ranked players, namely the ones presenting the higher g_i , will then be denoted as the *centroid players*. Within team sport, the *centroid players* could be considered as the players who maintain the connectivity of the whole team (Clemente *et al*., 2014). The centroid players are fundamental in the self-organisation process of the team, since they exhibit a higher level of quality during both execution and reception of passes, thereby contributing to a high intensity and density of the network of contacts established during the game. These players may contribute to a greater intensity and density of the contact network throughout the game. In order to compare easily the difference between successful and unsuccessful passes performed by a team in each of the 24 areas, according to game venue (games played home or away), a histogram-based analysis in the form of a *heat map* was carried out.

RESULTS

Game 1

The networks observed portrayed the interactions established between players of the same team through their distribution on the field during an offensive phase. Each player was assigned with an edge (arrow) connected to another player, with whom they engaged in an interaction, allowing the recording of the total number of interactions performed between the 2 players (Gama *et al*., 2014). In that sense, Table 1 shows 716 intra-team interactions (successful passes and crosses) between players of Team A. Table 2 shows the total amount of interactions between the players of Team B, in the first game. Player 5 interacted most with other players on Team A, engaged in a total of 99 interactions (51 passes and crosses; 48 ball receptions). Moreover, the highest level of interaction occurred between Player 21 and Player 12, with a total of 15 passes and crosses.

Table 1. **GAME 1: CENTROID VALUES FOR EACH PLAYER OF TEAMS A & B**

	Team A					**Team B**				
	Passes and crosses		**Ball receptions**			**Passes and crosses**		**Ball receptions**		
Rank	Player i	g_i	Player i	g_i	**Rank**	Player i	g_i	Player i	g_i
1st	5	0.5866	21	0.5697	1st	6	0.5954	4	0.5665
2nd	8	0.5023	5	0.4935	2nd	4	0.5472	17	0.5539
3rd					3rd				

4th	4	0.4242	12	0.4759	4th	17	0.4999	14	0.5396
5th	17	0.4208	8	0.4616	5th	14	0.4419	6	0.4734
6th	1	0.3966	14	0.4430	6th	8	0.3723	10	0.4299
7th	14	0.3960	6	0.4418	7th	23	0.3592	23	0.4266
8th	6	0.3924	7	0.4102	8th	18	0.3453	8	0.3536
9th	7	0.3750	4	0.3584	9th	10	0.3450	18	0.2658
10th	9	0.3544	1	0.3270	10th	12	0.3231	12	0.2384
11th	21	0.3345	9	0.3245	11th	27	0.2980	31	0.2222
12th	12	0.3239	28	0.2918	12th	20	0.2364	27	0.1925
13th	28	0.3212	17	0.2881	13th	15	0.1268	20	0.1914
14th	19	0.2550	19	0.1210	14th	31	0.1236	15	0.0651
	18	0	18	0		5	0.0217	5	0.0001

Table 2. **TEAM A: TOTAL AMOUNT OF INTERACTIONS* BETWEEN PLAYERS IN FIRST GAME**

(*Passes or crosses with receptions of ball)

Game time	Position	To/Of	1	4	5	14	21	6	7	8	9	12	17	2
97	GR	**1**	–	1	3	6	3	1	0	0	0	1	0	0
97	DC	**4**	6	–	6	4	3	5	1	0	0	0	0	0
97	DE	**5**	10	10	–	2	1	7	2	6	0	1	3	4
97	DC	**14**	3	4	4	–	10	4	2	3	0	2	0	1
97	DD	**21**	2	0	2	12	–	1	4	3	1	2	2	0
91	MC	**6**	2	5	4	2	2	–	4	3	0	0	3	3
82	MC	**7**	0	0	6	0	3	3	–	3	3	7	2	0
97	MC	**8**	0	6	5	4	3	5	2	–	6	2	4	2
97	PL	**9**	0	0	5	0	2	2	3	6	–	4	0	1
97	ED	**12**	0	0	2	1	15	0	9	3	3	–	0	1
86	EE	**17**	0	1	7	2	0	2	2	13	2	2	–	0
14	S	**28**	1	2	6	0	0	0	0	4	2	0	0	-
10	S	**19**	0	1	1	0	0	0	0	0	0	0	0	2
6	S	**18**	0	0	0	0	0	0	0	0	0	0	0	0
	Passes and crosses		24	30	51	33	42	30	29	44	17	21	14	1
	Ball receptions		15	25	48	33	29	28	27	40	23	35	31	2
	TOTAL of interactions		39	55	99	66	71	58	56	84	40	56	45	4

To= Interaction received by player Of= Interaction made by player

Rows display number ball receptions by each player ***Columns*** display number of passes or crosses performed by each player

GR= Goalkeeper; DC= Central Defender; DD= Right Defender; DE= Left Defender; MC= Central Midfielder; ED= Right Wing; EE= Left Wing; PL= Striker; S= Substitute

Table 3. **TEAM B: TOTAL AMOUNT OF INTERACTIONS* BETWEEN PLAYERS IN FIRST GAME**

(*Passes or crosses with receptions of ball)

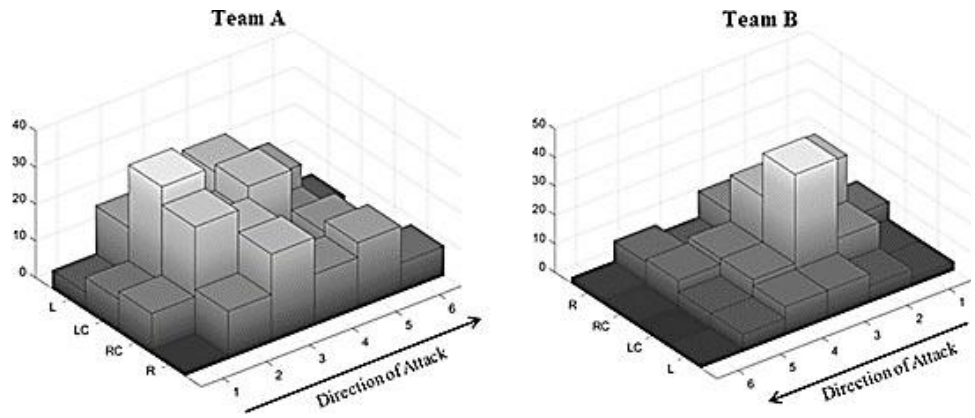
Game time	Position	To/Of	12	4	23	27	6	10	17	18	8	14	31	2
97	GR	**12**	–	2	3	0	1	1	1	1	0	0	0	0
69	DC	**4**	4	–	1	4	3	0	6	1	2	14	0	1
97	DE	**23**	0	2	–	2	7	3	4	3	0	0	0	1
47	DC	**27**	1	3	2	–	1	0	0	1	0	0	0	0
97	MCD	**6**	3	9	5	2	–	4	6	0	1	1	0	1
97	MCO	**10**	0	1	1	0	3	–	3	2	2	5	4	1
75	MC	**17**	0	4	2	1	10	7	–	3	1	5	1	1
97	ME	**18**	1	1	7	4	4	0	2	–	0	0	1	1

82	MCD	**8**	0	4	1	0	3	3	3	0	–	4	0	0
97	DD	**14**	0	12	0	0	3	1	4	0	1	–	2	0
97	PL	**31**	0	0	0	0	0	2	0	2	0	1	–	1
49	S	**20**	0	2	0	0	2	2	1	3	0	0	2	–
21	S	**15**	0	0	1	0	2	0	0	0	0	0	0	0
14	S	**5**	0	0	0	0	0	0	0	0	0	0	1	0
Passes and crosses			9	40	23	13	39	23	30	16	7	30	11	7
Ball receptions			9	36	22	8	34	23	35	22	18	23	7	13
TOTAL of interactions			18	76	45	21	73	46	65	38	25	53	18	20

To= Interaction received by player Of= Interaction made by player
Rows display number ball receptions by each player ***Columns*** display number of passes or crosses performed by each player
GR= Goalkeeper; DC= Central Defender; DD= Right Defender; DE= Left Defender; MCD= Defensive Midfielder; MCO= Offensive Midfielder; MC= Central Midfielder; MD= Right Midfielder; ME= Left Midfielder; PL= Striker; S= Substitute

Table 3 provides the centroid values for each player of Team A and Team B in the first game. The results reveal that Player 4 interacted most with other players on Team B. He engaged in a total of 76 interactions (40 passes and crosses; 36 ball receptions). In addition, the highest level of interaction occurred between Player 4 and Player 14 (14 passes and crosses performed). The centroid player was the most highly connected node in the network. Thus, from Team A, Player 5 presented the highest global rank for passes and crosses performed (0.5866), and Player 21 presented the highest global rank for ball receptions. On the other hand, from Team B, Player 6 achieved the highest rank for passes and crosses performed (0.5954), and Player 4 achieved the highest rank for ball receptions (0.5665).

Beyond quantification of the number of passes and crosses performed, it is worth noting where on the field (on average) the interactions were performed. Figure 2 displays the network providing a qualitative analysis of the main interactions performed (to which field location and between whom the passes were performed), based on the average field position of players. In addition to the collective connections performed between players, the relevance of centroid players from each team, particularly Player 5 (left defender) in Team A, and Player 4 (central defender) in Team B, is evident. Depending on the ball possession, Figure 3 identifies the location (areas) where the interactions were performed.



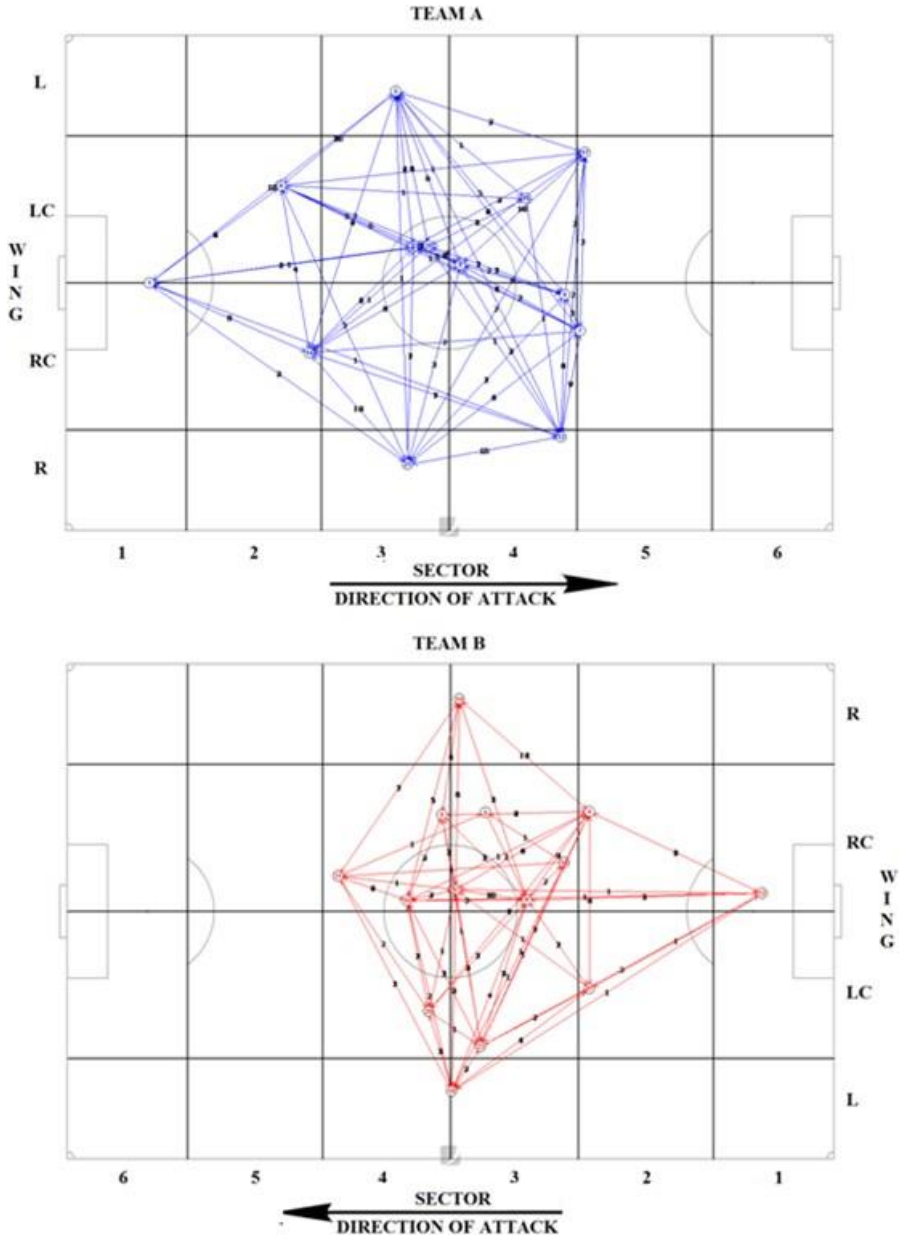
L= Left; LC= Left Centre; RC= Right Centre; R= Right.

Grey areas = Areas where largest number of passes and crosses occurred without success Dark areas = Areas where there was less interaction between players.

Figure 2. **GAME 1: HEAT MAPS OF RELATIVE INTERACTIONS* BY TEAM A AND TEAM B IN THE FIELD**

(*Passes and crosses performed with ball receptions)

The heat maps show that Team A preferred performing in the defensive midfield, areas 2LC, 2RC and 4RC, while Team B mostly explored the defensive midfield, areas 3LC, 2RC and 3RC. Thus, while Team A explored all areas of the soccer field, Team B mainly set their game in defensive sectors.



L= Left; LC= Left Centre; RC= Right Centre; R= Right. Value of interaction is brought to the centre thereof.

Figure 3. **GAME 1: REPRESENTATIVE NETWORK OF INTERACTIONS* BETWEEN PLAYERS (TEAMS A & B) BASED ON FIELD LOCATION**

(*Performed and received)

Game 2

Table 3 shows 474 intra-team interactions between players of each football team.

Based on this, Player 8 interacted most with other players on Team A, with a total of 70 interactions (38 passes and crosses; 32 ball receptions). The highest level of interaction was observed between Player 13 and Player 12, with a total of 12 passes and crosses performed. The data shows that Team B performed a total of 638 intra-team interactions, resulting from 318 passes and crosses performed and 320 ball receptions (Table 4).

The player with the highest manifestation of interaction in Team B was Player 6, who presented a total of 79 interactions (41 passes and crosses performed; 38 ball receptions). Table 5 shows the centroid values for each player of both teams during the second game.

Table 3. **GAME 2: CENTROID VALUES FOR EACH PLAYER OF TEAMS A & B**

	Team A					Team B			
	Passes and Crosses		Ball Receptions			Passes and Crosses		Ball Receptions	
Rank	Player i	g_i	Player i	g_i	Rank	Player i	g_i	Player i	g_i
1st	8	0.6135	8	0.5863	1st	10	0.6057	18	0.5869
2nd	5	0.5516	12	0.5693	2nd	18	0.4694	10	0.5733
3rd	13	0.4955	13	0.5643	3rd	20	0.4565	11	0.5568
4th	17	0.4846	25	0.4744	4th	11	0.4485	4	0.5324
5th	25	0.4476	6	0.4149	5th	30	0.4200	20	0.4518
6th	12	0.4067	9	0.3964	6th	25	0.4046	8	0.4489
7th	7	0.3738	17	0.3391	7th	6	0.3984	30	0.4352
8th	9	0.3675	5	0.3328	8th	8	0.3830	12	0.3296
9th	1	0.3462	7	0.3213	9th	4	0.3632	6	0.3206
10th	6	0.3401	14	0.3007	10th	27	0.2796	2	0.3107
11th	30	0.2689	30	0.2210	11th	2	0.1994	25	0.2705
12th	14	0.2413	1	0.1193	12th	12	0.1050	27	0.2589
13th	4	0.0928	4	0.0541	13th	7	0.0943	33	0.1023
14th	10	0.0606	10	0.0270	14th	33	0.0263	7	0.0303

The data indicated that Player 8 from Team A achieved the highest rank for passes and crosses performed (0.6135), and received (0.5863). On the other hand, Player 10 from Team B achieved the highest rank for passes and crosses performed (0.6057) and Player 18 for ball receptions (0.5869).

Table 4. **TEAM A: TOTAL INTERACTIONS* BETWEEN PLAYERS IN SECOND GAME**

(*Passes or crosses with reception of ball)

Game time	Position	To/Of	1	5	13	14	30	6	8	25	9	12	17	7
100	GR	**1**	–	0	0	3	0	0	1	0	0	1	0	0
100	DE	**5**	4	–	0	0	3	2	4	4	1	1	1	1
100	DD	**13**	1	0	–	4	0	0	8	4	1	6	0	3
100	DC	**14**	3	1	3	–	0	1	0	2	0	0	0	0
100	DC	**30**	4	2	0	0	–	2	0	2	0	0	0	0
87	MC	**6**	1	3	2	0	2	–	4	3	2	4	2	0
100	MC	**8**	1	4	5	0	1	0	–	5	3	5	6	2
100	MC	**25**	1	1	2	1	0	2	7	–	1	0	3	0
79	PL	**9**	0	4	4	2	0	1	3	2	–	3	0	0

100	ED	**12**	2	0	12	2	1	1	3	3	5	–	1	
78	EE	**17**	0	8	1	1	1	3	5	3	0	0	–	
21	S	**7**	1	1	2	0	0	0	3	0	0	1	0	
21	S	**4**	0	1	1	0	0	0	0	0	0	0	0	
13	S	**10**	0	3	0	0	0	0	0	1	0	0	0	
	Passes and crosses		18	28	32	13	8	12	38	29	13	21	13	
	Ball receptions		6	22	27	10	10	23	32	19	19	32	22	
	Total of interactions		24	50	59	23	18	35	70	48	32	53	35	1

To= Interaction received by player Of= Interaction made by player

Rows display number ball receptions by each player ***Columns*** display number of passes or crosses performed by each player

GR= Goalkeeper; DC= Central Defender; DD= Right Defender; DE= Left Defender; MC= Central Midfielder; ED= Right Wing; EE= Left Wing; AV= Forward; S= Substitute

Table 5. **TEAM B: TOTAL INTERACTIONS* BETWEEN PLAYERS IN SECOND GAME**

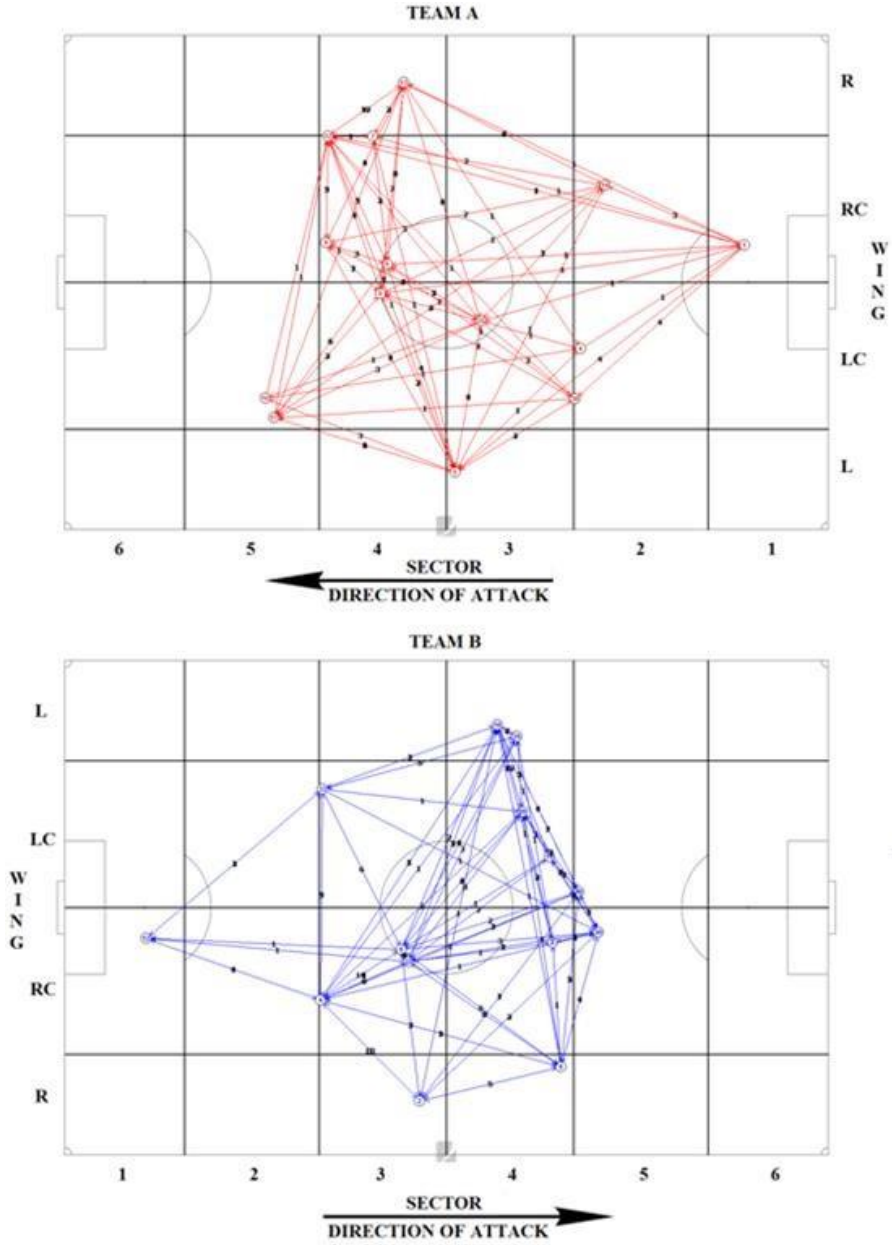
(*Passes or crosses with reception of ball)

Game time	Position	To/Of	12	4	18	2	27	6	10	20	8	11	30	2
100	GR	**12**	–	4	0	0	1	1	0	0	0	0	0	
100	DC	**4**	1	–	3	3	9	10	1	0	1	0	1	
100	DE	**18**	0	1	–	1	2	2	1	6	1	0	1	
66	DD	**2**	0	10	2	–	0	3	1	0	5	0	2	
100	DC	**27**	0	8	5	0	–	9	1	0	3	0	1	
100	MCD	**6**	0	11	0	7	7	–	0	2	0	1	0	
50	MCO	**10**	0	0	4	2	2	2	–	3	2	2	1	
100	ME	**20**	0	2	12	0	8	4	2	–	4	1	2	
100	MD	**8**	0	3	0	5	6	6	5	0	–	0	4	
50	AV	**11**	0	0	1	0	2	0	1	1	0	–	3	
100	AV	**30**	0	0	2	3	2	3	3	4	4	1	–	
50	S	**25**	0	1	8	0	0	1	0	5	0	0	0	
41	S	**7**	0	0	1	0	1	0	0	3	1	0	2	
33	S	**33**	3	3	2	0	0	0	0	0	0	0	0	
	Passes and crosses		4	43	40	21	40	41	15	24	21	5	17	2
	Ball receptions		7	34	25	23	29	38	18	40	30	8	25	2
	Total of interactions		11	77	65	44	69	79	33	64	51	13	42	4

To= Interaction received by player Of= Interaction made by player

Rows display number ball receptions by each player ***Columns*** display number of passes or crosses performed by each player

GR= Goalkeeper; DC= Central Defender; DD= Right Defender; DE= Left Defender; MCD= Defensive Midfielder; MC= Central Midfielder; MD= Right Midfielder; ME= Left Midfielder; MCO= Offensive Midfielder; AV= Forward; S= Substitute



L= Left; LC= Left Centre; RC= Right Centre; R= Right. The value of the interaction is brought to the centre thereof.

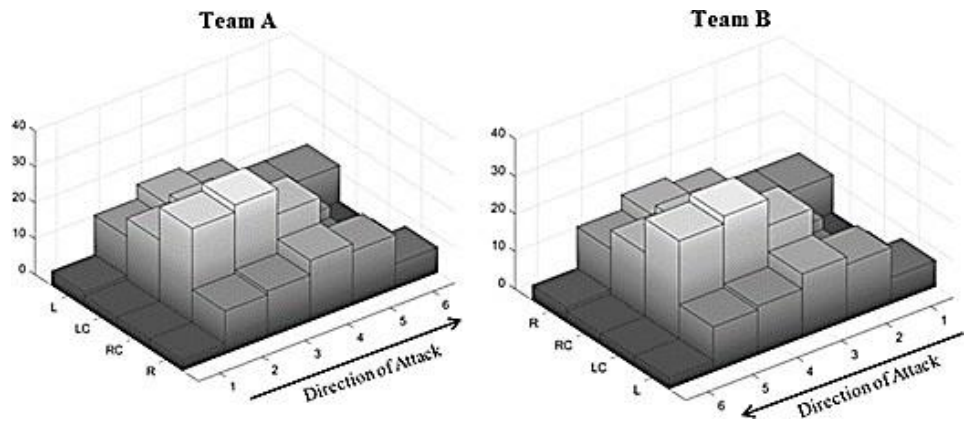
Figure 4. **GAME 2: REPRESENTATIVE NETWORK OF INTERACTIONS* BETWEEN PLAYERS (TEAMS A & B) BASED ON FIELD LOCATION**

(* Performed and received)

In the second game, some behavioural differences, expressed for each team, were identified.

For example, Team A kept exploring the offensives through an organised scheme and great rallies between players (positional attack). Figure 4 provides the location on the playing field where the interactions were observed for both teams during ball possession in all offensive phases.

The heat maps (Figure 5) indicate that both teams had a similar way to explore the offensive game, acting in all field areas, but with higher incidence in the central corridors. Team A acted mainly in the areas, 3RC, 2RC and 4RC, while Team B interacted mainly in 4LC, 5LC and 3LC.



L= Left; LC= Left Centre; RC= Right Centre; R= Right.
Grey areas = Areas where largest number of passes and crosses occurred without success
Dark areas = Areas where there was less interaction between players.

Figure 5. **GAME 2: HEAT MAPS OF RELATIVE INTERACTIONS* BY TEAM A AND TEAM B IN THE FIELD**

(*Passes and crosses performed with ball receptions)

DISCUSSION

The results present the centroid players who contributed the most to the overall connectivity of the team throughout the game. One can see that some other key-players, namely players who interacted the most but not throughout the game or with the whole team, were not always the centroid players. In fact, the centroid player was the player who maintained the overall connectivity of the whole team (Horvarth, 2011), and was considered as one of the most highly connected nodes in the network (Grund, 2012; Vaz *et al*., 2014).

Such evidence can be justified by the tactical approach of the players on the field, which was shaped and organised according to the behaviour and the actions of the opponent, as well as the strategy adopted by the coach (Gama *et al*., 2014). These players have an above average

quality of passing and receiving, therefore, contributing to a greater intensity and density of the contact network throughout the game (Duch *et al*., 2010; Lames *et al*., 2010).

Concurrent with the collective behaviour that was observed during the offensive phase, heat maps of relative interactions show all the relationships established by players and the areas that they mostly occupied. Hence, it was possible to measure objectively in which areas of the field the team acted and interacted more frequently (Gama *et al.*, 2014).

Finally, these results indicate that an effective knowledge about the way that the opponent team proceeds in the offensive game phase could help to understand better, how self-organisation of the collective behaviour occurs (Folgado *et al.*, 2014). For example, the data demonstrated that in both games Team A explored the offensive game in an organised way, promoting many rallies between players in order to maintain ball possession (positional attack), while in the first game Team B acted in an organised way contemplating ball possession and in the second game sought the opposing goal through a direct attacking game (fast attack and counter attack).

PRACTICAL APPLICATION

The findings of the present study may help coaches and sport scientists quantify the contributions and interactions of individual team members through analysis of their relevant actions in a team sport like football.

This study has practical implications for coaches, since it allows a multi-dimensional analysis of the football match. Therefore, professional football matches can be analysed through inter-player interactions (networks) in order to understand who the centroid player is and what his central role is in the collective team dynamics.

Moreover, this method consists of a potentially reliable option to measure the collective performance of the team and its players, which notational analysis appears not to provide robustly. From this perspective, here practical implications emerge again for coaches regarding the intra- and inter-individual performance trends, which results from playing actions, providing some answers about how teams self-organise their behaviour and performance. Furthermore, such an approach can be complemented with other indicators and other methods in order to increase the explanatory power of the variables presented in this study. For this purpose, it is suggested that further research analyse these and other indicators regarding sport performance in professional football teams, transversal to other sport teams, using a robust sample for this purpose from the standpoint of the number of games.

CONCLUSIONS

It was concluded that the intensity and density of this type of connectivity and the interaction nodes resulted through passes and crosses were successfully established during the games. Therefore, centroid players are fundamental in the self-organisation processes of the team, since they exhibit a higher level of quality during both execution and reception of passes, thereby contributing to a high intensity and density of the network of contacts established during a game. Finally, the network analysis showed that professional football teams attribute

particular importance to circulation and maintenance of ball possession, by passing to the centroid player several times.

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EXPERIENCE-BASED TYPOLOGY OF SPECTATORS AT AN INTERNATIONAL CRICKET SIXES TOURNAMENT

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ABSTRACT

This innovative research on managing and marketing team sport events was completed for the first time at an international Cricket Sixes tournament held in South Africa (SA). A visitor survey was conducted at SuperSport Park in Centurion during the Global Softech Sixes Tournament in 2014. Finally, spectators, who were selected by applying a stratified random sampling method, returned 278 of the self-administered questionnaires. The analysis was performed in three stages, two factor analyses, a cluster analysis and an analysis of significant differences between the experience-based clusters of the cricket-sixes spectators. Different cricket spectator segments were identified based on the factors that are regarded by the spectators as important for a memorable experience. The research identified three distinct cricket spectator clusters, namely Occasional, Selective and Comprehensive experience seekers (OSC-typology). These clusters differ in terms of their motives, socio-demographic and behavioural characteristics. Based on the findings, an OSC-typology of cricket spectators is proposed. The research also confirms that the motives for spectators differ from sport to sport and even from one category to the next in the same type of sport. The same applies to aspects pertaining to memorable experience.

Key words: Market segmentation; Cricket spectators; Cricket Sixes tournament; Memorable experience; Motives; South Africa.

INTRODUCTION

Sport events are big business and can be seen as the backbone of sport tourism (Saayman & Saayman, 2014). Cities and destinations are spending large sums of money on developing infrastructure to be able to host sport events. Therefore, amongst others, sport events are used to create a particular image, to attract investors, to offer tourists and residents the opportunity to enjoy various sports as a form of entertainment, to grow tourism, to grow sport participation and development, to grow their economies and to promote cities and destinations (Davies, 2010; Li & Jago, 2013; Thomson *et al*., 2013; Saayman & Saayman, 2014). However, of all the role players in sport events, one of the most important is the spectator, especially in team sport, such as football, baseball, rugby, soccer and cricket (Gibson, 1998; Bull & Weed, 1999; Wann *et al*., 2001; Cannon & Ford, 2002).

Spectators have an important role and function, since they generate income for sport stadia and they create an atmosphere at the event. Therefore, from a management point of view, it is not only important to know who the spectators are, but also what their needs are and that

these needs should be translated into aspects that can be managed, for example, memorable experience factors. Since sport events not only compete amongst one other for the time and money of spectators, they also compete with all the other activities that might interest potential spectators during their leisure time, such as watching television, going to the movies, spending time with their families, etc. Therefore, it is of paramount importance to understand the needs of spectators (Dolinting *et al*., 2015).

This is especially true in the case of a sport such as cricket, which is played in various formats. Cricket is a traditional English bat-and-ball sport that is immersed in history. The first reference game was played as early as the 13th century (Leach, 2007). The cricket game had two formats, namely double-innings and single-innings matches. The first format takes four days of domestic competition and five days of international competition, of which the latter is known as a test match. The second format of the game is played on one day, with limited overs (50 overs). Dhurup and Niyimbanira (2012) explain that the difference between the two formats is that the number of overs that each team bowls is predetermined. Fans displayed more interest in the second format in comparison to the first format (Dhurup & Niyimbanira, 2012).

Over time, crowd attendances began to dwindle and in 2003, cricket authorities in England introduced a new format to the game, known as Twenty20 cricket, where each team bats for only twenty overs (Craig, 2007; Goldman & Johns, 2009). With the format of the game continuously evolving, Cricket Sixes is another fast format of the game introduced in 1992. There are only six players per team on the field during each game and every innings consists of five 6-ball overs. A batsman must retire on 31 runs but can return when five wickets are down and the teams are encouraged to try to finish their games within the hour (Momentum Cricket Sixes, 2015).

While Cricket Sixes tournaments have been played since 1992, with the Hong Kong Cricket Sixes tournament being the most notable, this form of cricket has never before been played in SA (Momentum Cricket Sixes, 2015). In a move set to revitalise cricket on the African continent and kick-start the domestic season in September 2014 in style, six teams from Africa (SA, Tanzania, Uganda, Namibia, Zimbabwe and Kenya) and six South African franchises contested the Global Softech Sixes at SuperSport Park in Centurion in September 2014.

LITERATURE REVIEW

Memorable experience

Gao *et al*. (2012) maintain that in today's world visitors are seeking experiences rather than products. Equally important, Ryan (2002) asserts that the tourist experience is essentially what tourism is all about, therefore, it is paramount to manage experiences satisfactorily based on the desires of tourist. Hence, there has been a shift from a product focus to an experience focus and tourism businesses are placing greater emphasis on creating and managing experiences (Oh *et al*., 2007; Zomerdijk & Voss, 2010). Pine and Gilmore (1999) highlight that, on the one hand, tourism businesses must understand the experiences of tourists, yet on the other hand, they also need to understand the tangible and intangible

attributes of a destination or tourism offering when creating a memorable experience. Cohen (1979) and Kruger and Saayman (2012), not only confirm that a memorable experience depends on how satisfied tourists are, but also that the level of satisfaction differs from one tourist to the next and from one tourism sector to the next. Tourism is thus part of the experience economy as indicated by Pine and Gilmore (1999).

The question that remains is what is a memorable experience? An experience, according to Page and Connell (2009:649), is defined as "the overall impression, understanding, rating and meaning a visitor attaches to their encounter with a particular place, event, holiday or activity".

Since the work conducted by Pine and Gilmore (1999), the literature (see for example Hudson & Ritchie, 2009; Kim *et al*., 2010; Tung & Ritchie, 2011; Kruger *et al*., 2013; Kim, 2014; Manners *et al*., 2014), has revealed a shift from offering an experience to offering a memorable experience. This occurred due to the definitions of experience which did not address the essence of what people experience when they engage in activities or travel, rather they engage in experiences at emotional, physical, spiritual and intellectual levels (Chandralal & Valenzuela, 2013; Kim, 2014). According to Citrine (1995), one could also refer to it as the 'wow factor' when designing events. Kruger *et al*. (2013:147) define memorable experience as one that is "not only remembered, but also treasured long after the experience is over"; which implies an experience that has beneficial psychological outcomes.

A tourism product has five distinct areas or phases where it impacts on the total experience (Saayman, 2012). The first phase is the planning of the event, the second is the journey to the destination or event, the third, is the experience of the destination or event, followed by the journey back, and lastly, the recovery and recollection phase. This implies that for management, it is not only the actual event or the experience at the destination that influences the total experience. Rather, all the phases exert an influence, which renders it even more important for managers to know about in order to be able to contribute to a memorable experience.

Critical memorable experience factors

To offer a memorable experience, management needs to identify those factors that make a contribution to it, and according to Brotherton (2004), these are referred to as key management factors or critical success factors or even key result areas. From a pure management theory point of view, critical management factors are aspects that influence the ability to be successful and attain goals (Thompson & Strickland, 1999; Aaker, 2005). Various researchers (Godfrey & Clarke, 2000; Gibson, 2005; Shipway & Kirkup, 2011; Engelbrecht *et al*., 2014), highlighted the benefit of identifying the critical management factors, as it would improve service levels, it will indicate the areas of improvement or the gaps in service delivery, it will contribute to being more competitive, it will lead to higher levels of satisfaction and contribute to loyalty.

Various studies, for example Getz and Brown (2004), Marais and Saayman (2011), Lin and Fu (2012), Du Plessis *et al*. (2014), Padilla-Meléndez and Garrido-Moreno (2014) and Wang and Hung (2015), to name but a few, have focused on determining the critical management factors applicable to different tourism sectors. The results of these studies, however, collectively indicate that although certain management aspects, such as general management,

marketing and human resources, seem to overlap, the combination and importance of the factors differ from one tourism sector and product to the next. Thus, there is no universal set of memorable experience factors that can be applied to different tourism sectors and products.

Kim and Kim (1995) identified eleven dimensions of service quality at sport centres, namely ambience, employee attitude, reliability, information giving, programming, personal consideration, price, exclusivity, ease of mind, convenience and stimulation. Kelley and Turley (2001) identified nine distinct dimensions of service quality for sporting events, namely employees, price, facility access, concessions, fan comfort, game experience, show time and convenience of smoking. Ko and Pastore (2005) found that the range of programmes, operating times, information, client-employee interaction, inter-client interaction, physical

challenge, valence, sociability, ambient conditions, design, equipment and giving support to programme quality are additional aspects that influence spectator satisfaction. Additional critical success factors that play a fundamental role in creating a memorable and satisfying spectator experience include, the distance travelled, standard and capacity of transport, stadium infrastructure, duration, location and scheduling of the sport event, standard of a team or individual performance, competitive outcomes of a contest, layout of the sports ground/terrain, information signs, ancillary activities and entertainment, effective marketing, atmosphere, spatial distribution, and accessibility of sports facilities and venues (Hinch & Higham, 2004; Yoshida & James, 2011).

Other important aspects to consider are the memorabilia of the experience, along with the promotional activities, such as live entertainment, in-game activities and fan-player interactions in spectator sport settings (Kahle *et al*., 2003), as well as the design, theme, big screens and festive atmosphere (Wakefield *et al*., 1996; Pine & Gilmore, 1998; Berry *et al*., 2002; Yoshida & James, 2011). In the only South African study that has been conducted to date, Kruger and Saayman (2012) confirmed in their research that was carried out on the critical management factors for a memorable spectator experience at the Two Oceans Marathon held in Cape Town, SA during April, that different aspects influence spectator experiences at an event. Four factors were identified, namely amenities, comfort and visibility, marketing and personnel and provisions. Of these factors, amenities and marketing were considered the most important factors that contributed to a memorable spectator experience at the event.

In terms of research conducted on specifically cricket spectators and the game experience, Saayman and Uys (2003) found that fans at a one-day international test match in Potchefstroom, SA between SA and Australia were mainly males, aged 35 to 49 years, who attend one to two international cricket matches annually. The main reasons for attending the match included, to enjoy cricket, have fun, support their team and be with family and friends. In another study, Saayman *et al*. (2005) determined the spending patterns of fans at three World Cup Cricket matches also held in Potchefstroom, SA. Their findings showed that foreign fans spend more than nationals and that different age groups have different spending patterns (higher spenders were older). Dhurup and Niyimbanira (2012) identified six motives for fans who attended a Twenty20 test when and where match, namely escape, knowledge and skill, socialisation, drama, game aesthetics and fascination. Various research projects (Van Leeuwen *et al*., 2002; Lough & Kim, 2004), found that cricket fans attend games to

meet certain motivational needs, including group affiliation and entertainment value, and meeting these needs would exert influence overall satisfaction with attending the game.

Attending a cricket match requires that spectators dedicate their time and effort as cricket matches can be played for five to six hours in a day (Kuenzel & Yassim, 2010). Kuenzel and Yassim (2010) identified four themes or variables that are considered by cricket fans to be important to their game experience, namely star players, the quality of the game, social facilitation, and auditory and olfactory elements. Star cricketers are those players who have a proven record of accomplishment of high-quality and exciting performances in international and/or first-class country games. These players are recognised as 'stars' if the fans, management and media analysts perceive them as such and they are consequently popular among fans (Kuenzel & Yassim, 2010). To watch 'crowd-pulling' players is regarded as a form of enjoyment and reason for attendance. Many fans also claim that they would attend different

venues and games to see various star players, regardless of the team they play for.

The overall performance of the two teams and the level of competitiveness that is portrayed by the teams during a contest constitute the quality of the game (Kuenzel & Yassim, 2007). Several terms have also been used, such as game experience (Kelley & Turley, 2001), and entertainment value (Lough & Kim, 2004). Victory for their favourite team provides fans with great satisfaction. However, there is evidence (Madrigal, 2003; Matsuoka *et al*., 2003) suggesting that there is greater entertainment value in watching a 'close game' in which both teams display high-quality performance.

This is especially true in cricket, where, due to its various formats, quality of the game (as opposed to victory), needs to be emphasised (Kuenzel & Yassim, 2010). Kelly and Turley (2001) agree and recognise that the athletic contest itself is a principal factor that affects the quality of the service encounter and game experience. This includes aspects, such as 'good cricket' and 'a competitive match'. In a five-day test match, where the result is only known on the last day, many fans may not be present for the entire competition. Thus, fans of these games would value a close competition as opposed to victory. Fans attending a one-day or Twenty20 competition regard quality of contest and strength of opposition to be more important than victory (Yassim, 2011).

'Social facilitation' refers to the interaction of fans with others, including friends and family, as well as people whom they have just met during a particular game, and sharing the experience of the game with others (Westerbeek, 2000; McDonald *et al*., 2002). Deighton (1994) emphasised that spectators can have a good time in the stands, even if the game is not rewarding overall. Therefore, it could be argued that spending an enjoyable time with family and friends is one of the key reasons why fans may enjoy themselves despite the outcome of the game. Due to the length of most cricket games, social facilitation becomes even more important as fans spend a whole day at the game. Thus, opportunities to interact with fellow fans and devote more time with family and friends would add value to their positive game experience (Kuenzel & Yassim, 2010).

With the experiences that are derived from other popular games, such as football, cricket fans also expect an exciting atmosphere at the match (Kuenzel & Yassim, 2010). Auditory and olfactory components refer to the sounds, the noise of the crowd and smells at a sport facility

that help to enhance the atmosphere (Wakefield & Blodgett, 1996; Westerbeek, 2000). Although 'ambient conditions' are important in spectator enjoyment, it is difficult for management to control them. However, Wakefield and Blodgett (1996:45) state that, "despite elements of ambient conditions, such as weather not being in the control of management, it is important that they understand which of their fan segments place greater emphasis on it, and try to control the elements that are within their control, such as music and noise".

When comparing the atmosphere between four-day and one-day games, fans have observed that crowds are generally more boisterous during one-day games, which enhances the atmosphere, whereas the atmosphere is quieter and more reserved during four-day games (Parry & Malcolm, 2004). Relating to the findings by Westerbeek (2000), Kuenzel and Yassim (2010) found that older fans at four-day games dislike the singing of crowds and loud music, whereas younger fans enjoy the noise and colour. In addition, they found that four factors influence the experience of English and Welsh domestic cricket fans, namely star players,

quality of the game, social facilitation and auditory and olfactory factors. Kuenzel and Yassim (2007) indicated that social facilitation, quality of play and auditory factors are dimensions that contribute towards a memorable spectator experience.

PURPOSE OF THE STUDY

After examining these studies, it became clear that there are differences about the factors that generate memorable experiences at different types of events, as well as similar events that span over different timeframes. However, no studies have segmented cricket fans to date in terms of the factors they regard as important for a memorable experience and no study to date focused on spectators at a Cricket Sixes tournament. The purpose of this research was to identify the factors that spectators regarded as important for a memorable experience and used them to profile the various market segments and to determine how cricket spectator markets differ. This information would allow event marketers and managers of team sports to deliver an optimally run and well-advertised event that will leave spectators more than satisfied, thereby facilitating to increase the appeal of the game to a wider audience.

METHODOLOGY

This study followed a quantitative research approach and a structured questionnaire was used to collect the data. This section describes the sampling method, survey and profile of the respondents, as well as the statistical analysis.

Questionnaire

The questionnaire was divided into 4 sections. Section A captured demographic details (gender, home language, age, occupation, home province, annual gross income, level of education, marital status), and spending behaviour (number of persons paid for, length of stay and expenditure). Section B captured respondents' cricket behaviour in terms of a number of matches previously attended; preferred type of matches, age first exposed to cricket and live test matches and sources of information about the test matches. Section C captured motivational factors, measuring 21 items on a 5-point Likert scale, where 1=not important at all; 2=less important; 3=important; 4=very important and 5=extremely important. Section D measured 39 factors for a memorable spectator experience on a similar 5-point Likert scale.

The following steps, as proposed by Field (2005) and Tustin *et al*. (2005) were followed to design and validate the questionnaire: (1) *Content validity*: An in-depth literature analysis was conducted to identify the relevant motivational factors and critical success factors for a memorable cricket spectator experience (Matsuoka *et al*., 2003; Saayman & Uys, 2003; Saayman *et al*., 2005; Yassim, 2011; Dhurup & Niyimbanira, 2012); (2) *Face validity*: Statistical consultation services at the North-West University, Potchefstroom Campus advised on the formulation of the statements, as well as the measurement scales used; (3) *Construct validity*: Factor analyses were performed on both the motivational and memorable experience factors in order to determine the degree to which the statements measure what it claims and purports to be; and (4) *Reliability*: Establishing the reliability of the identified factors by means of reliability coefficients (Cronbach's alpha) that were calculated by applying inter- item correlations.

Sampling method and survey

Self-administered questionnaires were distributed during the Global Softech Sixes Tournament

at SuperSport Park in Centurion, SA. The survey took place from 4 to 7 September 2014. A stratified sampling method was used. In order to limit bias, a simple random sampling method was used within the stratified sample, where 3 trained fieldworkers followed specific guidelines when questionnaires were handed out to different non- homogeneous age groups, gender group and nationalities. This process was eased as fans seated on the fields (grass) paid a lower entrance fee compared to spectators seated on the stands, meaning that they might have had different levels of experience. This implies that a more improved distribution of questionnaires was achieved. Only 1 person per travelling group in every second group of spectators was asked to complete the questionnaire. Groups were identified by using screening questions. Fieldworkers remained in close proximity to respondents in order to limit the number of questionnaires being lost. Krejcie and Morgan (1970) recommend that for a population (N) of 1 000 000 people, the sample (S) should be 384 in order to be representative. With SuperSport Park's 22 000-attendee capacity in 2014, it was decided that 400 questionnaires should be distributed. The researchers were unsuccessful in obtaining the exact number of spectators to the matches on the 2 survey days. Based on availability sampling and loss of questionnaires, 300 respondents formed part of the survey of which the 278 completed questionnaires were included in the analysis.

Profile of respondents

The general demographic profile of the respondents to the Global Softech Sixes revealed that they were married (42%), males (65%), well-educated with a diploma or degree (49%), Afrikaans-speaking (63%), of an average age of 33 years, and received an annual income of less than R20 000 (27%) per annum. The majority of the respondents were South African (99%), lived in Gauteng (95%) and were either students (21%) or in professional occupations (20%). The average size of a travelling group was 4.57 people, of whom the respondents were financially responsible for an average of 2 people. On average, respondents spent R414.21 during the event/tournament and stayed in Gauteng for an average of 1 night. In the preceding 3 years, the respondents had supported an average of 3 international test matches, 4 domestic matches and 5 to 6 club cricket matches. Respondents indicated that 1-day matches (83%) and Twenty20 (80%) were their preferred types of cricket. This group was first exposed to cricket at the age of 10 years (on average) and the first live match they attended was at the average age of 16 years.

Statistical analysis

Microsoft Excel was used to capture the data while SPSS (2015) and Statistica (StatSoft, 2015) were used for the analysis. The analysis was performed in 3 stages: 2 factor analyses, a cluster analysis and an analysis of significant differences between the experience-based clusters of the cricket-sixes spectators.

Firstly, 2 principal axis factor analyses, using an Oblimin rotation with Kaiser normalisation, were performed on the 21 motivation items and 39 critical factors for a memorable cricket experience in order to explain the variance-covariance structure of a set of variables through a few linear combinations of these variables. The Kaiser-Meyer-Olkin measure of sampling adequacy was used to determine whether the covariance matrix was suitable for factor analysis. Kaiser's criteria, for the extraction of all factors with Eigen values larger than 1, were used because they were considered to explain a significant amount of variation in the data. All items with a factor loading greater than 0.3 were considered as contributing to a factor, and all items with loadings less than 0.3 as not correlating significantly with this factor (Steyn, 2000). Any item that cross-loaded on 2 factors and with factor loadings both greater than 0.3, was

categorised with the factor where interpretability was best. A reliability coefficient (Cronbach's alpha) was computed for each factor to estimate its internal consistency. All factors with a reliability coefficient above 0.6 were considered acceptable in this study. The average inter-item correlations were also computed as another measure of reliability of which these, according to Clark and Watson (1995), should lie between 0.15 and 0.55.

Secondly, a cluster analysis using Ward's method with Euclidean distances was performed in Statistica (StatSoft, 2015) based on the memorable experience factors as identified in the factor analysis. Thirdly, ANOVAs were used to investigate any significant differences between the identified market segments. Effect sizes were used to further identify any significant differences between the clusters. The purpose of effect size is to establish whether any differences exist between the clusters; in this case, in which combination of clusters of the mean values of the motives and the averages of the socio-demographic and behavioural variables, as well as mean values of the memorable experience factors, had the smallest or largest effect. Cohen (1988), Ellis and Steyn (2003) and Steyn (2009) offer the following guidelines for the interpretation of the effect sizes: small effect: d=0.2, medium effect: d=0.5 and large effect: d=0.8.

RESULTS

The results of the factor analyses (motives to support the tournament and factors for a memorable cricket experience), and of the cluster analysis and ANOVAs to investigate significant differences are presented.

Factor analyses

The pattern matrix of the principal axis factor analyses using an Oblimin rotation with Kaiser normalisation identified 5 motivational factors and 5 factors for a memorable experience. These were labelled according to similar characteristics (Table 1 and Table 2). These factors account for 70 and 66% respectively of the total variance.

All factors have relatively high reliability coefficients, ranging from 0.86 to 0.94 for the motivational factors and 0.74 to 0.91 for the memorable experience factors. The average inter-item correlation coefficients of between 0.54 and 0.67 for the motivational factors and 0.43 and 0.83 for the memorable experience factors also imply internal consistency for all factors. Moreover, all items loaded on a factor had a loading greater than 0.3, and the relatively high factor loadings indicate a reasonably high correlation between the factors and their component items. The Kaiser-Meyer-Olkin measure of sampling adequacy (0.91 and 0.95 respectively) indicates that patterns of correlation are relatively compact and yield distinct and reliable factors (Field, 2005). Barlett's test of sphericity reached statistical significance in both cases ($p<0.001$), supporting the factorability of the correlation matrix (Pallant, 2007).

Table 1. **MOTIVES OF SPECTATORS: FACTOR ANALYSIS**

Motivational factors and items	**Factor loading**	**Mean value**	**Reliability coefficient**	**Inter-item correl.***
Factor 1: Event novelty		*3.36*	*0.90*	*0.59*
To see my favourite cricketer(s) in action	0.77			
To support the various teams	0.72			
It is a unique type of cricket test match – the	0.62			

first in SA	0.54			
It is a unique, once-in-a-lifetime experience	0.53			
To be part of the event	0.49			
To see world-class cricketers perform		*3.94*	*0.77*	*0.46*
Factor 2: Fun and escape	0.73			
For fun	0.67			
To relax and get away from my routine	0.64			
To spend time with family and friends	0.47			
It is an accessible match to attend (closest stadium to me)		*3.43*	*0.90*	*0.62*
Factor 3: Cricket affinity	0.90			
I am a cricket enthusiast	0.70			
I regularly attend cricket matches	0.67			
Because I enjoy watching cricket matches	0.61			
I annually attend/follow test matches between various teams	0.43			
To enjoy the art of the game		*3.10*	*0.74*	*0.43*
Factor 4: Socialisation	0.75			
To socialise	0.51			
To meet new people and interact with other supporters	0.43			
It is a sociable event	0.36			
To see the cricketers I despise or do not like in action		*2.76*	*0.91*	*0.83*
Factor 5: Knowledge	0.84			
To learn technical aspects of the game	0.72			
To improve my knowledge of the game and game strategy				

Factor scores were calculated as the average of all items contributing to a specific factor in order to interpret them on the original 5-point Likert scale of measurement. As seen in Table

1, the following motives were identified: *Event novelty* (Factor 1), *Fun and escape* (Factor 2), *Cricket affinity* (Factor 3), *Socialisatio*n (Factor 4) and *Knowledge* (Factor 5). *Fun and escape* (Factor 2) obtained the highest mean value (3.94) and was the most important motive for supporting this new format of the game. *Cricket affinity* had the second highest mean value (3.43), followed by *Event novelty* (3.36) and *Socialisation* (3.10). *Knowledge* (Factor 5) had the lowest mean value (2.76) and rated as the least important motive.

Five factors for a memorable cricket experience are presented in Table 2. *Parking, facilities and affordability* (Factor 4) obtained the highest mean value (4.02). It was regarded as the most important factor for a memorable experience. *Visibility, comfort and accessibility* (3.99), *engaging match* (3.84) and *match qualities and crowd atmosphere* (3.81) followed this closely. *General management* with a mean value of 3.78, although still important when interpreted on the Likert scale, was regarded as the least important of the 5 factors for a memorable cricket experience.

Table 2. **FACTORS FOR MEMORABLE EXPERIENCE: FACTOR ANALYSIS**

Memorable experience factors and items	**Factor loading**	**Mean value**	**Reliability coefficient**	**Inter-item correl.***
Factor 1: General management		***3.78***	***0.94***	***0.58***
Visibility of emergency personnel	0.73			

Personnel that are easily noticeable	0.72			
Personnel that are trained to handle any match enquiries	0.64			
Accessibility for the disabled	0.60			
Variety of food and beverages available (e.g. Halaal, vegetarian)	0.57			
Adequate safety precautions in place during the match	0.57			
Visibility of security on the sport grounds	0.54			
Friendly and professional personnel in and around the stadium	0.44			
Adequate number of rubbish bins at the stadium	0.41			
Effective and reliable marketing prior to the match regarding date, time, venue etc.	0.41			
High quality performances of both teams	0.39			
Good quality viewing of the match on a big screen	0.34			
Factor 2: Match quality and crowd atmosphere		***3.81***	***0.90***	***0.55***
Furious batting	0.70			
A fast paced game	0.65			
Beer tents available	0.63			
Dynamic bowlers	0.61			
Good atmosphere and entertainment	0.52			
Energetic, lively and cheerful crowd	0.49			
Favourable weather conditions	0.47			
Effective technical aspects during the event	0.38			

Table 2. **FACTORS FOR MEMORABLE EXPERIENCE: FACTOR ANALYSIS** (*cont.*)

Factor 3: Visibility, comfort & accessibility		***3.99***	***0.89***	***0.54***
Good visibility of the players from all viewpoints at the stadium	0.79			
Good layout of the stadium	0.73			
Adequate information boards on the terrain and effective signage and directions to the stadium	0.70			
Accessibility of seats in the stadium	0.59			
Adequate seats in the stadium	0.50			
Comfortable seating	0.49			
Spending an enjoyable time with family, friends and fellow supporters.	0.37			
Factor 4: Parking, facilities and affordability		***4.02***	***0.86***	***0.55***
Adequate security at parking areas	0.87			
Adequate parking arrangements	0.76			
Adequate, clean and hygienic ablution facilities inside/outside the sport ground	0.49			
Affordable tickets	0.40			
Affordable food and beverages at the stadium	0.35			

Factor 5: Engaging match		***3.84***	***0.91***	***0.67***
An engaging and competitive match	0.64			
A nail-biting match/drama of a close game	0.61			
An entertaining and action packed match	0.52			
Seeing star players in action	0.41			
A victorious match for my team	0.37			

Cluster analysis: Identification of segmented clusters

An exploratory cluster analysis based on all cases in the data was performed on the motivational factors. A hierarchical cluster analysis, using Ward's method of Euclidean distances, was used to determine the structures of the clusters based on the memorable experience factors. A three-cluster solution was selected as the most discriminatory solution (Figure 1).

The results of the multivariate analyses were used to identify the 3 clusters and to indicate that significant differences existed between them (p<0.05). According to Table 3, ANOVAs revealed that all 5 memorable experience factors contributed to differentiating between the 3 experience-based clusters (p<0.05) with large effect size differences.

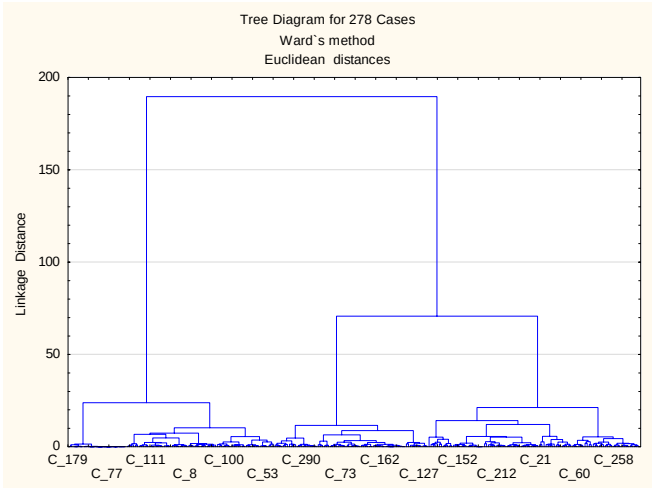

Figure 1. **THREE CLUSTER SOLUTION: WARD'S METHOD WITH SQUARED EUCLIDEAN DISTANCE MEASURES**

Table 3. **MULTIPLE COMPARISONS FOR MEMORABLE EXPERIENCE-BASED FACTORS IN THREE CLUSTERS OF SPECTATORS**

Memorable experience factors	**Experience-based segments**			**F-ratio**	**Sign. level**	**Effect sizes ****		
	Cluster 1 (n=103)	**Cluster 2** (n=75)	**Cluster 3** (n=100)			1 & 2	1 & 3	2 & 3
General management	3.00[a]	3.87[b]	4.60[c]	311.619	0.001*	1.65	2.71	1.18
Match quality &	3.06[a]	3.80[b]	4.63[c]	226.231	0.001*	1.13	2.19	1.44

crowd atmosphere								
Visibility, comfort and accessibility	3.33[a]	3.95[b]	4.66[c]	181.876	0.001*	1.03	2.02	1.29
Parking, facilities and affordability	3.20[a]	4.22[b]	4.75[c]	269.130	0.001*	1.63	2.33	1.06
Engaging match	3.03[a]	3.76[b]	4.74[c]	259.185	0.001*	1.08	2.37	1.77

Cluster 1= Occasional seekers Cluster 2= Selective seekers Cluster 3= Comprehensive seekers

[a, b, c] Group differs significantly from type in row * Significant difference: p≤0.05

** Effect sizes between clusters: d= 0.2 (small effect); d= 0.5 (medium effect); d= 0.8 (large effect)

Cluster 3, the second largest with 100 respondents was labelled, *Comprehensive experience seekers*, because these respondents assigned the highest rating to all 5 memorable experience factors and seemed to value the entire experience. Cluster 1, the largest with 103 respondents was labelled *Occasional experience seekers*, because this cluster yielded the lowest mean values across all 5 memorable experience factors. However, these respondents still value the game experience and rated *visibility, comfort and accessibility*, *parking, facilities and affordability*, as well as *match quality and crowd atmosphere* as important aspects for a memorable experience. Cluster 2, the smallest one with 75 respondents was labelled, *Selective experience seekers* because they singled out certain aspects, especially management

aspects that they valued particularly in order of importance: *parking facilities and affordability*, *visibility, comfort and accessibility* and *general management* as the most important factors.

ANOVAs, Tukey's post hoc multiple comparisons and effect sizes

ANOVAs, Tukey's post hoc multiple comparisons and effect sizes were used to determine the differences between the respondents based on their socio-demographic and behavioural characteristics. As indicated in Table 4, the statistically signficant of 3 clusters of spectators do not differ based on their socio-demographics, spending behaviour or supporter behaviour. The clusters of spectators of the Cricket Sixes differed significantly based on television (p=0.007), radio (p=0.010), email (p=0.008) and Facebook (p=0.003) as media sources and in terms of all five motivational factors (p<0.05).

With regard to the media sources, *Comprehensive experience seekers* were influenced more by television (3.17) and radio (2.37) compared with *Occasional experience seekers* (2.61 and 1.77 respectively). *Selective experience seekers* were influenced more by emails (2.13) compared with *Comprehensive experience seekers* (1.77), while *Selective experience seekers* along with *Comprehensive experience seekers* (2.05 and 2.02 respectively), were influenced more by the social media network, Facebook, compared with *Occasional experience seekers* (1.45). Concerning the motivational factors, all 3 clusters showed distinct preferences for the various motives. *Occasional experience seekers* were motivated by *cricket affinity* (3.92) followed by *fun and escape* (3.55). *Fun and escape* (3.98) followed by *cricket affinity* (3.33) and *event novelty* (3.28), were the main motives for *Selective experience seekers*, while *Comprehensive experience seekers* scored the highest ratings among all 5 motivational factors. This cluster was especially motivated by *fun and escape* (4.29).

DISCUSSION OF FINDINGS AND PRACTICAL APPLICATION

Motives to support a Cricket Sixes Tournament

Although previous studies (Saayman & Uys, 2003; Dhurup & Niyimbanira, 2012) show similar motives, the combination and importance of each motive found in this study is distinct from other literature. It supports the notion by Kruger and Saayman (2012) that the type of sport greatly influences motives of spectators for support. Additionally, cricket spectators were primarily motivated by intrinsic motives, confirming the results of previous research on sport spectators. Five motives for supporting the Cricket Sixes Tournament were identified, namely (in order of importance): *fun and escape*, *cricket affinity*, *event novelty*, *socialisation* and *knowledge*.

Table 4. **MULTIPLE COMPARISONS AND EFFECT SIZES FOR CLUSTERS OF VISITOR CHARACTERISTICS: (ANOVA and TUKEY'S POST-HOC)**

Characteristics	Cluster 1 (n=103)	Cluster 2 (n=75)	Cluster 3 (n=100)	F-ratio	Sign. level	1 &
Socio-demographics						
Average age	31.81	31.89	34.59	1.331	0.266	0.0
Average group size	5.00	4.16	4.28	1.538	0.217	0.2
Average number paying	2.23	2.03	2.00	0.290	0.749	0.0
Length of stay (nights) visitors	0.76	1.27	1.79	1.909	0.154	0.2
Spending categories:						
Tickets	60.12	57.35	72.42	0.805	0.448	0.0
Accommodation	5.95	1.47	60.24	2.794	0.063	0.0
Transport	52.38	42.35	52.52	0.617	0.541	0.1
Food and restaurants	94.02	111.79	131.04	1.549	0.215	0.1
Beverages	120.24	112.96	148.98	0.837	0.435	0.0
Souvenirs	9.04	5.88	21.95	1.897	0.152	0.0
Entertainment	12.38	6.42	20.49	1.260	0.286	0.1
Other	23.75	8.66	20.49	0.479	0.620	0.1
Total spending	304.37	312.81	435.81	2.323	0.100	0.0
Spending per person	166.65	161.78	214.18	1.468	0.233	0.0
Supporter behaviour						
Previously supported an international test match	2.70	2.86	3.69	1.292	0.277	0.0
Previously supported a domestic test match	3.49	3.69	4.49	0.678	0.509	0.0
Previously supported club cricket matches	3.27	5.05	7.12	1.955	0.145	0.1
Age exposed to cricket	10.06	10.22	9.72	0.104	0.901	0.0
Age exposed to live cricket match	15.52	16.10	15.60	0.990	0.905	0.0

Table 4. **MULTIPLE COMPARISONS AND EFFECT SIZES FOR CLUSTERS OF VISITOR CHARACTERISTICS: (ANOVA and TUKEY'S POST-HOC)** *(continued)*

Characteristics	Cluster 1 (N = 103)	Cluster 2 (N = 75)	Cluster 3 (N = 100)	F-ratio	Sign. level	1 &
Influential media						
Television	2.61^{a}	2.77^{ab}	3.17^{b}	5.020	0.007*	0.1
Radio	1.77^{a}	2.13^{ab}	2.37^{b}	4.770	0.010*	0.3
Website	1.68	2.05	2.02	2.162	0.118	0.3
Email	1.27^{a}	1.82^{b}	1.49^{ab}	4.922	0.008*	0.5

Magazines	1.42	1.58	1.78	2.304	0.103	0.1
Newspapers	1.67	1.81	2.06	2.528	0.083	0.1
Word-of-mouth	2.82	2.75	3.00	0.835	0.436	0.0
Facebook	1.45[a]	2.05[b]	2.02[b]	5.926	0.003*	0.4
Twitter	1.33	1.63	1.67	2.344	0.099	0.3
Internet blogs	1.28	1.56	1.59	2.204	0.114	0.3
Motives to attend						
Event novelty	2.81[a]	3.28[b]	3.94[c]	34.170	0.001*	0.4
Fun and escape	3.55[a]	3.98[b]	4.29[c]	20.241	0.001*	0.4
Cricket affinity	3.92[a]	3.33[b]	3.99[c]	28.760	0.001*	0.4
Socialisation	2.76[a]	2.96[s]	3.44[b]	12.851	0.001*	0.2
Knowledge	2.31[a]	2.45[b]	3.37[c]	20.275	0.001*	0.1

Cluster 1= Occasional seekers Cluster 2= Selective seekers Cluster 3= Comprehensive seekers

°Expenditure per person, which was calculated by adding the spending of the respondent on the various components asked about, and dividing the total by the number of people for whom respondents indicated they were financially responsible.

* Significant difference: $p \leq 0.05$ Effect sizes: **small effect: d= 0.2; medium effect: d= 0.5 and large effect: d= 0.8

[#] Respondents were asked to indicate to what extent the various media had influenced their decision to attend the cricket matches: 1= not at all, 2= to a lesser extent, 3= to a greater extent, and 4= completely.

The motives *escape* and *socialisation* were also identified by Saayman and Uys (2003) and Dhurup and Niyimbanira (2012), and *cricket affinity* (to enjoy the game) was identified by Saayman and Uys (2003). *Knowledge* and *event novelty* have not been identified previously as motives to support cricket matches and can be regarded as distinct motives for this research. This finding implies that marketing messages should promote the sport of cricket and especially this format of the game to current and potential fans as a relaxing and fun pastime, which is ideal for socialisation in an enviornment that provides high class and fast- paced entertainment. This is vital since the sport of cricket not only competes against itself and its different formats, but also with other sport, recreation and leisure activities. Although the factor *knowledge* was regarded as the least important motive, it would also benefit cricket in general if the event/tournament makes provision for educating spectators on the rules and basics of cricket.

It is especially important to create exposure to the rules of Cricket Sixes, which is a relatively unknown format of the game in SA. This could be achieved in an entertaining manner and by using star players to convey the message on the big screens during breaks or during wickets. In turn, *cricket affinity* could also be enhanced among spectators. The results furthermore confirm that the type and format of the cricket game influence the motives of spectators. Although not the purpose of this study, comparing the results with a 1-day cricket match in SA as reported by Saayman and Uys (2003), similarities exist in terms of the motives *socialisation* and *escape*, as well as *cricket affinity*. However, distinct motives were identified for the spectators of Cricket Sixes confirming that cricket spectators cannot be regarded as homogenous in terms of their motives for the different formats. This emphasises the need for further research to identify the diverse motives of cricket spectators.

Management factors for a memorable experience

The results confirm the notion of Kruger and Saayman (2012) that memorable experience factors differ from one sporting event to the next. Compared to previous research on the cricket experience as discussed in the literature review, although some factors resemble the current factors, for example, parking (Kruger & Saayman, 2012), match qualities (Kuenzel & Yassim, 2007), quality of the game, social facilitation (Kuenzel & Yassim, 2010) and crowd atmosphere (Yassim, 2011), the combination of the factors identified in this research is distinct. This research identified 5 memorable experience factors, namely (in order of importance) *parking, facilities and affordability*, *visibility*, *comfort and accessibility*, *engaging match*, *match qualities and crowd atmosphere* and *general management*. The identified factors furthermore revealed a higher correlation with the factors that were obtained by previous research that was conducted on spectators at various team sport events (Kim & Kim, 1995; Kelley & Turley, 2001; Hinch & Higham, 2004; Ko & Pastore, 2005; Yoshida & James, 2011; Kruger & Saayman, 2012), than the results that were obtained in the cricket- related research (Kuenzel & Yassim, 2010).

Furthermore, there is a combination of factors that management has a direct control over and those it cannot control. However, most of the factors can be managed, for example, general management and affordability, crowd atmosphere, visibility, comfort and accessibility. These factors contribute towards a memorable experience even though aspects, such as match qualities and engaging match, cannot be controlled. Focusing on the identified memorable

experience factors should contribute to greater satisfaction, as well as greater loyalty and positive word-of-mouth referrals. This can help expand the market base of this distinct format of the sport. The high rating of the factor, *parking* can be ascribed to the setting and location of SuperSport Park where the said tournament took place and the fact that spectators want to be assured of adequate and safe parking, especially during test matches that require their support for numerous days. This implies that cricket marketers should emphasise and promote the parking options available at the venues. This aspect can deter fans from attending; organisers can also introduce a park-and-ride system to counter this problem.

Experience-based market segmentation

From a methodological point of view, this research confirms that memorable experience factors constitute a useful segmentation base thereby challenging the use of traditional socio-demographic segmentation bases, which do not provide a detailed overview of a market and its characteristics. This approach proves to be effective, especially for organisers wanting to understand a relatively unknown market, such as the spectators of Cricket Sixes in SA. The results provide an OSC-experience-based typology of supporters of Cricket Sixes that is descriptive of the characteristics of each market, thereby filling a gap in the current sports tourism literature.

Based on the identified memorable experience factors, three distinct cricket sixes supporter segments have been identified, namely *Occasional*, *Selective* and *Comprehensive experience seekers*. *Comprehensive experience seekers* accorded the highest rating to all five memorable experience factors and appeared to value the entire experience. While *Occasional experience seekers* had the lowest mean values while still valuing the game experience and rated *visibility*, *comfort and accessibility*, *parking facilities and affordability* as well as *match quality* and *crowd atmosphere* as important aspects for a memorable experience. *Selective experience seekers* singled out management aspects that they particularly valued, such as *parking facilities and affordability*, *visibility*, *comfort and accessibility* and *general management* as the most

important factors.

Based on the results of this study, it is evident that cricket spectators cannot be regarded as homogenous and that the type and format of the game greatly influence the market. Apart from the significant differences between the segments in terms of the memorable experience factors, the three clusters further differed significantly in terms of their media preferences and their motives to attend the matches. *Comprehensive experience seekers* were influenced more by mass media, such as television and radio, while *Selective experience seekers* were influenced more by emails and by the social media network, Facebook. *Occasional experience seekers* seem not be influenced by media. Concerning the motivational factors, all three clusters show distinct preferences for the different motives with *Occasional* and *Selective experience seekers* being motivated by *fun and escape* and *cricket affinity*. The *Comprehensive experience seekers* had the highest ratings among all five motivational factors. It is thus crucial that marketers approach each of the three clusters separately, as each cluster is a viable and sustainable fan market, but this can only be achieved by focusing on each specific need of the market in terms of a memorable experience. Cricket marketers and organisers of similar tournaments should consider the results of this research to ensure a memorable experience.

CONCLUSION

The research set out to identify the management factors in creating a memorable experience at a cricket sixes tournament and, based on these factors, to identify different cricket fan segments at the matches and to determine whether these segments differ in terms of socio-demographic and behavioural characteristics, as well as motives for attending. Based on the results and findings, this research makes an important contribution to the greater understanding of sport spectators, specifically cricket spectators and the literature on managing and marketing of team sports events of this nature. The research proposes an OSC- experience-based typology of cricket sixes spectators that could be applied to other cricket match formats and team sports. As markets change and a sport, such as cricket, reinvents itself by adopting different versions of the game, this research concurs that different spectators exist and that their needs differ. It further highlights which areas event managers should focus on. However, the findings also caution that events differ hence the recipe for success can differ from one event to the next. As a greater focus of entertainment falls on sporting events, it is recommended that further research explore other forms or formats of cricket, and levels, for example international competitions.

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"BLACK GOLD" GRADE12-LEARNERS: RELATIONSHIP BETWEEN LEISURE/SPORT AND SATISFACTION WITH LIFE

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ABSTRACT

There tends to be an increase in scholarly literature regarding the leisure and sport participation of high school learners. However, in the South African context there are many black high school learners within townships who might not have access to leisure/recreation and sport facilities. "Black gold" (based on ethnicity and different cultural backgrounds), refers to black Grade 12 learners from a diverse group of South Africans. This study aimed to determine whether "black gold" leisure and sport participation during a previous holiday influenced their satisfaction with life. Questionnaires were used and 288 were completed. An Exploratory Factor Analysis (EFA) on attitude towards and viewpoint on leisure and sport activities, as well as leisure and sport benefits after participation during a previous school holiday resulted in two factors. The highest means belonged to physical/mental health aspects and physical benefits. Satisfaction with life (SWL) was identified as a single factor. Positive medium to high correlations were achieved between the factors. Structural Equation Modelling (SEM) revealed that statistical significant relationships exist between attitude towards and viewpoint on leisure and sport, leisure and sport benefits and satisfaction with life. Overall, a good model fit was achieved.

Key words: Leisure; Sport; "Black gold"; Satisfaction with life; Holiday; Rural townships; Structural Equation Model.

INTRODUCTION

The establishment of residential areas, so-called townships (planned urban settlements of black Africans or Coloured people), in South Africa (SA) was a form of separating individuals, based on race (ethnicity). The townships consisted of low-cost housing and ensured that black employees were located close to their white employers, who resided in cities and towns (Mampane & Bouwer, 2011). Because of the perception of individuals, townships residents are

often portrayed in the international media as people who experience poverty and high crime rates, with violent youth in the community (Prinsloo, 2007). During the apartheid era, many townships were not well developed in terms of infrastructure and amenities, such as sport and leisure/recreation facilities. Nongogo *et al*. (2014) argue that there are many black learners in townships who might not have access to sport or leisure and recreation facilities. According to Mchunu and Roux (2010) and Van den Berg and Grobler

(2014), this could be a result of the fact that black learners are discouraged to participate in leisure/recreation and sport-related activities. Race is still a controversial topic in the South African context, especially the term "black South Africans". Cover and Thomas (2012) and Deegan (2014) state that this term refers to a diverse cultural group (speaking indigenous languages, such as Xhosa, Zulu or Tswana), that could be based on ethnicity. For the purpose of this study, the authors define “black gold: as black learners in Grade 12 from a diverse group of South Africans, based on ethnicity and different cultural backgrounds

There is an interesting tendency in scholarly literature regarding high school learners (adolescents or youth), with a focus on leisure/recreation and sport research in SA as a developing country (Caldwell *et al*., 2010; Pule *et al*., 2013; Weybright *et al*., 2015). A handful of studies focused on leisure boredom (Wegner *et al*., 2006), leisure constraints (Palen *et al*., 2010), structured leisure activities (Fox *et al*., 2010), and leisure benefits (Caldwell, 2011). On the other hand, some social scientists focused on high school learners as part of their study in relation to sport, such as sport participation (Slater & Tiggemann, 2011), physical activity (PA) (McVeigh & Meiring, 2014); PA and body composition (Lennox *et al*., 2008; De Ridder *et al*., 2012), and sport benefits for children associated with low-income families (Holt *et al*., 2011). The main focus of these studies was on learners with respect to leisure- and sport-related participation in the school environment and not during a holiday.

Kleiber *et al*. (2014) found that in the leisure experiences of adolescents (also referred to as high school learners in the South African context), two distinct categories of leisure are prominent, namely relaxation leisure activities (free time activities of socialising, listening to music, eating and resting), and transitional leisure activities (sport-related activities, games and hobbies). A possible interpretation of the findings of Kleiber *et al*. (2014) is that relaxation leisure activities could provide pleasure to the self without personal demands that are high, whereas transitional leisure activities (arranged for subjective experiences that are experienced by high school learners), might be based on effort and demand. These two leisure categories will play an important role in the demands of future adult life activities (knowledge, feelings and behaviour patterns), and to fit in well with society (Teixeira & Freire, 2013).

Other authors found that leisure motivation amongst Taiwan school learners had a direct relationship with (effect on) leisure involvement and that those learners who were more involved in leisure activities stated that they were more satisfied with their leisure time and leisure life (Chen *et al*., 2013). Therefore, school learners should be encouraged by significant others to participate in leisure activities often, thereby enhancing their overall satisfaction with life (SWL) and, for the purposes of this study, during a holiday.

A study conducted by Holt *et al*. (2011: 490) found that school learners from low-income families achieved social benefits ("better relationships with others, making new friends, social skills"), and personal benefits ("emotional control, more disciplined, weight management, keeping busy and good academic achievements"), that resulted from participation in sport-

related activities. It can be construed that when school learners who are supported by their parents have the opportunity to participate in regular school sport activities during a holiday, they will gain social and personal benefits from this opportunity. They could, therefore,

continue with sport activities during a holiday if facilities or services are available in their community.

Evidence also points to the fact that cognitive aspects (such as individual development in relation to sport), influence the perceptions, beliefs and feelings of young adolescents about sport participation that could be formed by positive and negative experiences, based on their attitude towards and viewpoint on sport (Subramaniam & Silverman, 2007). In the same context, Greenleaf *et al*. (2009) argue that when high school learners participate in regular sport activities (during a holiday as well), sport participation has a direct linear relationship with body image, physical competence and psychological well-being. This suggests that high school learners should be encouraged to become involved in sport participation, as a healthy body portrays a healthy spirit, which would enhance psychological well-being and benefit black high school learners in the long run. "Black gold" from other countries that succeed in sport, like Tony Yeboah (Ghana), Samuel Eto'o (Cameroon), Jackie Joyner (USA) and Venus Williams (USA), is indicative that "black gold" could excel, if they are exposed to sport participation at a young age (*Daily Mail*, 2009).

The concept subjective well-being (SWB) can be explained as the manner in which individuals assess their life based on global judgments such as: SWL, fulfilment and on-going feelings in their lives. Individuals evaluate their lives themselves based on the standards they set (Diener, 2009). The underlying dimensions of SWB include four components: *pleasant emotions/mood; lack of negative emotions/mood; satisfaction with judgements, optimism and feelings of fulfilment* (Diener, 2009:274). Sirgy (2001:2012) and Van Hout *et al*. (2013) theorise that SWB is a long-term affective state that consists of the evaluations of overall SWL. This SWL could further be explained as a cognitive function in which one could evaluate life against a specific standard.

SWL is a multi-dimensional concept, which is interchangeably used by social science scholars as quality of life, life satisfaction, life quality and happiness (Pennock, 2015). As a controversial perception and often difficult to understand, SWL includes a combination of *collective action; individual behaviour; simply sensory experiences; higher cognition; stable characteristics of the individual, the environment* and *change factors* (Veenhoven, 1996:6-10; Pennock, 2015:1). Research conducted by Leversen *et al*. (2012) found that competence, relatedness and autonomy, based on self-chosen activities (leisure), mediate the relationship between leisure participation and SWL amongst adolescents. Eime *et al*. (2013) measured psychological and social benefits related to by 18-year-olds and found that sport contributes to their self-esteem and social interaction and those who participated in regular sport-related activities showed less depression symptoms. Sport activities contributed to their physical and social well-being, as well as their psychological health (SWL overall).

PURPOSE OF RESEARCH

Based on the introduction, the aim of this study was to investigate whether *attitude towards and viewpoint on sport/leisure and leisure/sport benefits during a previous holiday would influence the SWL of Grade 12 "black gold" learners.* Typically, participation in self-chosen leisure activities by Grade 12 learners during a holiday may add to their SWL overall.

METHODOLGY

The research design for this study was exploratory, descriptive and includes a quantitative approach.

Ethical clearance

The Ethics Committee approved the application and granted permission to conduct the research in Leisure/Tourism and Positive Psychology in the period 2012 to 2017.

Subjects

The study population included Grade 12 learners from traditional black and previously disadvantaged high schools from a township in the North-West Province of SA. Permission to conduct the research was sought from the headmasters of the 3 selected high schools. A stratified sampling technique was used in selecting the sample frame. A stratified sampling technique includes dividing strata (Grade 12 learners) into mutually exclusive groups, after which a simple random sample was drawn (Hamada & Ryan, 2016) within these groups (male and female).

Procedures

Fieldworkers were briefed about the aim of this study and distributed the measuring battery as indicated to Grade 12 learners during school hours (February 2012). All questions in the measuring battery, based on their previous holiday, were completed. The authors remained available for assistance if any questions were not clear. A total of 300 questionnaires were distributed and 288 fully completed questionnaires were used for the statistical analyses of the study. This number represents a 96% return rate. According to Krejcie and Morgan (1970), out of a study population size (N) of 290, 165 respondents (S), are needed to be representative of a study population. The number of 288 fully completed questionnaires was, therefore, sufficient to represent the specific population.

Measuring instrument

The measuring instrument was a questionnaire designed by the authors, as some studies (Ho, 2008; Diener, 2009; George, 2011; Burns & Bush, 2013; Kruger *et al*., 2014), has shown that all factors were reliable (≥ .7) and valid, which shows from a psychometric point of view high internal consistency of the Likert scales used. The questionnaire consisted of 4 sections and will be discussed briefly in the following sections.

Demographic profile (4 measurers)

Section A includes questions based on *gender*, *age*, *participation in leisure activities during my previous holiday* and *participation in sport activities during my previous holiday*.

Attitude towards and viewpoint (32 measurers)

Section B includes statements of leisure and sport activities with a focus on their previous holiday, such as *I love to participate in my favourite leisure and sport activities, leisure and sport activities can make me happy*. A 5-point Likert scale, ranging from 1=*strongly disagree* to 5=*strongly agree*, served as response to the statements.

Leisure and sport benefits (23 measurers)

Section C of the measuring battery contains statements that are related to leisure and sport benefits, based on their previous holiday, such as *Leisure and sport activities can help to*

improve my relationships with family or friends and *Leisure and sport activities can prevent and control diseases.* Again a 5-point Likert scale was applied.

Satisfaction with life [SWL] (5 measures)

The last, Section D, includes statements, such as *I am satisfied with my life* and C*onditions of my life are excellent*. SWL was measured on a 7-point Likert scale, ranging from 1=*strongly disagree* to 7=*strongly agree*. Psychometric properties of the Likert scale that were used are based on previous work done by Diener (2009) and Ho (2008), who reported an acceptable Cronbach's alpha (α) of ≥0.7. Moreover, Kruger *et al*. (2015) tested the SWL scale in the South African environment that achieved α of 0.80. Therefore, as both studies provided high internal consistency, it was considered appropriate for this study.

Analysis of data

The software package that was used to analyse the data included *IBM SPSS Statistics for Windows* for descriptive indicators, exploratory factor analyses, α and Pearson correlations, version 22.0 (IBM, 2013) and *AMOS* (statistical significance set at $p<0.05$), for the structural equation model: SEM (AMOS Development Corporation, 2011).

RESULTS

Study sample profile

The 288 black Grade 12 learners who participated in this research consisted of 54% boys and 44% girls. The average age of these learners was, 18 years of which 14% were 20 years old. These Grade 12 learners indicated that during a previous school holiday, 79% listened to music, whereas 58% chatted with friends and 48% just rested or slept, similar to what was found by Ncube (2014), 25% took part in soccer and 17% in cycling, but none of them indicated that they played tennis or hockey, nor that they went swimming. During the previous school holiday, they participated in leisure activities with friends (37%) and classmates (12%), and in sport-related activities with friends (38%) and classmates (17%). It is interesting to note that during this holiday, not many Grade 12 learners participated in leisure (5%) and sport-related (3%) activities with their parents. A possible explanation might be that parents and Grade 12 learners who live in a semi-rural setting and an underprivileged society might be working or the parents do not have jobs to support leisure and sport participation financially (Walter, 2011).

Exploratory Factor Analysis (EFA) and Pearson correlation

The rotation of all the factor loadings (Section B to D) included a direct Oblimin with Kaizer normalisation and a principal component extraction method, which depicted factor structures with no cross-loadings. The 32 statements of attitudes towards, and viewpoints on leisure/sport activity and SWL, were subjected to a Principal Component Analysis (PCA) during which maximum variance of the data (factor loadings) was extracted in determining the suitability of the data that were generated by SPSS to conduct an Exploratory Factor Analysis EFA (Table 1).

Table 1. **PEARSON CORRELATIONS BETWEEN SATISFACTION WITH LIFE, ATTITUDE, VIEWPOINT AND BENEFITS OF LEISURE AND SPORT ACTIVITIES**

Section	B	C

Factors	Cognitive aspects	Physical/mental health aspects	Behavioural aspects	Negative cognitive aspects	Affective/personal components	Motivation	Social benefits	Psychological benefits	Health benefits	
Cognitive aspects	—									
Physical/mental health asp.	0.493**	—								
Behavioural aspects	0.458**	0.429**	—							
Negative cognitive aspects	0.547**	0.413**	0.358**	—						
Affective/pers. components	0.577**	0.376**	0.384**	0.413**	—					
Motivation	0.572**	0.258**	0.396**	0.498**	0.420**	—				
Social benefits	0.489**	0.400**	0.379**	0.366**	0.420**	0.451**	—			
Psychological benefits	0.634**	0.534**	0.433**	0.482**	0.377**	0.443**	0.523**	—		
Health benefits	0.446**	0.552**	0.334**	0.460**	0.394**	0.367**	0.429**	0.535**	—	
Fellowship benefits	0.494**	0.432**	0.415**	0.418**	0.354**	0.413**	0.589**	0.580**	0.438**	
Individual benefits	0.425**	0.374**	0.379**	0.358**	0.279**	0.432**	0.410**	0.500**	0.508**	0.
Satisfaction with life (SWL)	0.245**	0.124*	0.184**	0.282**	0.182**	0.308**	0.199**	0.304**	0.149*	0.
Cronbach's alpha	0.86	0.82	0.70	0.64	0.76	0.66	0.76	0.84	0.76	0.
Mean inter-item correlation	0.41	0.44	0.32	0.37	0.40	0.32	0.45	0.44	0.45	0.
Mean	4.00	4.35	3.81	3.82	3.79	3.58	4.01	4.00	4.30	4.
Standard deviation (±)	0.64	0.62	0.75	0.77	0.79	0.76	0.74	0.64	0.65	0.

* p<0.05 (2-tailed). ** p<0.01 (2-tailed)

The correlation matrix showed eigenvalues larger than 0.3 of the 32 statements and they were, therefore, retained for inclusion in the EFA.

The Kaizer-Meyer Olkin test (KMO) for the factors of Section B was statistically significant (0.90), and the associated Bartlett's test of sphericity (p=≤0.05). This shows the statistical significance of the factors that are depicted in Section B of the questionnaire. The univariate descriptive amongst the 6 factors was *physical/mental health aspects* that achieved the highest mean. All factors had acceptable reliabilities, with the exception of *negative cognitive aspects* and *motivation*. Moreover, the use of a 5-point Likert scale is an acceptable measure, if the internal consistency of Cronbach's alpha (α) is ≤0.07 (Pallant, 2010). The total variance explained for in the aspects was 53.3%, while the benefits produced a total variance of 0.90%.

Regarding Section C, *health benefits* and *fellowship benefits* achieved the highest means. Acceptable reliabilities were found, with the exception of *individual benefits*, which showed high correlations between factors and internal consistency of the Likert scale that was used in Section C of the questionnaire. As far as could be established, this factor has not to date been identified in the literature regarding high school learners or SWL, as discussed in the literature review. This factor can thus be regarded as distinct to this research. For Grade 12 learners in the present study both *health* and *fellowship benefits* were equally important.

The principal component extraction and oblimin with Kaizer normalisation rotation

techniques produced 1 factor in Section D of the questionnaire, namely SWL. The Bartlett's test of sphericity was statistically significant for this factor at p=≤0.05, and the KMO was 0.76. SWL as a factor, accounted for 51.35% of the total variance explained. From a psychological perspective, satisfaction with life could be viewed as the overall judgment of a person's life at hedonic level. Hedonic level refers to the balance between the positive and negative life experiences of an individual's emotional life (Diener, 2009; Suldo *et al*., 2014), thus providing support for this factor, namely SWL.

With reference to the Pearson correlations amongst the latent constructs, the following values served as a guideline in the interpretation of the strength of relationships between latent constructs, namely r=0.10, small; r=0.30, medium; r=0.50, large (Cohen, 1988). SWL was positively correlated with psychological benefits (r=0.30), fellowship benefits (r=0.25), social benefits (r=0.20), individual benefits (r=0.18) and health benefits (r=0.15). Correlations between factors of attitudes towards and viewpoints on leisure and sport activities and factors in relation to sport and leisure benefits were medium to large (0.33 to 0.63). The positive correlations between the factors in leisure and sport benefits, and SWL factor, indicate a linear relationship between leisure and sport benefits

Structural Equation Model (SEM)

The proposed structural interrelationship between the unobserved variables is depicted in Figure 1. The fit of the model was evaluated by using several goodness-of-fit indices, namely the chi-square statistic, the RMSEA (Root Mean Square Error of Approximation), and the Comparative Fit Index CFI. As suggested by Schreiber *et al*. (2006), an acceptable ratio of the chi-square divided by its degrees of freedom should range between 2 and 5. An RMSEA below 0.05 indicates an excellent fit, whereas values below 0.08 and 0.10 indicate a good fit.

For the CFI, a value of 0.95 is recognised as an acceptable value in relation to a SEM fit (Chen *et al*., 2008).

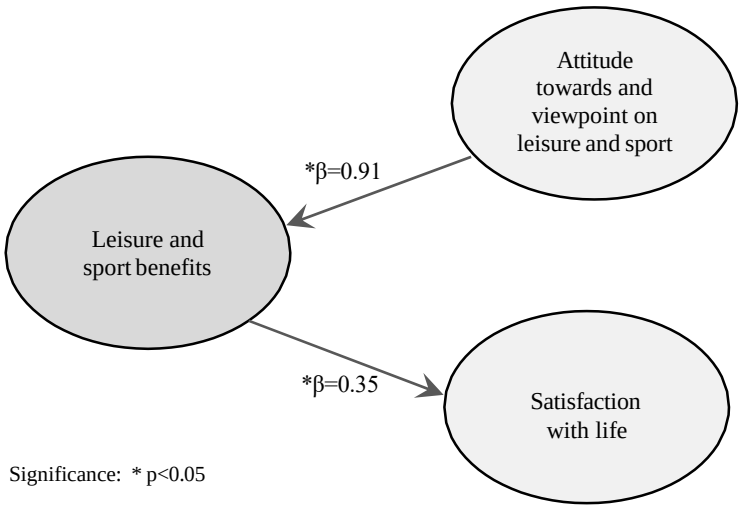

Figure 1. **STRUCTURAL RELATIONSHIP BETWEEN ATTITUDE VARIABLES**

The results indicated that the data fit the structural equation model in Figure 1 well. The ratio

of the chi-square divided by its degrees of freedom obtained for the SEM was 2.38, which suggests an appropriate fit (Byrne, 2013). The model produced an acceptable CFI=0.92 (Perry *et al*., 2015) and a RMSEA=0.067, with a 90% confidence interval of 0.058-0.081 (Kenny *et al*., 2015).

The pattern of structural relationship that was hypothesised in the structural equation model (SEM) was tested to establish whether it was the same for males and females. The CFI difference between the unrestricted loadings model and equal loadings model was 0.006 (0.896 to 0.890), which is less than the 0.01 cut-off point that was proposed by Byrne (2013). The results from the model comparison suggest that imposing the restrictions of equal factor loadings across the groups of male and female black Grade 12 learners did not result in a statistically significant worsening of the overall model fit. Thus, the same factor structure for both male and female learners was used.

The standardised coefficients (β) indicated a positive relationship between the attitude towards and viewpoint on leisure and sport activities and leisure and sport benefits (β=0.91). Most of the black Grade 12 learners expressed positive opinions between leisure and sport benefits that were gained from leisure and sport activities. Similarly, leisure and sport benefits had a positive relationship with SWL (β=0.35). These learners experienced satisfaction in their lives, based on the benefits that were attained from sport and leisure activities they participated in during a previous school holiday. Zullig and White (2011) support the notion that sport benefits or participation of high school learners is related to an increase in their SWL and self-related health, which could result in social, mental and physical benefits. On the other hand, participating in self-selected, leisure-related activities

could directly influence physical and psychological disorders, such as releasing stress/intrinsic inspirations, body image (bulimia) and a pleasurable mood (Kim, 2007; Akgul, 2015).

DISCUSSION

An extensive literature search on various academic journal platforms delivered a vast amount of literature on the topic of *leisure and sport related activities/benefits* in relation to "black gold" and SWL. However, no research could be found that approached the topic in a holiday context. The importance of administering the questionnaire to black Grade 12 high school learners with a focus on a previous holiday was to emphasise time sensitivity. Kruger *et al*. (2014) suggest that future research should take into account measuring the subjective indicators of quality of life in the past tenure, therefore, contributing to literature and methodology.

The findings include results from the demographic profile, Exploratory Factor Analysis (EFA), Pearson correlations and the Structural Equation Model (SEM). In terms of the demographic profile, it was found that during a previous school holiday "black gold" listened to music (boys: mean=4.73; girls: mean=4.09), chatted with friends (boys: mean=4.10; girls: mean=4.09), rested and slept (boys: mean=3.82; girls: mean=4.25), did cycling (boys: mean=2.88; girls: mean=2.24) and played soccer (boys: mean=3.58; girls: mean=2.04). These learners did not play tennis, hockey or participate in swimming during the holiday. This could be explained by the fact that many of these learners might not have been exposed to westernised sport.

Early socialisation of black girls in a rural township are often dominated by a cultural perception that girls should help with home chores and are not expected to partake in sport/leisure related activities. These could result in them resting and sleeping more during a previous holiday when compared to the boys. Headmasters and teachers should start assisting girls in developing social leisure and sport skills at a young age. This would equip girls in Grade 12 to liberate themselves from traditional cultural ways of thinking (Pule *et al*., 2014). An example would be for a black female sport celebrity (like Caster Semenya) to be invited as a motivational speaker for black high school girls (*Daily Mail*, 2009).

The next step could be to conduct an audit to determine the interests/needs of young people and, based on these, to develop an appropriate infrastructure. Arrangements could be made that "black gold" should be allowed to commute during a school holiday to leisure- and sport-related facilities in the neighbouring city (enjoying an affluent lifestyle, differences caused by groups of individuals based on their financial situation). This could provide an opportunity to participate in leisure and sport activities on a regular basis and during school holidays. Furthermore, the local municipality, community politicians and community leaders have a duty to re-evaluate the infrastructure of all fast growing townships and as a matter of importance to foster positive mental/physical health outcomes of these "black gold" high school learners.

It has been shown that during a school holiday sedentary lifestyles (reading, listening to music, resting or sleeping), of high school learners could subject them to obesity, frustration,

mental/psychological/health problems, drug use and crime-related activities (Dhurup & Grobler, 2012). Rottcher *et al*. (2013:160) found that young adolescents from various socio-economic areas in Durban (SA), often participate in swimming at the beach or boys swimming at a pool or girls walking for pleasure as part of leisure-related activities. Boys participate in sport-related activities, such as soccer, cricket, athletics, table tennis, volleyball and tennis. Girls according to Rottcher *et al*. (2013:160) like to participate in netball, athletics and volleyball. This contradicts the findings of the current study, however, these learners could have had access to leisure and sport facilities that those of the current study population did not have.

The results of the EFA of the attitudes towards, and viewpoints on, leisure and sport activities/leisure and sport benefits during a previous school holiday suggest that *physical/mental health aspects* and *physical benefits* achieved the highest mean and that SWL was identified as a single factor. "Black gold" who participates in leisure and sport activities regularly, may gain many benefits, like improved health status, social relationships amongst learners in the community, community cohesion or a sense of community pride, and achievements that will ultimately improve their SWL and life quality (Meyer & Surujlal, 2014). An implication of this finding with regard to *physical/mental health aspects* and *physical benefits* is that parents, teachers and community leaders of this township should realise that regular leisure and sport activities of "black gold" during a holiday, could induce a sense of freedom in developing various social skills and, therefore, enhance social development that could become prevalent in adulthood.

Deprivation from regular leisure and sport activities could also have a negative impact on their social well-being development towards adulthood and could result in negative

psychosomatic-related health problems (major depressive symptoms, physical psychosomatic complaints/ anxiety, psychosomatic complaints/depression and panic symptoms), that could culminate in substance and alcohol abuse. The end result could have an effect on their academic achievements and SWL. Social care workers (with the support of parents, teachers and community leaders) should avail themselves, especially during a holiday, to assist with any physical and mental health-related problems to combat these challenges. All negative psychosomatic-related health problems could become chronic illnesses that are ultimately carried into adulthood, snowballing into a decrease in SWL (Caldwell & Faulk, 2013; Shin & You, 2013).

The results of the Pearson correlations indicated positive medium to large correlations between *attitude towards and viewpoint on leisure and sport* (cognitive aspects, physical / mental health aspects, behavioural aspects, affective component/personal aspects, and motivation), and *leisure and sport benefits* (social benefits, psychological benefits, physical benefits, relationships/significant others, and individual benefits), with the result that "black gold" were satisfied with their lives during the previous school holiday. Township developers and sponsors, supported by local government, should take this finding further and begin to invest in the infrastructure of this township, ultimately contributing to the social function and further enhancement of the SWL of "black gold" in establishing well-rounded adults after their completion of high school (Priest *et al*., 2007; Chi & Cho, 2012).

The standardised coefficients in the SEM indicated a positive relationship between *attitude towards and viewpoint on leisure and sport activities* and *leisure and sport benefits*. Positive opinions are, therefore, a consequence of the leisure and sport benefits that are gained from the attitude towards and viewpoint on leisure and sport activities, resulting in SWL. Implications of this finding support Meyer and Surujlal (2014), who suggest that politicians, local government, community leaders, teachers, developers and parents should conduct a needs assessment of the leisure and sport facilities that are required by "black gold", as it will enhance community pride for future generations residing in this township. These key role-players should further educate and motivate "black gold" to participate in regular leisure and sport activities, thereby keeping them off the streets, and develop youth programmes (leisure/sport) during holidays that will be attractive to these learners. Ultimately, the benefits will be endless.

CONCLUSION

This study was not without limitations. The findings are based on the results that were obtained from the study sample and cannot, therefore, be generalised as representative of the total "black gold" population in the broader South African context. Although the focus was on Grade 12 learners in one specific township, future studies should be directed towards Grade 8 to 12 learners in other townships in SA in order to allow generalisation of the findings based on the current study. Furthermore, it is suggested that these results should be shared amongst politicians so that it could be debated meaningfully in parliament.

It is suggested that key role-players in this rural township should make contact with the Anna Foundation (2013) that focus on education, sport and life development of "black gold" in SA in order to close the gap between leisure and sport issues of advantaged and previously disadvantaged communities with a focus on holiday experiences. This research could also be duplicated in rural townships to ascertain a larger picture of the "black gold" attitudes towards

and viewpoints of leisure and sport and leisure benefits of a holiday.

Additional research into the importance of sport in schools and its contribution to SWL should be considered a priority by government and local school administrators. The White Paper on Sport and Recreation, as well as the National Sport and Recreation plan should further evoke the importance of empirical research to understand the scope of sport in schools and aid in the implementation of the objectives outlined in these strategies. Moreover, a better understanding of sport and SWL to address current shortcomings in health and fellowship benefits is necessary to ensure sustainable development in communities. Since sport is a catalyst towards tertiary education and can contribute to safe and lawful activities within communities. This has the potential to reduce negative influences, such as 'gangsterism' and substance and drug abuse.

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DESIGN AND VALIDATION OF A CARDIORESPIRATORY CAPACITY TEST FOR PRESCHOOL CHILDREN

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ABSTRACT

This study aimed to validate the 10x20m test for children aged 3 to 6 years in order to analyse cardiorespiratory capacity. 298 children, 159 boys (age=57.84±10.25 months) and 139 girls (age=56.68±11.00 months), that were randomly selected from three schools in the southeast of Spain participated in this study. The 10x20m test was designed to evaluate aerobic endurance. The 6-minute walk test (6MWT) was selected and used for convergent validity. The analysis of reliability using a test-retest found no significant differences ($p \geq 0.05$). As for convergent validity between the 10x20m test and 6MWT, a Pearson correlation coefficient of $r = -0.657$, ($p < 0.001$) was found. The linear regression analysis yielded a $R^2 = 0.432$. Regarding gender and age influences, no significant differences ($p \geq 0.05$) for any variable according to gender were found, while significant differences were found ($p < 0.001$) in the 10x20m test between age sub-groups. The results showed that the 10x20m test obtained adequate parameters of reliability and validity in healthy children aged 3 to 6 years. Therefore, to assess cardiorespiratory endurance in preschool children this test is valid, reliable and easy-to-perform.

Key words: Cardiorespiratory endurance; Physical fitness; Preschool assessment; Validation.

INTRODUCTION

The importance of physical activity (PA) for health is well known and research has noted both physical and psychological benefits when children participate in PA (Janssen & LeBlanc, 2010; Ahn & Fedewa, 2011). Fitness, adiposity and body fat distribution during childhood have shown a high correlation with cardiovascular health in adulthood (Casajús *et*

al., 2012). Additionally, cardiovascular fitness is a biomarker of health at all ages (Ortega *et al*., 2008). The physical condition components related to health are: cardiorespiratory capacity; musculoskeletal capacity; and body composition (Ruiz *et al*., 2009). Cardiorespiratory capacity, in particular, is strongly associated with health even at early ages, and is a determinant of cardiovascular risk in preschool children (Bürgi *et al*., 2011), and an early risk factor for obesity (Chinn, 2006). Nevertheless, cardiorespiratory fitness has been studied least in pre-schoolers (Ortega *et al*., 2015).

Despite the fact that a sedentary lifestyle at this age is a reality (De Bock *et al*., 2013), few studies analysed the physical fitness and PA of children in the age range three to six years

(Bürgi *et al*., 2011; Niederer *et al*., 2012). Numerous tests have been proposed and developed for assessing physical fitness in children (ALPHA; EUROFIT in the Council of Europe Committee for the Development of Sport, 1988). Nevertheless, these are usually inadequate to determine fitness in preschool children as they have difficulty following strict instructions. Limited information is available about the reliability and validity of fitness tests for preschool children (Ortega *et al*., 2015). In relation to cardiorespiratory fitness, Cadenas-Sánchez *et al*. (2014), employed the Leger Test for preschool children and experienced some problems with the application, because preschool children exhibited limitations in their space-time perception. This limitation makes the Léger test impractical and it has not been validated for preschool children.

Fulton *et al*. (2001) emphasise the need to develop valid measurement methods of PA and sedentary behaviour in children aged 2 to 5 years. In this line, some studies have proposed modified tests for evaluating fitness in pre-schoolers (Fjørtoft *et al*., 2011; Ayán, 2013), but none of them provide parameters for validity and reliability. In addition, most of the above-mentioned studies show serious constraints to be implemented in a school context; necessary space or absence of a recreational area. Therefore, to the best of the researcher's knowledge, no test has been adapted and validated for pre-schoolers.

Considering the above information, it seems necessary to establish reference values with regard to fitness and physical development in pre-schoolers. Therefore, the aim of this study was twofold: (1) to design a physical test to evaluate cardiorespiratory endurance in preschool children; and (2) to assess the validity of the proposed test "10x20m" for cardiorespiratory endurance evaluation in children 3 to 6 years of age.

METHODOLOGY

Participants

In this study, children (N=298) between the ages of 3 to 6 years participated, namely 159 boys (age: 57.84±10.25 months, body mass index [BMI]=16.81±2.26kg/m^2), and 139 girls (age 56.68±11.00 months, BMI=16.76±2.25kg/m^2). They were randomly selected from 3 conveniently sampled schools in the southeast of Spain. Inclusion criteria included children enrolled in preschool and who did not suffer from any physical and/or intellectual disabilities.

Measures and materials

The anthropometric parameters analysed included height (cm), measured with a stadiometer

(Seca 222, Hamburg, Germany), and weight (kg) that was recorded with a Seca 634 (Hamburg, Germany). Body mass index (BMI) was calculated as weight (in kg) divided by height squared (in m), that is BMI=weight(kg)/height(m)². Cardiorespiratory endurance was assessed using the 10x20m test, inspired by the spatial structure of the Léger test (Léger *et al*., 1988), and based on the guidelines of the Spanish Athletics Federation (RFEA) for the endurance efforts of participants at this age. The test design took into account that the rules were very simple and the test had a playful motivation.

Materials required include a tape measure to mark the distances of the runway (20m), 2 boxes, 5 balloons and a stopwatch. It is a 20m shuttle test, in which participants have to move 5 balloons from Box A located at the one end to box B located at the opposite end. The total distance covered was 200m and timed from the signal "Go" until the last balloon was deposited. It did not matter if the balloon did not enter the box. If the balloon was dropped while moving, the participant had to pick it up and continue moving. Supervisors informed the participants that the balloons must be caught with both hands. The test allows running and walking. Only 1 measured trial was given and time was recorded in seconds to the first decimal.

The test score was the running time where a longer time indicated a lower performance. As a test for convergent validity, the 6-Minute Walk Test (6MWT) was used (Rikli & Jones, 2103). The 6MWT was designed originally for adults and measures aerobic endurance evaluated by the maximum distance covered on flat ground for 6 minutes following a standard protocol. In healthy children and adolescents, this test has been validated and standardised in international studies (Li *et al*., 2005; Geiger *et al*., 2007). Specifically, Li *et al*. (2005) included young children (14.2±1.2 years), and reported an intraclass correlation coefficient 0.94 (0.89–0.96; $p<0.05$). In addition, due to its ease of understanding and execution, it was the most feasible option at the time to establish convergent validity.

Procedure

Parents signed an informed consent form for the children to participate in this research. The standards of the Declaration of Helsinki (2013 version), and following the European Community's guidelines for *Good Clinical Practice* (111/3976/88 of July 1990), as well as the Spanish legal framework for clinical research on humans (Real Decreto 561/1993 on clinical trials), were adhered to. The Bioethics Committee from the University of Jaén (Spain), approved the study and the informed consent procedures. The appropriate permission was obtained from schools in this study.

Data were collected between March and April of 2014. The tests were performed at sport facilities of schools and on a flat non-slip surface. In the first session, pre-test data were recorded. Before the test, a warm-up was given consisting of 5 minutes of running and 5 minutes doing exercises for mobility and elasticity. The children performed a familiarisation trial followed by the 10x20m test. After 72 hours, the 6MWT was administered. A week later, a re-test of the 10x20m test was conducted with a sample of 92 children. The children were motivated and encouraged at all times during the execution of the tests.

Statistical analysis

Data for this study were analysed using the SPSS statistical program, v.19.0 for Windows (SPSS Inc., Chicago, USA). The level of significance was set at $p<0.05$. The results are

shown by means of descriptive statistics that includes the mean, standard deviation and percentiles. Tests for normal distribution and homogeneity (Kolmogorov-Smirnov and Levene, respectively), were conducted on all the data prior to analysis. For the comparison between the genders, Student's t-test and analysis of variance (ANOVA) were used with the *post-hoc* Bonferroni adjustment test for the comparison of age groups. The reliability was analysed by pre-post-test through the Intra-class Correlation Coefficient (ICC), and the

Bland-Altman graphic. The convergent validity was calculated by Pearson's correlation. Furthermore, a Pearson correlation analysis between variables was performed. Finally, a linear regression between 10x20m and 6MWT was applied.

RESULTS

Table 1, Table 2 and Figure 1 show the results of the different variables according to gender and age groups.

Table 1. **VARIABLES ACCORDING TO GENDER**

Variables	**Gender**		**p-Value**
	Boys Mean±SD	**Girls** Mean±SD	
Age (months)	57.84±10.25	56.68±11.00	0.350
BMI (kg/m^2)	16.81±2.26	16.76±2.25	0.858
10x20m test (sec.)	92.78±18.12	95.55±19.19	0.201

SD (standard deviation); BMI: body mass index

Table 2. **VARIABLES ACCORDING AGE GROUPS**

Variables	**Age**				**p-Value**
	3 years Mean±SD	**4 years** Mean±SD	**5 years** Mean±SD	**6 years** Mean±SD	
Age (months)	43.92±2.28	54.03±3.75	65.71±3.46	74.78±3.57	**<0.001**
BMI (kg/m^2)	16.91±2.03	16.37±2.19	17.08±2.42	16.74±2.33	0.166
10x20m test (sec.)	109.07±18.01	96.90±16.33	84.12±12.29	78.81±13.26	**<0.001**

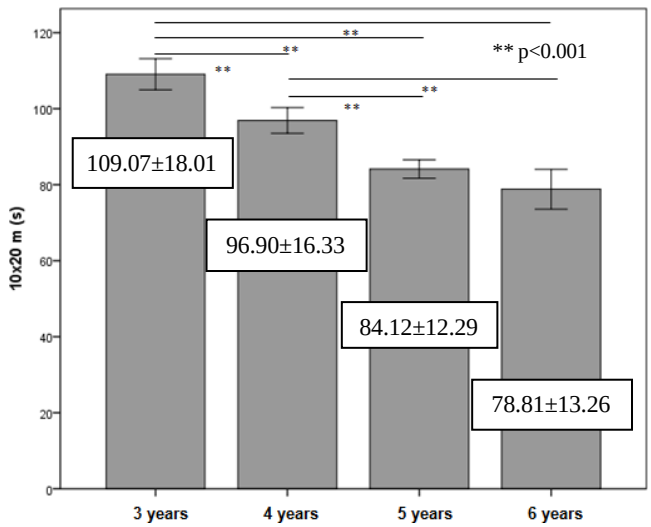

Figure 1. **RESULTS FOR 10X20M SHUTTLE ACCORDING TO AGE**

No significant differences ($p \geq 0.05$) for any variable according to gender were found. There were significant differences ($p < 0.001$) in the 10x20m test between some age groups, where no significant differences were found between 5- and 6-year-olds. In addition, the Pearson correlation analysis showed that age significantly correlated with the 10x20m test ($r = -0.617$, $p < 0.001$). The 10x20m test showed no significant correlation with BMI.

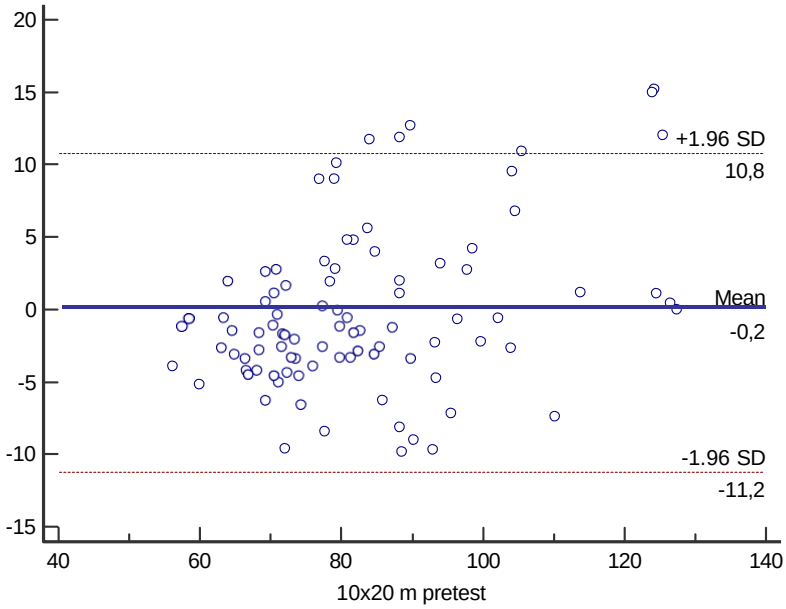

Figure 2. **10X20M PRE- POST-TEST**

In the analysis of reliability using a test-retest, the following results were obtained for the pre-test (mean=83.11±16.64s) and the retest (mean=83.31±15.48s), with no significant differences ($p \geq 0.05$) and an ICC=0.969, 95% confidence interval=0.953 to 0.979. The Bland-Altman graphic (Figure 2) presents the limits of accordance (±1SD) of 10.8 and -11.2s, with a mean difference of -0.2.

Regarding the convergent validity between the 10x20m test and the 6MWT, a Pearson correlation coefficient of $r = -0.657$, that was significant ($p < 0.001$), was found. The linear regression analysis yielded a $R^2 = 0.432$ (Figure 3).

In Table 3, the different percentiles are provided for the 10x20m for the different age groups. The 50th percentile was 107.10 for the 6-year-olds, 95.05 for the 5-year-olds, 83.00 for the 4-year-olds and 79.30 for the 3-year-olds.

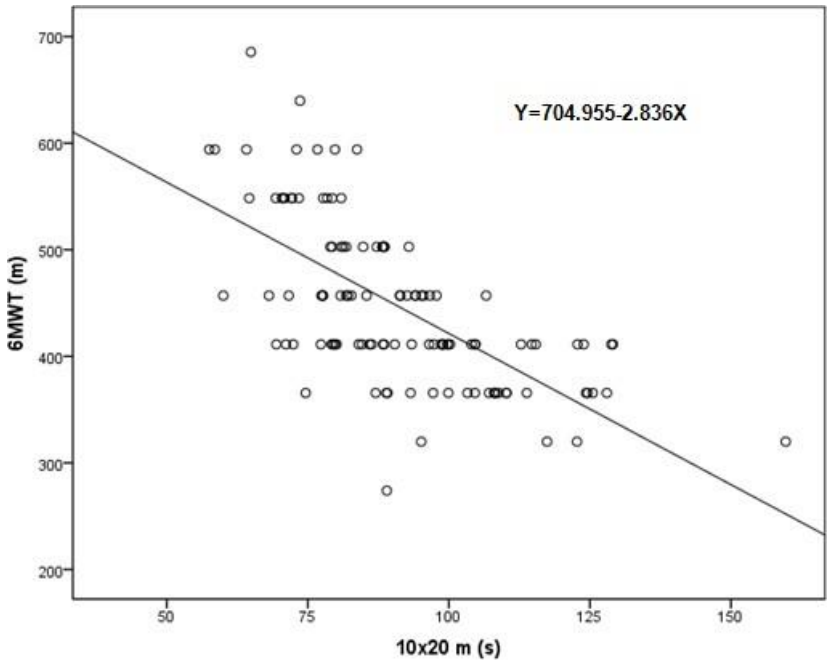

Figure 3. **LINEAR REGRESSION BETWEEN 10X20M AND 6MWT**

Table 3. **PERCENTILES BY AGE GROUP FOR 10X20-METRES SHUTTLE TEST**

Age groups	Percentiles						
	5	10	25	50	75	90	95
3-year-olds	84.76	87.60	96.75	107.10	122.10	129.44	136.20
4-year-olds	72.58	77.49	86.00	95.05	106.75	115.85	129.42
5-year-olds	66.51	70.10	76.65	83.00	90.00	97.16	105.73
6-year-olds	57.90	62.18	67.00	79.30	86.00	99.64	104.18

DISCUSSION

The evaluation of an individual response to exercise is an important and useful clinical tool because it provides a review of the respiratory, cardiac and metabolic systems (Li *et al*., 2005), and it is of particular relevance in children three to six years old. Higher levels of cardiorespiratory endurance in childhood and adolescence are associated with healthier cardiovascular profile in the future (Ruiz *et al*., 2009). Therefore, the evaluation of this capability is needed from early ages. The absence of specific tests validated for children three to six years old prompted this study to focus on the design and validation of a test for cardiorespiratory endurance in this age group.

The results indicate adequate reliability and validity parameters for the 10x20m test in healthy three to six years old children. A test cannot be valid unless it is reliable, that is, with

repeated administration of the test and the same participants, the results should be comparable and should not be influenced by irrelevant or random factors, such as time of day, motivation, fatigue or boredom (Fjørtoft *et al*., 2011). A high temporal reliability (test/retest) and convergent validity between the 6MWT and 10x20m test was found. Therefore, this test has been shown to be safe, easy to perform and highly acceptable for preschool children. Therefore, the 10x20m test becomes a test, which provides a simple and inexpensive tool to measure cardiorespiratory endurance.

The 10x20m test also correlated significantly with age and it can be a test for monitoring the development of cardiorespiratory endurance in children of this age. In this regard, the time spent is reduced with increased age. Likewise, no significant differences between genders were found. As for the 6MWT, Lammers *et al*. (2008) reported similar results with children aged between 4 and 11 years. Unlike other studies of children between 7 to 12 years of age (Sugiyama & Hamlin, 2013; Tambalis *et al*., 2013), in which BMI inversely correlated with physical endurance and with cardiorespiratory capacity in particular. In the current study, the 10x20m test had no significant correlation with BMI. However, other authors (Niederer *et al*., 2012) pointed out differences between groups of normal weight, overweight and obesity in physical conditions including cardiorespiratory endurance, and note that such differences may be present in preschool children.

The most important limitation of this study lies in the fact that it was not feasible to obtain a direct measure of maximal oxygen consumption (VO_{2max}) for convergent validity. It is recommended that further research be undertaken in the same line, trying to achieve a larger sample of children to ensure a standardisation of the test and the establishment of normative values according to age and gender.

CONCLUSIONS

The results obtained in the current study show that very good parameters of reliability and validity were obtained for the 10x20m test in children aged 3 to 6 years. The tests used are safe, easy to perform, very acceptable and appropriate for children of this age group.

The relationship between cardiovascular fitness and health at all ages has been widely established and supported. Considering this statement, it seems surprising that sedentary lifestyle during childhood is an essential reality. Additionally, just a few studies have focused on analysing the physical fitness of children aged 3 to 6 years, probably due to the difficulty of assessing such young children. In fact, to the best of the researcher's knowledge, no previous studies have validated a physical test for assessing fitness in children at these ages. Therefore, from a practical viewpoint, this study presents a valid, reliable and simple test to assess cardiorespiratory endurance in preschool children that can be an easy indirect way to examine the health of preschool children. Teachers, coaches, trainers or any other staff working with children of these ages can administer this test without needing an abundance of material and technological resources.

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REPRESENTATION OF PHYSICAL ACTIVITY DOMAINS AND SEDENTARY BEHAVIOURS IN PHYSICAL EDUCATION TEXTBOOKS: AN IMAGE ANALYSIS

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ABSTRACT

Schools play an important role in promoting active lifestyles among children. The aim of this study was to evaluate the representation of physical activity (PA) and sedentary behaviours (SBs) in the images of physical education (PE) textbooks. The initial sample was composed of 1 094 images from Spanish PE textbooks. A final sample of 291 images was randomly selected. They were analysed using a coding scheme. The PA domains and SBs, the gender and age of the characters, the time at which the activity occurred and the presence of disability were considered. Men were mainly predominant in the images, which showed leisure-time physical activities (LTPAs). A high percentage of images showed both genders performing SBs. Both the images representing LTPAs and SBs took place mainly after school. Images illustrating active commuting situations were negligible. Both disabled and the elderly groups were under represented. These findings highlight the need to reduce the normalisation of SBs in PE textbooks whilst also minimising differences in gender, age and disability categories in distinct PA contexts. Teachers should be made aware of the imbalance of images according to these categories in order to select textbooks that depict under-represented persons engaged in PA in multiple settings.

Key words: Curriculum; Health policy; Methods and materials of instruction; Public Health; School.

INTRODUCTION

Insufficient PA among young people is a major health problem worldwide (Hallal *et al*., 2012). A review of the literature has shown that a lack of PA and high amount of Sedentary Behaviour (SB) are related to a greater prevalence of non-communicable diseases, such as obesity, which can result in increased mortality (Ekelund *et al*., 2012). The development of successful interventions to increase childhood PA, and reduce the amount of time children spend on SBs is currently a major research priority (Sallis *et al*., 2006).

According to authors, such as Pate *et al*. (2006), schools play an important role in promoting PA levels and decreasing the time spent on SBs among children. International public health organisations, such as the Pan American Health Organisation (Pan American Health Organisation, 2011), have emphasised the need to design and implement global strategies at school level in order to promote healthy lifestyles. In addition, these organisations indicate

the need to analyse elementary and middle school curricula to include educational activities and PA. In this regard, school-based PE has a clear role in promoting a healthy and active lifestyle outside of school (Haerens *et al*., 2011).

The use of printed materials plays an important role in promoting active lifestyles (Marcus *et al*., 1998). Furthermore, according to the literature, printed materials are methods that promote knowledge of ideas, values and norms (Vallance *et al*., 2008). Additionally, they have been identified as predisposing factors in promoting PA and have been widely used as educational tools for promoting public health. Marks *et al*. (2006) observed that printed workbooks were effective in increasing the levels of PA among a North American sample of middle school learners. The authors concluded that traditional print formats might provide a more effective context than an identical content website for increasing PA intention and

behaviour.

Focusing on the school context, textbooks can improve learning processes when they function as key educational tools that guide the construction of the school curriculum (Montagnes, 2000). In this respect, textbooks have undergone different types of analysis, most notably those related to their implicit and explicit content (Brugeilles & Cromer, 2009). According to Taboas-Pais and Rey-Cao (2012b), the relevance of evaluating the content of textbooks lies in the large capacity that they have to convey ideas and feelings from one person to other. Content can work as a control mechanism that promotes non-reflective acceptance of thoughts and reproduces stereotypes without questioning their validity. For instance, the role of textbooks in promoting healthy habits has been analysed in previous research.

Kosonen *et al*. (2009) analysed the pedagogical properties of Finnish health education textbooks at primary and secondary education levels. The authors determined that the approach that textbooks took gave learners the opportunity to build critical skills and recommended a greater focus on health promotion through critical training, to help promote healthy habits and lifestyles in learners. In the Spanish context, a study on health education was conducted with textbooks from different subjects at primary and secondary school levels. It was concluded that the promotion of PA as an option to promote a healthy lifestyle was not observed in these curricular materials (Gavidia, 2003).

Even though several studies have analysed health topics in school textbooks on different subjects, PE textbooks have rarely been examined. A review of the literature that focused on analysing the content of PE textbooks reveals gender differences in which the male gender model is clearly predominant in pictures and female images are stereotyped (Browne, 1990; Taboas-Pais & Rey-Cao, 2012b). Other studies on the subject have examined the image of disability in PE textbooks and their results indicated that people with disabilities were not usually represented in pictures and, females with disabilities were less represented than males with disabilities (Taboas-Pais & Rey-Cao, 2012a, b). There are also other studies that have analysed the content of textbooks, taking the age variable into account. Taboas-Pais *et al*. (2013) noted that older people were under-represented.

When the kind of PA represented in the PE textbooks is analysed, it is customary to speak of types of activities based on the usual content of PE (sport, fitness activities, artistic activities, activities in nature, etc.), or types of sport activities (individual vs. team sports; elite vs. non-elite) (Taboas-Pais & Rey-Cao, 2012b; Taboas-Pais *et al*., 2013).

Within the body of literature on health promotion, PA is considered as a complex set of behaviours and is usually evaluated taking into account the domains or settings where activities occur (Bauman *et al*., 2006). The main four domains of active living are active recreation or leisure-time PA [LTPA] (exercise, sport, active school recess, etc.); occupational PA through work or occupations; household or domestic activity (housework, gardening, etc.); or active commuting (AC) to get to places, including travel to and from school. In addition to these domains, SBs are commonly analysed and usually involve sitting, such as watching television (TV) or using a computer (Bauman *et al*., 2006).

PURPOSE OF THE STUDY

There is a lot of current interest in, and extensive research on, the role of the different

domains or locations where activities are carried out in the promotion of active lifestyles (Sallis *et al*., 2006; Molina-García *et al*., 2015). However, there is a lack of research addressing how PA domains are represented in PE textbooks and, therefore, examining what PA patterns are predominantly transmitted to school learners. Furthermore, there is also a need for a more thorough study of the relationship between each PA domain and gender stereotypes, different age groups, or the presence of a disability.

The goal of this study, therefore, was to evaluate how PA domains are represented in images published in Spanish PE textbooks. In addition, gender and age variables and the presence of disability, were considered in this analysis. The availability of PE learner textbooks has increased in Spain in recent decades and 23.2% of teachers use them as classroom material (Peiró-Velert *et al*., 2015).

METHODOLOGY

Sample

To obtain a sample of Spanish elementary PE textbooks, the most important publishing houses in Spain were searched, following the *Panoramica de la edición española de libros 2012* as a guide (Ministerio de Educación Cultura y Deporte, 2013). As a result, the sample selected included the 5 most popular Spanish publishing houses for the 2010 to 2012 period (Santillana, Edelvives, Paidotribo, Anaya, and Bruño), who produced 30 textbooks. 10 primary PE textbooks were randomly selected for analysis based on 3 criteria, namely that the textbooks were for primary PE, presented in Spanish and published in Spain between 2010 and 2012. A simple random sampling procedure was followed. The 30 textbooks were numbered and a table of random numbers was employed to select them. Therefore, each textbook had the same probability of being chosen.

The analysis was restricted to images of the human body, while animals with human characteristics, fantasy characters and fabricated characters were not included in the analysis. After taking a count, the total number of images with humans in these 10 textbooks totalled 1,094. From this, a representative sample was taken from the total population, and using a confidence level of 99% and a margin of error of 6%, 336 images were analysed. This sample

was taken randomly (simple random process), for each textbook using a table of random numbers. Once all the images were numbered, a random selection was made culminating with a choice of 32±2 images per textbook. The initial sample consisted of 336 images, but 45 were discarded because it was not possible to identify the age and gender of the subjects. For each image, the most prominent characters or group of characters were recorded.

Analysis of images and coding scheme

An analysis was performed on each image following a coding scheme, which was constructed by the research team following guidelines from previous studies (Fitzpatrick & McPherson, 2010; Taboas-Pais & Rey-Cao, 2012b; Molina-García & Martínez-Bello, 2014; Martínez-Bello & Martínez-Bello, 2016). Having defined the categories and indicators, 2 experts who promote PA and PE evaluated the categories and indicators. Once the coding scheme system had been discussed independently by these experts, it was rewritten based on their feedback. The final coding scheme had 5 categories, namely *PA domains, gender, age, time* and *disability*. Each unit of analysis (image) was coded by choosing 1 indicator from each of the categories. Indicators and operational definitions (activities) for each category are presented

in Table 1.

Table 1. **CODING SCHEME FOR ANALYSIS**

Categories	Indicators	Descriptions
Physical activity domains	1. Sedentary behaviour or low activity	'Awake' activities when sitting, lying or standing that involve low energy expenditure.
	2. Active commuting	Physical activities, including cycling or walking, as a way to get to places.
	3. Occupational activity	Physical activities through work or occupations.
	4. Physical education class (educative context)	Activities framed in the physical education classes that take place at school.
	5. Leisure-time physical activity	Physical activities for exercise or recreation that can be organised, such as team or individual sports, or non-organised, such as traditional games or recreational sports.
	6. Household physical activity	Physical activities in a household setting such as gardening or child minding.
Gender	1. Male 2. Female 3. Group of females & males	The image shows one or more people whose basic characteristics represent males or females based on clothing, hairstyle, presence or absence of facial hair, physical stature and other distinguishing characteristics.
Age of character	1. Children 2. Adolescents 3. Adults 4. Older adults	The image shows one or more people whose basic characteristics represent different ages based on appearance and behaviour, such as adult-like facial structures, clothing, occupational context and other distinguishing characteristics.

Table 1. **CODING SCHEME FOR ANALYSIS *(continued)***

Categories	Indicators	Descriptions
Time	1. School time 2. School-break time 3. Outside school time 4. Undetermined	Activities occur during school hours (not including school recess), at school recess time or after school hours. The classroom, school gym and playground are the usual locations for school time and school-break time.
Disability	1. Non-disability 2. Disability	The images show one or more people whose characteristics represent a physical, sensorial or mental impairment.

In particular, indicators and operational definitions of the PA domains category were developed taking into account previous studies on the promotion of active lifestyles and the analysis of SBs among youth (Marshall *et al*., 2002; Bauman *et al*., 2006). SB was defined as any 'awake' activity that involves energy expenditure when sitting or lying down less than or equal to 1.5 metabolic equivalents [METs] (Barnes *et al*., 2012).

Both seated and standing positions were included, such as traditional children's and board games (playing with 'bottle caps' or card games) or motionless standing. These activities are usually classified as very light or light intensity activities (<3METs) (Ainsworth *et al*., 2000). The activities included in the AC, LTPA, occupational activity and household PA categories involve at least a moderate intensity activity (≥3METs) in accordance with reports from Ainsworth *et al*. (2000) and the Centres for Disease Control (Centres for Disease Control, 1999). The Compendium of Physical Activities (Ainsworth *et al*., 2000) was used for the image coding process.

Procedure

The process of image analysis was performed using a triangulation method with an observational group. This observational group was different from the experts who participated in the process of building the coding scheme. 3 coders (Primary pre-service PE teachers) in the observational group were trained on the coding scheme following previous studies (Fitzpatrick & McPherson, 2010; Taboas-Pais & Rey-Cao, 2012b). During the practice coding training, reliability was monitored and informally assessed. The observational group was trained on 2 different days for 1 hour in order to clarify uncertainties about the process. On the first day, the researchers explained the objectives of the research project and the coding process.

On the second day, the coders analysed 3 example images in order to clarify questions about the coding process. The categories and indicators in the coding scheme were checked with the observational group. The image was put on the desk and 1 member of the research group read each category containing the list of indicators. After each image was discussed, the observational group decided 1 indicator for each of them, requiring about 1 to 3 minutes per image. When it was not possible to reach an agreement, the category was coded as unclear. During the discussion of each image, the researchers encouraged the coders to challenge one

another's perspectives when there was not agreement. When a response differed from the other coders, the researchers asked the coder to clarify further his/her position.

Following the training process, the final coding was performed following the same procedure. 10 sessions (of 2 hours each) were required to analyse all of the images. Interference by the research team was minimal and they only focused on presenting the images and reading each of the categories and indicators. For each image, the observational group worked to achieve agreement, but when it was not possible (less than 5% of the total), the indicator was coded as non-identifiable.

Analysis of data

For the statistical analysis, a contingency table was constructed using the *PA domain* as an independent variable against the dependent variables of *gender*, *age* and *disability*. The *time* category was used descriptively. To define a statistically significant probability only p-values less than 0.05 were accepted. The Statistical Package for the Social Sciences (IBM, 2014), version 22, was used for the analysis.

RESULTS

The frequency and percentage of representation of the different PA domains in the sample is shown in Table 2. The most frequent indicators were LTPA and SB or low activity domains, accounting for 42 and 36% of the total respectively. Of the total sample, 16% were of PE class and 5% were depicted as active commuting (AC). There were no images based on occupational activity and household PA domains.

Referring to the gender category in Table 3, the results show that of the 123 LTPA domain images, 52% were male, 28% were female and 20% were depicted as a group of males and females. Of the 105 images represented as SB or low activity domain behaviours, 38% were male, 33% were female while 29% were represented as a group of both females and males. Of the 48 images represented as PE class, 58% were depicted as a group of females and males, 25% were females and 17% were males. Finally, of the 15 images represented as AC, 53% were males, 27% were females and 20% were groups of females and males. The Pearson chi-square test performed showed a statistically significant difference between PA domains and gender (χ^2 =29.821, df=6, p<0.001).

There was a higher representation of children in the PA domains (Table 3). In particular, of the 123 images of LTPA, 82% were children and 18% were adults. Of the 105 images of SB or low activity, 95% were children and 5% were adults. Of the 48 images of PE class, 100% were depicted as children. Finally, of the 15 images of AC 87% were children and 13% were adults. A Pearson chi-square test showed a statistically significant difference between the PA domain and age (χ^2 =17.272, df=3, p<0.01).

Table 2. **FREQUENCIES AND PERCENTAGES (%) OF IMAGES FOR SPECIFIC ACTIVITIES IN PHYSICAL ACTIVITY DOMAINS**

PA domains	**Activities [n (%)]**					**Sub-total**
Sedentary behaviour/ low activity	Standing motionless	Sitting activities	Academic activities	Static traditional games	Other activities	
	29 (10%)	29 (10%)	12 (4%)	9 (3%)	26 (9%)	105 (36%)
Active commuting	Walking	Others				
	9 (3%)	6 (2%)				15 (5%)
Physical education class	Sedentary/low intensity	Moderate-vigorous intensity				
	29 (10%)	19 (66%)				48 (16%)
Leisure-time physical activity	Sport	Leisure & traditional games	Physical exercise	Physical artistic activities	Other activities	
	58 (20%)	21 (7%)	12 (4%)	6 (2%)	26 (9%)	123 (42%)
Total count: 291 (100%)						

The time category in Table 3 shows that of the 105 images of SB or in the low-activity domain, 29% were portrayed after school and 11% at school, but this was not determined for 60% of the images. Of the 123 LTPA images, 33% were portrayed after school, whereas this was undetermined in 67% of cases.

Finally, Table 3 shows that only 2 images were coded as bodies with a disability. In particular, of the 48 images of the PE class, 96% (46) were depicted without a disability and 4% (2) with a disability. None of the 29 adults was depicted with having a disability.

DISCUSSION

Analysis of PE textbooks in this study showed that the representation of different PA domains is not balanced. In relation to LTPAs, there was a high percentage (42%) of representation for these types of activities. This finding supports what is reported in the literature on the promotion of active lifestyles among young people, which suggests that promotion of LTPA is a good strategy for this age group (Sallis *et al*., 2012).

Table 3. **IMAGES BASED ON PHYSICAL ACTIVITY DOMAINS: CONTINGENCY TABLE FOR PHYSICAL ACTIVITY DOMAINS FOR GENDER, AGE, TIME AND DISABILITY**

Physical activity domains	Gender [n (%)]				Age [n (%)]			Time [n (%)]				
	Males only	Females only	Males & females	Sub-total	Children	Adults	Sub-total	School time	After school	Undetermined	Sub-total	N
Sedentary or low activity	40 (38%)	35 (33%)	30 (29%)	105	100 (95%)	5 (5%)	105	12 (11%)	30 (29%)	63 (60%)	105 100	
Active commuting	8 (53%)	4 (27%)	3 (20%)	15	13 (87%)	2 (13%)	15	– –	9 (60%)	6 (40%)	15 100	
Physical education class	8 (17%)	12 (25%)	28 (58%)	48	48 (100%)	0 0	48	20 (42%)	1 (2%)	27 (56%)	48 100	
Leisure-time physical activity	64 (52%)	34 (28%)	25 (20%)	123	101 (82%)	22 (18%)	123	– –	41 (33%)	82 (67%)	123 100	

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After analysing the content of the images related to LTPAs, it was found that the main participants in these activities were males (male=52%, female=28%, group of males and females=20%) (Table 3). Current evidence indicates that there are gender differences in the representation of school activities in PE textbooks. Taboas-Pais and Rey-Cao (2012b) found that males were more frequently the protagonists in pictures about sport activities, especially for team sports.

Considering that the levels of PA tend to reduce with age, with the most significant decrease occurring during adolescence, especially for the girls (Kwan *et al*., 2012), it is particularly important to avoid non-fair representation of gender in textbooks for young children. The results of this study demonstrate the transmission of a dominant male model in PA undertaken during free time and emphasises the idea that LTPA is closely associated with the male gender. Therefore, the publishing houses should strive to better promote gender equality in their textbooks. On the other hand, as expected, pictures related to PE classes showed a well-balanced representation of both genders that can act to reinforce schools as co-educational contexts (Yoncalik, 2011; Taboas-Pais & Rey-Cao, 2012b).

The textbooks analysed in the current study did not transmit the idea that break-time is an excellent opportunity to increase PA levels among young people. According to the results, no pictures showed LTPA situations depicted at school break-time. This is in contrast to current recommendations that clearly indicate that break-time is a potential period for interventions aimed at improving the levels of PA and health among children (Chin & Ludwig, 2014). In contrast, the location of 67% of the pictures related to LTPA was identified as 'undetermined'. It means that it was not possible, by independent coders, to distinguish the place where the people were located. In addition, the location of 33% of the pictures related to LTPA was identified as 'after school', suggesting that the school was not portrayed as a space for the PA domain. It is important to keep in mind that schools play a leading role in the promotion of active lifestyles, not only through teaching their own subjects, such as PE, but also by making it easier for students to be more physically active during the school day (Pate *et al*., 2006). Because children spend almost a third of their time at school, its role in creating active spaces must be strengthened. Hence, we advocate for the better representation of physically active situations during the school break-time in PE textbooks.

Analysis of the age variable in this study showed that children had the highest representation in the images during LTPA (children=82%; adults=18%) (Table 3). This result corresponds with the data from the analysis of preschool textbooks (Molina-García & Martínez-Bello, 2014). In contrast, the elderly was not represented in the images analysed in this study, which correlates with data from Taboas-Pais *et al*. (2013) that analysed Spanish secondary school PE textbooks. Furthermore, given the reduced portrayal of older people doing LTPA, it is argued that these printed curricular materials reinforce the existing negative stereotypes of old age. We agree with Taboas-Pais *et al*. (2013) that the absence of older people in these images creates negative ideas about old age, for instance that older adults are not able to participate in PA or that the young body is more superior at sport.

Furthermore, the results indicate that adults were not represented in the pictures related to LTPA. In general, the images show situations after school where parents do not usually exercise with children. It is already known that family support for the practice of PA is one of

the main determinants of PA among young people, mainly because parents have a significant function as role models when they exercise with other family members (Moore *et al*., 1991). The images presently used in PE textbooks do not represent the leading role that family members play in PA practice during out-of-school time. It can be recommended that new versions of these textbooks include more pictures depicting children doing PA with family members.

Similarly, the presence of disability is almost non-existent in the images analysed from PE textbooks. Only two images with a disability were portrayed (Table 3) and these results are in accordance with those found in preschool (Martínez-Bello & Martínez-Bello, 2016) and secondary school textbooks (Taboas-Pais & Rey-Cao, 2012a). Some authors, such as Hardin and Hardin (2004), describe the habitual dialogue surrounding PE at school as part of a non-inclusive context, and refer to the role of the hegemony culture in sport as one of the main reasons for the exclusion of disabled people. Publishing houses should become aware of the need to include more disabled people in their textbooks and by showing pictures of inclusive participation of people with and without disabilities during PA practice (Taboas-Pais & Rey-Cao, 2012a).

Commuting to school offers another important opportunity for incorporating PA into students' daily routine (Molina-Garcia *et al*., 2010). It has been used, together with the promotion of the active use of leisure time, to improve PA levels among those of school age (Sallis *et al*., 2012). Authors, including Pabayo *et al*. (2010), assert that AC among school learners must be encouraged and integrated at a young age to be reinforced later. Unfortunately, there were almost no messages promoting AC in the images analysed from PE textbooks in this study. Only 15 images were coded as AC (Table 3). Tranter and Sharpe (2012) demonstrated the positive role such messages had in movies to promote AC in children. As pictures are elements that attract children's attention (Selander, 1990), it is important to consider the inclusion of pictures about AC at school, mainly to encourage adopting these behaviours in secondary school.

The findings of this study clearly show the normalisation of SBs in PE textbooks (36% of the images were coded as SB or low activity) (Table 2). As already known, sedentary leisure-time has increased dramatically among young people in recent decades (Trost *et al*., 2003). The time that children devote to SB activities, such as watching TV, is a significant predictor of body weight increases (Jago *et al*., 2005), because calorie consumption is frequently higher in these kinds of situations (De Craemer *et al*., 2012). However, one positive aspect that was noted in this study was the low occurrence of pictures that depict children participating in technological SB leisure activities (watching TV or playing videogames).

One of the main limitations of this study is that only Spanish textbooks were examined. Future studies should be done using PE textbooks (especially in elementary and primary education), from other countries and in different languages. In the same way, it would be interesting to carry out intervention studies in which the connection between the use of different PE textbooks and PA behaviours can be analysed.

PRACTICAL APPLICATION

Based on the present findings, PE teachers should be made aware of the imbalance of images according to gender, age and disability in elementary and primary textbooks. It is recommended that teachers in Spain review textbooks carefully with an eye towards both content and images prior to adopting a text. The goal should be to select textbooks that depict under-represented persons engaged in PA in multiple settings.

CONCLUSIONS

The school sector has been identified as an essential element in the promotion of PA by implementing programmes and using quality educational materials (Sallis *et al*., 2012). The curricular materials, and especially textbooks for children, currently characterise the social and cultural reality, including its inadequacies, gender stereotypes and other types of parodies (Brugeilles & Cromer, 2009; Martínez-Bello & Martínez-Bello, 2016). This is why the content of implicit and explicit messages in school textbooks must be analysed. Statistically, significant differences were found in this study between PA domains and gender. The textbooks analysed did not promote gender equality. This has implications for building and reinforcing gender-sensitive curricula specifically in PE. Moreover, a significant difference between PA domains and age was found. In this respect, given the reduced portrayal of older people, it is argued that PE textbooks reinforce the stereotypical beliefs of a hegemonic conception of able-bodiedness related with age.

On the other hand, Sääkslahti *et al*. (2004) found that the use of printed school materials in a PA promotion programme for children could modify their PA patterns significantly. These materials should show specific messages, especially in the images, to make them truly educational in the transmission of health promotion messages (Clark *et al*., 1999). Besides this, as also indicated by Vallance *et al*. (2008), printed educational resources on PA should include information consistent with the current public health guidelines.

From the point of view of the promotion of PA, the results of the present study emphasise the need to reduce the normalisation of the SBs in PE textbooks and to increase the presence of images related to PA during the school break-time as well as active commuting. Considering textbooks as resources that transmit meanings, current textbooks are not creating models that are sufficiently strong enough to promote PA in accordance with the current public health recommendations. This has also been indicated in the literature. Likewise, it suggests the need to keep the imbalance in the representation of gender, age, and disability variables to a minimum in the varied contexts where PA takes place.

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MINDFULNESS, PSYCHOLOGICAL WELL-BEING AND DOPING IN TALENTED YOUNG HIGH-SC HOOL ATHLETES

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ABSTRACT

The primary aim of this research was to determine how mindfulness and psychological well-being relate to the propensity to use Performance-Enhancing Drugs (PEDs) in a sample of talented young athletes. A secondary aim was to determine how mindfulness and psychological well-being are related. This was a survey study with a quantitative research approach. South African Academy athletes at a high performance centre and competitive high school athletes from four private high schools participated in the survey. In the survey, two validated questionnaires (Five Facet Mindfulness Questionnaire [FFMQ] and Ryff's Psychological Well-being Scale), and a self-constructed questionnaire to establish the propensity of athletes to use PEDs were employed. 346 athletes (208 boys, 138 girls) aged M=16.0, SD=1.4 years participated. There was a significant correlation (r=0.32, p=0.00) between overall mindfulness and psychological well-being as measured by the FFMQ and Ryff's Psychological Well-being Scale respectively. Two possible predictors of propensity to use PEDs were identified by means of logistic regression and cross tabulation. It is concluded that mindfulness and psychological well-being were inversely related to the propensity to use PEDs.

Key words: Anti-doping; Performance-enhancing drugs; Psychological well-being; Mindfulness.

INTRODUCTION

The fight against doping in sport is extremely complex (European Commission, 1999). Therefore, the World Anti-Doping Agency (WADA) is continually investigating new approaches to combat the use of performance-enhancing drugs (PEDs) in sport. Psychological factors play an important part in sport participation. Besides influencing athletes' success in their sport, it can also influence the way they approach training and competition. An area that is rapidly gaining more attention concerning the important role psychology plays in health and sporting success is the concept of mindfulness.

Various definitions for mindfulness have been proposed. Mindfulness means being consciously aware of the present moment in a non-judgemental way (Kabat-Zinn, 2008). Another description of mindfulness is the observation of the ongoing stream of internal and external stimuli as it presents itself in a non-judgemental way (Baer, 2003), and bringing

awareness to practically any situation (Simon & Wylie, 2004). Wallace (2006) defined mindfulness as the sustained, voluntary attention continuously focused on a familiar object without absent-mindedness or distraction and meta-attention, the ability to check the state of the mind, quickly recognising whether one's attention has succumbed to either arousal or negligence.

Mindfulness has been associated with psychological well-being. Recent research revealed a strong relation between mindfulness and psychological well-being (Brown *et al*., 2007). It is, therefore, meaningful to combine mindfulness and psychological well-being to determine possible psychological factors that relate to the propensity to use PEDs. Mace (2008) maintains that it is because of the distinct characteristic of mindfulness of focussing on a

process instead of extraneous factors that it is able to contribute towards psychological well-being. Well-being has generally been conceptualised either as psychological well-being (Ryff, 1989), subjective well-being (Diener, 2000), happiness (Myers, 2000), or quality of life (Frisch, 2006).

Although a fair amount of research on mindfulness has been conducted particularly in the last two decades, limited research has been conducted specifically in relation to sport participation. Recently, a few studies have shown that higher levels of mindfulness can optimise and enhance sport performance (Kee & Wang, 2008; Bernier *et al*., 2009; Wolanin & Schwanhausser, 2010). Due to the nature of mindfulness, athletes who are highly mindful and whose psychological well-being is good, might possibly also be less prone to doping in sport.

According to Deci and Ryan (1980), open awareness may be especially valuable in facilitating the choice of behaviours that are consistent with person's needs, values and interests. The extensive research overview of mindfulness and the benefits of being mindful indicate that mindfulness can be associated with increased capacity to improve the freedom to choose suitable and favourable reactions to situations and behaviour in general (Brown *et al*., 2007). Research on mindfulness reveal that individuals who are higher in dispositional mindfulness make safer choices in life and are more aware of outcomes and of gains and losses (Brown *et al*., 2007).

Gaining insight into the relationship between mindfulness and psychological well-being with the tendency to use PEDs to improve performance can possibly assist in identifying athletes who are more likely to use PEDs. An improved understanding of the psychological constructs related to the use of PED can assist in developing strategies to prevent doping in sport, for example, mindfulness training.

AIM OF THE STUDY

The first aim of the research was to determine how mindfulness and psychological well-being relate to the propensity to use performance-enhancing drugs (PEDs) in a sample of talented young athletes. A second aim was to determine how mindfulness and psychological well-being are related.

METHODOLOGY

This was a survey study and a quantitative research approach was used. Ethical clearance for this study was obtained from the Postgraduate and Ethics Committee of the Faculty of Humanities and the athletes from 4 private high schools.

Measurement tools

The survey consisted of 2 validated questionnaires, namely the *Five Facet Mindfulness Questionnaire* (FFMQ) (Baer *et al*., 2006) and Ryff's *Psychological Well-being Scale* (Ryff, 1989), as well as a self-constructed questionnaire. The latter questionnaire was used to establish the attitudes and knowledge of the athletes concerning PEDs use and their propensity to use PEDs. The questionnaire consisted of 15 questions using a 6-point Likert scale for the responses.

The FFMQ is based on a factor-analytic study of 5 independently developed mindfulness questionnaires. The analysis yielded 5 factors that appear to represent elements of mindfulness as it is currently conceptualised. The 5 factors are observing, describing, acting with awareness, non-judging of inner experiences and non-reactivity to inner experience. The questionnaire consists of 39 statement items, which are rated by using a 1-5 Likert scale ranging from 'never or very rarely' to 'very often or always true'. The FFMQ has been shown to have strong psychometric characteristics, including adequate to good internal consistencies for the 5 facets (Baer *et al*., 2006).

Ryff's (1989) *Standardised Psychological Well-Being Scale* was used as an outcome measure to assess the athletes on the 6 dimensions of psychological well-being: autonomy; personal growth; environmental mastery; purpose in life; positive relations with others; and self-acceptance. It assesses the participants on 18 questions (3-item scale) along a 6-point Likert scale ranging from 1 ('Strongly disagree') to (6 'Strongly agree'), and has been used in various large-scale national and international surveys (Ryff & Keyes, 1995; Edwards & Steyn, 2008; Steyn *et al*., 2015*).*

Procedures

A pilot study was conducted with 10 academy athletes, after which a few minor adjustments were made to the questionnaires based on the feedback received from them. This was to ensure that the questionnaires were user-friendly and that the athletes understood all the questions. Participants signed an informed consent or assent form (parents or guardians of participants under the age of 18 years signed informed consent forms), giving their approval to participate in the study. Participants were given clear instructions on how to complete the questionnaires and anonymity was ensured in order to allow the participants to answer the questions as openly and honestly as possible.

Analysis of data

Cronbach's alpha was used as a measure of reliability to assess the internal consistency of the scales of the questionnaires. To determine whether any relationships exist between the various psychological constructs and subscales as measured by the questionnaires, Pearson's Product Moment Correlation Coefficient and Spearman's Rho were calculated. Results from

the 2 methods were similar; therefore, results from the Pearson's Product Moment Correlation Coefficient are reported.

Furthermore, 3 questions from the questionnaire developed by the researchers were used as an indication of the likelihood of a respondent to use PEDs. The 3 statements were:

I would consider using a prohibited substance or method to improve my performance even if I knew I would not be caught out.

I would consider using a prohibited substance or method to improve my sports performance even if I knew I might be caught out.

I currently use a prohibited substance or method to improve my sports performance.

This indicator was then also correlated with the psychological constructs and subscales.

Logistic regression was used to model the propensity to use PEDs indicators, using as predictors those subscales or psychological constructs that had the highest correlations. For the purposes of the logistic regressions, binary variables (agree vs. disagree) were created by dichotomising the averages of each indicator and subscale. Despite the poor performance of the logistic regression models, it enabled the researchers to identify a few subscales with predictive power. Cross tabulations of the dichotomised indicator variables and the selected subscales were consequently constructed and reported with Fisher's exact-test statistics, as well as with the standardised residuals of each cell, to assess the level of interrelation between the indicators and the subscales and to quantify the interactions between them. The statistical analysis was computed using *IBM SPSS Statistics 20.* All statistical tests were conducted using the conventional 5% level of significance. The Landis and Koch reliability classification scale was used to label the strength of reliability for the correlation statistic with adjectives (Landis & Koch, 1977).

RESULTS

The research sample consisted of 346 participants (208 boys, 138 girls), with a mean age in years of 16.9±1.4. The athletes participated in various sports. Soccer was the highest (28.5%) represented sport of the sample of athletes. More than 32.0% of the participants had been participating in their respective sport for more than 8 years.

Parametric Cronbach's alpha (coefficient of internal consistency) is commonly used as an estimate of the reliability of a psychometric test. The reliabilities of each construct and/or subscales of the questionnaires were determined. In general, the reliabilities as measured by the Cronbach's alpha of the constructs and/or subscales of the questionnaires were acceptable. However, the internal consistency coefficients of the subscales of Ryff's *Psychological Well-being Scale* were questionable as the Cronbach's alphas were below what would be considered acceptable (0.70) (Table 1). The 3-item scales were used for this study instead of the 14-item or 9-item scales due to the survey as a whole becoming too long. This could have influenced the results obtained since the 3-item scales were developed for national telephone surveys and they have lower internal consistency (Ryff & Keyes, 1995).

Table 1. **CRONBACH'S ALPHA: CONSTRUCTS AND/OR SUB-SCALES**

Questionnaire & Constructs/Sub-scales	**Cronbach's alpha**
Five-factor Mindfulness Questionnaire	**0.84**
Observing	0.68
Describing	0.81
Acting with awareness	0.83
Non-judging of inner experience	0.75
Non-reactivity to inner experience	0.58
Ryff's Psychological Well-being Scale	**0.35**
Autonomy	0.43
Positive relations with others	0.42
Environmental mastery	0.54

Personal growth	0.54
Purpose in life	0.41
Self-acceptance	0.54

There was a weak but significant correlation (r=0.32, p=0.00) between overall mindfulness and psychological well-being as measured by the *FFMQ* and Ryff's *Psychological Well-being Scale*, respectively. Regarding the subscales or psychological constructs of the 2 questionnaires there were numerous weak to fair correlations (Table 2).

Answers to the 3 questions that served as an indicator regarding the propensity of the athlete to use PEDs are presented in Table 3.

The correlations between the indicator (propensity to use PEDs), and the psychological constructs or subscales as determined by the *FFMQ* and Ryff's *Psychological Well-being Scale*, are provided in Table 4.

Although Table 4 also reveals a significant correlation between 'personal growth' and the propensity to use PEDs, only 2 significant predictors of the propensity to use PEDs were identified by means of logistic regression and cross tabulation, namely 'acting with awareness' from the *FFMQ* and 'purpose in life' from Ryff's *Psychological Well-being Scale* (Table 5).

Table 2. **CORRELATION BETWEEN PSYCHOLOGICAL CONSTRUCTS AND/OR SUBSCALES OF QUESTIONNAIRE AND SCALE**

Five Facet Mindfulness Questionnaire subscales	**Ryff's Psychological Well-being Scale subscales** r (p-Value)						
	Autonomy	Positive relations with others	Environmental mastery	Personal growth	Purpose in life	Self-acceptance	Overall psychological well-being
Observing	-0.19* (0.00)	0.13* (0.02)	-0.04 (0.42)	-0.26* (0.00)	0.12* (0.03)	-0.10* (0.07)	
Describing	-0.33* (0.00)	0.22* (0.00)	-0.31* (0.00)	-0.29* (0.00)	0.13* (0.01)	-0.27* (0.00)	
Acting with awareness	-0.10* (0.00)	0.29* (0.00)	-0.34* (0.00)*	-0.33* (0.00)	0.24 (0.00)	-0.37* (0.00)	
Non-judging of inner experiences	-0.11* (0.05)	0.20* (0.00)	-0.24 (0.00)	-0.07 (0.17)	0.04 (0.44)	-0.27* (0.00)	
Non-reactivity to inner experience	-0.29* (0.00)	0.10 (0.07)	-0.22* (0.00)	-0.29* (0.00)	0.11 (0.03)	-0.16* (0.00)	
Overall mindfulness							0.32*

	(0.00)

r= Pearson's Correlation coefficient * Significance: p<0.05 (2-tailed)

Table 3. **PROPENSITY TO USE PERFORMANCE-ENHANCING DRUGS: RESULTS OF INDICATOR QUESTION**

Questions and response options	Response: Percentage (%)
Q2: I would consider using a performance-enhancing drug, e.g. anabolic steroids, to improve my sports performance, if I knew I would not be caught out.	
Strongly disagree	69.9
Moderately disagree	8.5
Slightly disagree	6.7
Slightly agree	6.7
Moderately agree	1.8
Strongly agree	6.4

Continued

Table 3. **PROPENSITY TO USE PERFORMANCE-ENHANCING DRUGS: RESULTS OF INDICATOR QUESTION *(continued)***

Questions and response options	Response: Percentage (%)
Q3: I would consider using a performance-enhancing drug to improve my sports performance even if I knew there was a chance that I may be caught out.	
Strongly disagree	80.1
Moderately disagree	6.9
Slightly disagree	3.0
Slightly agree	5.7
Moderately agree	2.7
Strongly agree	1.5
Q4: I currently use a performance-enhancing drug to improve my sports performance e.g. anabolic steroids.	
Strongly disagree	90.9
Moderately disagree	2.4
Slightly disagree	2.7
Slightly agree	3.0
Moderately agree	0.0
Strongly agree	0.9

Table 4. **CORRELATION BETWEEN INDICATOR[#] (PROPENSITY TO USE PEDs) AND PSYCHOLOGICAL CONSTRUCTS AND/OR SUBSCALES OF ATHLETES**

Questionnaires and subscales	Propensity to use PEDs	
	Correlation (r)	(p-Value)
Five Facet Mindfulness Questionnaire		
Observing	0.04	0.52
Describing	-0.06	0.29
Acting with awareness	**-0.19***	**0.00**
Non-judging of inner experiences	-0.04	0.41
Non-reactivity to inner experience	0.06	0.27
Overall mindfulness	-0.08	0.13
Ryff's Psychological Well-being Scale		
Autonomy	0.01	0.81
Positive relations with others	-0.08	0.81
Environmental mastery	0.04	0.46
Personal growth	**0.16***	**0.00**
Purpose of life	**-0.20***	**0.00**
Self-acceptance	0.09	0.11
Overall psychological well-being	0.00	0.95

r= Pearson's Correlation coefficient * Significance: p<0.05 (2-tailed) # Indicator= Propensity to use PEDs

Table 5. **CROSS TABULATION: PROPENSITY TO USE PERFORMANCE-ENHANCING DRUGS**

Binary mean of 3 items		Subscale: Acting with awareness	
		Disagree	Agree
Agree	*Count*	130.0	191.0
	Expected count	136.2	184.8
	SRD	-0.5	0.05
Disagree	*Count*	16.0	7.0
	Expected count	9.8	13.2
	SRD	2.0** (p=0.08)	-1.7
Binary mean of 3 items		**Subscale: Purpose of life**	
		Disagree	Agree
Agree	*Count*	39.0	282.0
	Expected count	44.8	276.2
	SRD	-0.9	0.3
Disagree	*Count*	9.0	14.0
	Expected count	3.2	19.8
	SRD	3.2** (p=0.02)	-1.3

SRD= Standard Residual Deviation

DISCUSSION

Mindfulness concerns being consciously aware of the present moment in a non-judgemental way. Mindfulness is a way to get oneself unstuck from the future and the past and to become

solely aware of the present moment (Kabat-Zinn, 2008). The current study revealed a weak but significant correlation ($r=0.32$, $p<0.01$) between overall mindfulness and psychological well-being as measured by the *FFMQ* and Ryff's *Psychological Well-being Scale* respectively. The correlation between mindfulness and psychological well-being was expected since previous research has shown a link between the two. According to Brown and Ryan (2003), by adding clarity and vividness to experience, mindfulness might contribute to well-being and happiness in a direct way. Kabat-Zinn (1990) found that the enhancement of mindfulness through training facilitates a variety of well-being outcomes. In addition, mindfulness might be important in disengaging individuals from automatic thoughts, habits and unhealthy behaviour patterns and could, therefore, play a key role in fostering informed and self-endorsed behavioural regulation, which has long been associated with well-being (Ryan & Deci, 2000).

The question that arises from the relationship between mindfulness and PEDs, is the possibility that mindfulness training and interventions might assist in counteracting the use of PEDs. Recent research on substance abuse among young adult's reveal promising results, but at this stage, no research data are available on mindfulness training and interventions on athletes and PEDs (Himelstein, 2011). Regarding the subscales or psychological constructs of the two questionnaires, there were numerous correlations, although they were not robust

(Table 1). The highest significant correlation ($r=0.37$, $p<0.01$) was between 'acting with awareness' (*FFMQ*) and 'self-acceptance' (*Psychological Well-being Scale*). Self-acceptance, according to Ryff and Keyes (1995), is a fundamental feature of psychological well-being and a prerequisite for optimal functioning, improved satisfaction with life and confidence that can lead to greater achievement and acceptance of life as it is.

It is important to bear in mind that the internal consistencies of the subscales of Ryff's *Psychological Well-being Scale* were questionable as the Cronbach's alphas were below what would be considered acceptable (0.70). The three-item scales were used for this study instead of the 14-item or 9-item scales because the survey as a whole became too long. This could have influenced the results obtained since the three-item scales were developed for national telephone surveys and they have a lower internal consistency (Ryff & Keyes, 1995). Therefore, the results from this questionnaire should be interpreted with caution and could be a reason why a higher correlation between the two questionnaires was not found. Recent research on PEDs indicated that direct measurement of PEDs use and related constructs might be affected by response biases and particularly social desirability that might influence the validity of the results (Brand *et al.*, 2011). It is interesting to note that research in this field has also explored the indirect measurement of PEDs (Brand *et al*., 2011; Huybers & Mazanov, 2012).

The primary aim, however, of this research was to determine if mindfulness, psychological well-being and their respective subscales could be linked to the propensity of athletes to use PEDs. It could thus assist in identifying which athletes are more likely to use PEDs and as such the appropriate interventions could be implemented as a preventative measure.

Only two possible predictors were determined using the process of logistic regression and cross tabulation. The predictors included 'acting with awareness' (subscale from the *FFMQ*) and 'purpose of life' (subscale from the *Psychological Well-being Scale*) (Table 4). Thus, it may be possible that athletes who have less awareness (as it relates to mindfulness), and who

lack a clearly defined purpose in life (as it relates to psychological well-being), are more likely to use PEDs.

'Acting with awareness' is one of the five factors that has been identified to represent mindfulness. The other factors are observing, describing, non-judging of inner experiences and non-reactivity to inner experience (Baer *et al*., 2006). Results from this study indicate that only 'acting with awareness' had predictive value. Thus, it may be possible that athletes, who tend to be more aware, will be less likely to use PEDs. Awareness is the background 'radar' of consciousness, continually monitoring the inner and outer environment. One may be aware of stimuli without them being at the centre of attention (Westen, 1998). Most individuals have the capacity to attend and be aware. The researchers, nonetheless, assume that individuals differ in their propensity or willingness to be aware and to sustain attention to what is occurring in the present, and that this mindful capacity varies within persons, because it can be sharpened or dulled by a variety of factors (Brown & Ryan, 2003).

According to Deci and Ryan (1980), open awareness may be especially valuable in facilitating the choice of behaviours that are consistent with one's needs, values and interests (Deci & Ryan, 1980). Therefore, athletes who are more aware may choose not to use PEDs

since they are inconsistent with their values and beliefs. This is in line with the *Disconnected Values Model* (DVM), which has been proposed to decrease doping in sport. It is based on the premise that people are more likely to change their behaviour when they acknowledge the incongruence between their actions (negative habits), and their deepest values and beliefs. The primary purpose of the model is to assist athletes in acknowledging that taking drugs, whether for performance-enhancing or recreational purposes, is a negative habit that might have benefits, but also dire costs and long-term consequences (Murphy, 2005). Studies have shown in the business environment that the DVM provides an effective cognitive-behavioural approach to replace negative habits with positive routines that lead to good health and good job performance (Anshel & Kang, 2007).

If athletes who are less aware are more likely to use PEDs, it might be possible that improving awareness through mindfulness training may be beneficial for these athletes. Most of the research findings indicate that mindfulness could be developed and cultivated (Kabat-Zinn, 1990). Thus, it might be a plausible preventive measure or intervention to decrease doping in sport. Mindfulness-based interventions have multiple components, including mindfulness-practice exercises, didactic instruction and social support (Bishop, 2002). To date, most research on the effects of mindfulness on stress, mood and other indicators of mental health and well-being has been conducted within the context of treatment interventions including *Mindfulness-based Stress Reduction* (MBSR), and *Mindfulness-based Cognitive Therapy* (MBCT) (Kabat-Zinn, 1990; Segal *et al*., 2002). The primary aim of these interventions is to cultivate mindful presence, to facilitate stress reduction and enhance well-being. Controlled and uncontrolled trials with MBSR, MBCT and other mindfulness-based and mindfulness-integrated interventions have demonstrated success in producing these and other effects over both short- and long-term follow-up periods (Baer, 2003; Grossman *et al.*, 2004).

Mindfulness training and research in a sport setting have steadily increased in the last decade, particularly regarding performance enhancement (Gardner & Moore, 2007). Research by Bernier *et al*. (2009) found that sport performance could be enhanced through a programme

based on mindfulness and acceptance. The essence of mindfulness can be captured in the notion of having a present-moment focus. According to Jackson and Csikszentmihalyi (1999) and Ravizza (2002), such a present-moment focus is the essence of peak performance in sport. Therefore, mindfulness training might serve a dual purpose in terms of improving sport performance, as well as decreasing the likelihood of doping.

Regarding the second predictor identified in this study, 'purpose in life' is a central characteristic of psychological well-being, because purpose creates meaning in life. This also relates to Frankl's existential theory, which states that people are motivated and driven mainly by searching for meaning and purpose in life (Shantall, 2003). The question arises: if athletes who do not have a clearly defined purpose in life are more prone to using PEDs, can psychological well-being also be improved with specific training? A study by Edwards and Steyn (2008) found that psychological skills and psychological well-being were inter-related concepts with overlapping components. Therefore, psychological skills training (PST) could possibly play a role in positively influencing this aspect of psychological well-being and consequently decrease the likelihood of an athlete doping.

PST programmes refer to interventions, typically in health and sporting contexts, wherein systematic training of various psychological skills takes place. PST programmes usually adopt an overlapping theoretical and practical approach to the discussion and teaching of skills. They can be applied to a single sport in depth, used at different levels of competition, and the same programme can be adapted and implemented in a variety of life and sport contexts (Wann & Church, 1998). In a study conducted on PST, the results indicate general improvement in psychological skills, psychological well-being and sporting performance (Edwards & Steyn, 2008).

Various limitations of this study should be noted. As mentioned previously, the internal consistencies of the subscales of Ryff's *Psychological Well-being Scale* were questionable and might have influenced the results. Therefore, it is strongly recommended that the 9-item and 14-item scale be used in future studies. A possible reason for identifying only two predictors was that although the athletes were assured that their responses would remain anonymous, they might have not answered the questionnaires completely honestly, specifically the self-constructed questionnaire to determine propensity to use PEDs. Only 3.9% of the athletes in this survey admitted to currently using PEDs. Between 10 and 14% of the athletes indicated that they would consider taking PEDs, depending on what the chances were of being caught out.

PRACTICAL APPLICATION AND CONCLUSION

The results of this study were unexpected regarding the strength of the correlations and the fact that only two possible predictors of PEDs use were identified. However, it appears possible that athletes that are highly mindful and enjoy a sound psychological well-being have a lower inclination to use PEDs. In addition, athletes' awareness and purpose of life could possibly act as predictors with regard to the probability to use PEDs. Mindfulness and psychological skills training might be appropriate interventions for athletes to decrease the likelihood of them using PEDs, as well as to improve their sport performance. Future research specifically regarding mindfulness and psychological skills training within the domain of athlete performance and doping in sport is recommended.

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EFFECT OF A LOW-INTENSITY RESISTANCE EXERCISE PROGRAMME WITH BLOOD FLOW RESTRICTION ON GROWTH HORMONE AND INSULIN-LIKE GROWTH FACTOR-1 LEVELS IN MIDDLE-AGED WOMEN

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ABSTRACT

The effect of a 12-week low-intensity resistance exercise programme with blood flow restriction (LI-BFR) on growth hormone (GH) and insulin-like growth factor-1 (IGF-1) levels in middle-aged women (52.7±7.8 years) was examined. Subjects (N=44) were randomly assigned to the following five groups: control group (CG; n=8), low-intensity (40% of 1RM) resistance exercise group (LI; n=9), high-intensity (70% of 1RM) resistance exercise group (HI; n=9), low-intensity (20% of 1RM) resistance exercise group with a 5% reduction in cuff circumference for blood flow restriction (LI-5% BFR; n=7), and a low-intensity (20% of 1RM) resistance exercise group with a 3% reduction in cuff circumference (LI-3% BFR; n=11). Subjects completed pre- and post-assessments of body weight, percentage body fat, waist-to-hip ratio, muscle strength, GH hormone and IGF-1 levels. A significant effect ($p<0.05$) was observed for waist-to-hip ratio, GH, IGF-1, biceps curls, triceps extensions, leg curls and leg extensions. A significant elevated GH level was observed in HI and LI-5% BFR groups when compared with the control group ($p<0.05$). A significant increase in IGF-1 levels was observed in the HI, LI-5% and LI-3% BFR groups when compared with the LI group ($p<0.05$). Portable cuffs reducing arm and thigh circumferences by 5% were effective in improving GH and IGF-1 levels in middle-aged women.

Key words: Blood flow restriction; Growth hormone; Insulin-like growth factor-1; Resistance exercise; Middle-aged women.

INTRODUCTION

Low-intensity resistance exercise with blood flow restriction can facilitate greater muscular gains than equivalent training without blood flow restriction (Scott *et al*., 2014). Previous studies have suggested that even low-intensity resistance exercise may have a positive effect on skeletal muscles, such as improving muscle mass and strength (Takarada *et al*., 2000b; Madarame *et al*., 2008; Abe *et al*., 2010; Yasuda *et al*., 2010; Loenneke *et al*., 2011). These findings led to the development of blood flow restriction exercise to achieve muscle hypertrophy with 20 to 30% of 1RM intensity (Yasuda *et al*., 2012). It has also been suggested that performance of low-intensity resistance exercise with blood flow restriction (LI-BFR) presents no greater risk than traditional high-intensity resistance exercise (Loenneke *et al*., 2011). As a result, LI-BFR exercise may be an appropriate way to achieve improvement in muscle mass and strength. For example, elderly people need to maintain their strength and muscle mass to decrease the prevalence of osteoporosis (Czarkowska-Paczek *et al*., 2011) and sarcopenia (Forbes *et al*., 2012). However, due to the risk of injury, older people should not maintain a high intensity during resistance exercise. Moreover, for people wishing to gain muscle without having to perform high-intensity resistance exercise (like people needing skeletal muscle rehabilitation), LI-BFR exercise should be of a suitable intensity to achieve their goals.

Even though LI-BFR exercise is beneficial for muscle hypertrophy and gaining strength, the BFR method is not simple. Controlling pressure levels during exercise must always be considered (Loenneke *et al*., 2013a). Therefore, more simple criteria are needed for measuring the pressure during BFR exercise. Previous studies have suggested many different BFR exercise devices, such as elastic wraps, elastic belts with a pneumatic bag inside, nylon pneumatic cuffs, or traditional nylon blood pressure cuffs (Crenshaw *et al*., 1988; Graham *et al*., 1993; Laurentino *et al*., 2008; Karabulut *et al*., 2011; Loenneke *et al*., 2013b;). However, the criteria for pressure levels during BFR are not yet clear. In general, the range of pressure used is higher than that of systolic brachial blood pressure (>120mmHg) (Loenneke *et al*., 2012a; Loenneke *et al*., 2013a).

Most devices are not customised, but instead are set to a universal pressure for all study participants. When using BFR, pressure should differ depending on the individual. During concentric and eccentric contraction, pressures differ among individuals because of differences in arm and leg circumferences (Loenneke *et al*., 2012a; Loenneke *et al*., 2013a). Therefore, the application of the circumference ratio by limiting the blood flow on an individual basis is suggested. This can be accomplished by making the belt shorter than the limb circumference of the subject and marking the length on the belt. It is more convenient to wear a belt fitting the limb circumference of a subject than using an existing pressure regulator.

PURPOSE OF THE STUDY

The purpose of this study was to examine the effects on growth hormone (GH), insulin-like growth factor-1 (IGF-1) and muscle strength in middle-aged women during 12 weeks of LI-BFR by tightening the belt shorter than the limb circumference (3 to 5%) of the subject.

METHODOLOGY

Participants

Forty-four healthy middle-aged women (52.7±7.8 years) were recruited from a gymnasium in Seoul, Republic of Korea and screened with a Physical Activity Readiness Questionnaire (PAR-Q), before participation in this study. Informed and written consent was obtained from all participants prior to starting the study and the Institutional Review Board of the Institute of Sports Science of Dongguk University approved this study. The body mass index of the

subjects was 22.7±2.8kg/m^2. Exclusion criteria included any known orthopaedic problem or cardiovascular, pulmonary, or metabolic disease. None of the subjects were on any medication.

Research design

The subjects (N=44) were randomly assigned to 1 of the following 5 groups: the Control Group (CG; n=8), a Low-Intensity resistance exercise group (LI; n=9), a High-Intensity resistance exercise group (HI; n=9), a Low-Intensity resistance exercise group with 5% reduction in circumference of cuff length for Blood Flow Restriction (LI-5% BFR; n=7), and a Low-Intensity resistance exercise group with 3% reduction in circumference of cuff length for Blood Flow Restriction (LI-3% BFR; n=11). The blood flow was limited by tightening the belt shorter than the limb circumference (3 to 5%) of the subject and marking the length on the belt. All training groups completed pre- and post-training assessments of all variables, including GH, IGF-1 and muscle strength (Figure 1).

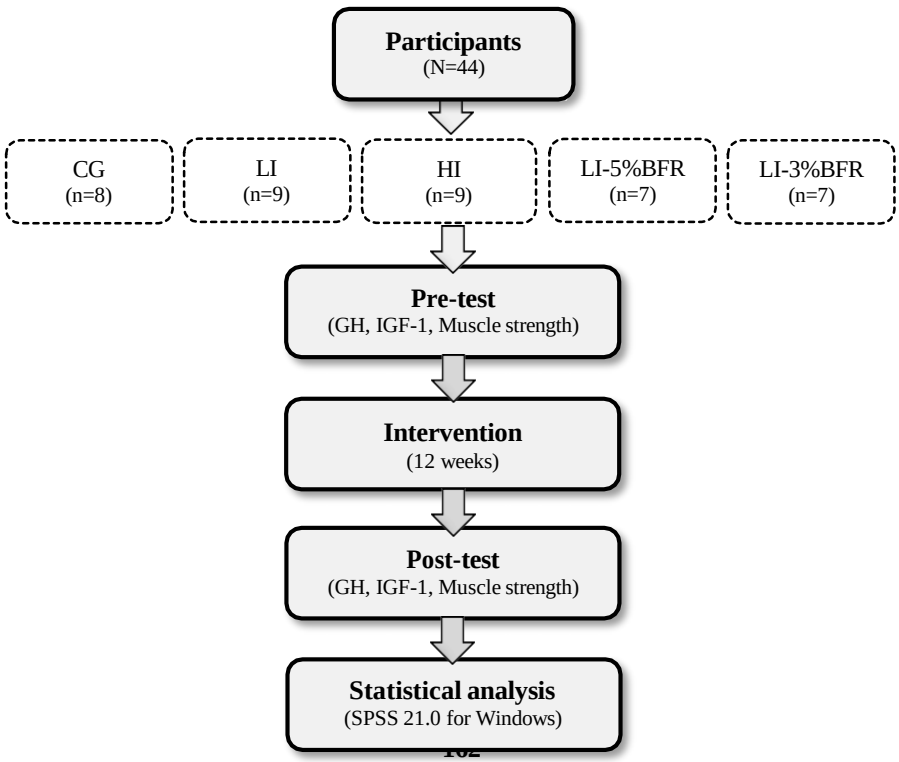

Figure 1. **EXPERIMENTAL DESIGN**

Measurement variables

Anthropometric measures

Height and weight were measured to the nearest 0.1cm and 0.1kg respectively, by using

InBody 720 (Biospace, Seoul, Korea), and the body mass index (BMI) was calculated in kg/m^2. Waist-to-Hip Ratio (WHR) was calculated by dividing the waist circumference by the hip circumference as measured to the nearest 0.1cm by using a standard measuring tape (Hoechstmass, Germany). Body fat was measured by means of bioelectrical impedance analysis (InBody 720, Biospace, Seoul, Korea).

Muscle strength

All subjects warmed up before testing by cycling for 5 minutes on a stationary bicycle. 1RM testing was performed using leg extensions, lying leg curls, biceps curls, and triceps extensions (Cybex, USA), using standard 1RM procedures (Seo *et al*., 2012). After a 1-minute rest period, subjects were familiarised with each of the resistance machines by performing 8 to 10 repetitions with a light load (approximately 50% of predicted 1RM). After a 1-minute rest, subjects performed the full range of exercises with a load approximately 80% of their estimated 1RM. After each successful performance, the weight was increased by 2 to 5kg for each following attempt. The exercises were performed until a failed attempt occurred. Rest periods of 1 minute were taken between each attempt, and 1RM was attained within 5 attempts and a 5-minute rest period separated each test from the next. To facilitate recovery and reduce the effect of fatigue, upper and lower body tests were alternated. All 1RM measurements were recorded in kilograms for subsequent data analysis.

Blood assay

Blood samples were obtained in the morning after a 12-hour fast and collected in Vacutainer® tubes with ethylenediaminetetraacetic acid pre- and post-training. The samples from the subjects were packed in ice and sent to the NEODIN Medical Institute in Seoul, Korea. An immunometric assay (Immulite Analyzer, Diagnostic Products Corp., DPC, Los Angeles, CA, USA), was used for the measurement of serum GH concentrations. The sensitivity of this method was 0.01ng/mL, having intra- and inter-assay coefficient variance percentage of 5.2 and 5.9, respectively. The enzyme-linked immunosorbent assay (ELISA, Diagnostic Systems Laboratories, Dallas, TX, USA), was used to determine serum IGF-I levels. This method had a sensitivity of 0.01 ng/mL, and it had an intra- and inter-assay coefficient variance percentage of 4.9 and 7.7, respectively (Daughaday & Rotwein, 1989).

Exercise training programme with the BFR belt

Subjects in the CG underwent a supervised major muscle stretching exercise programme. Subjects in all training groups performed dumbbell biceps curls, triceps extensions, leg curls and leg extensions 3 times per week for 12 weeks. In the LI group, exercises were performed with an intensity of 40% of 1RM; in the HI group, exercises were performed with an intensity of 70% of 1RM. In the LI-5% BFR and the LI-3% BFR groups, subjects performed exercises with an intensity of 20% of 1RM. They performed 15 repetitions per set and 3 sets per day.

All subjects in the training groups stretched major muscles before and after each training session for 5 minutes. For the BFR exercise group, subjects wore a specially designed BFR

belt (SONU KAAP BELT, Seoul, Korea), on the most proximal portion of both legs and arms during exercise training only. The belt was not the usual rubber material with a high flexibility, but instead was a rigid nylon belt with almost no elasticity. The blood flow was reduced by tightening the belt shorter than the limb circumference (3 to 5%) of the subject and marking the length on the belt. The BFR belt width was 3cm for the arms and 5cm for the thighs (Figure 2).

Figure 2. **BLOOD FLOW RESTRICTION BELTS FOR ARMS AND LEGS**

Statistical analysis

On the basis of the 5 × 2 (group × time), repeated measures design and an anticipated statistical power of 0.80 with an effect size of 0.3, a total sample number of 40 subjects was estimated to be needed for this study (G power program 3.12, Germany). Descriptive variables are presented as mean and SD. One-way analysis of variance (ANOVA) was used to examine baseline differences in participant characteristics between groups. Data analysis was performed by using 5 × 2 repeated-measures ANOVA. When main effects and interactions were significant, 1-way ANOVA was used for identifying significant differences between the groups. Statistical significance was set at $p<0.05$. SPSS 21.0 (SPSS Inc., Chicago, IL, USA) was used to perform all analyses.

RESULTS

Table 1. **PHYSICAL CHARACTERISTICS OF ALL GROUPS**

Variables	**CG** (n=8)	**LI** (n=9)	**HI** (n=9)	**LI-5%BFR** (n=7)	**LI-3%BFR** (n=11)	**p#**
Age (years)	47.8±6.8	55.3±6.2	52.0±2.8	51.7±7.6	53.6±11.3	NS (0.351)
Height (cm)	160.5±3.8	155.7±4.1	158.2±2.7	160.9±6.2	158.5±5.7	NS (0.185)
Weight (kg)	61.5±10.1	54.7±8.6	56.0±4.7	59.1±5.5	55.6±4.6	NS (0.255)
BMI (kg/m^2)	23.8±3.5	22.6±3.6	22.4±2.1	22.9±2.1	22.2±2.8	NS (0.806)
Body fat (%)	32.3±5.4	30.5±5.4	31.4±5.2	28.6±4.0	27.3±5.0	NS (0.218)

BMI=Body Mass Index, CG=Control Group, LI=Low Intensity resistance group, HI=High Intensity resistance group,

LI-5% BFR=Low Intensity resistance with 5% reducing circumference for blood flow restriction,
LI-3% BFR=Low Intensity resistance with 3% reducing circumference for blood flow restriction,
NS=Not Significant # Tested using one-way analysis of variance

Table 2. **CHANGES IN VARIABLES AFTER 12-WEEK INTERVENTION**

Variables	Test	CG	LI	HI	LI-5% BFR
Weight	Pre	61.5±10.1	54.7±8.6	56.0±4.7	59.1±5.5
(kg)	Post	62.1±10.0	54.8±8.8	56.1±4.8	59.1±5.1
Body fat	Pre	32.3±5.4	30.5±5.4	31.4±5.2	28.6±4.0
(%)	Post	32.6±5.2	30.5±5.9	30.1±3.7	27.9±4.1
WHR	Pre	0.99±0.18	0.95±0.05	0.96±0.03	0.95±0.03
	Post	1.00±0.18	0.95±0.05	0.92±0.04#	0.93±0.04
GH	Pre	1.29±0.76	1.09±0.62	1.16±0.96	1.37±0.96
(ng/ml)	Post	1.30±0.80	1.14±0.78	2.12±1.92*#	1.97±1.30*
IGF-1	Pre	177.0±63.0	129.0±35.0	138.0±35.0	167.0±53.0
(ng/ml)	Post	175.0±61.0	134.0±36.0*	203.5±56.0*#	226.3±54.0*#
Biceps curl	Pre	20.8±6.0	18.9±3.1	23.2±2.9	22.1±4.5
(kg)	Post	17.9±8.3	18.8±3.7	26.2±3.1*#	24.9±4.5*#
Triceps extension	Pre	16.9±3.9	16.4±3.9	20.1±3.5	22.7±4.5
(kg)	Post	16.1±3.9	15.6±2.9	22.8±2.9*#	25.1±4.8*#
Leg curl	Pre	40.7±4.6	36.3±6.0	39.2±5.5	30.8±3.3
(kg)	Post	40.2±4.5	35.7±5.8	43.5±7.2*#	34.9±3.2*#
Leg extension	Pre	48.5±7.2	47.2±5.5	51.4±7.5	47.3±4.8
(kg)	Post	47.8±6.6	47.0±5.8	54.6±7.0*#	50.9±3.0*#

a=time b=group c=time x group CG=Control Group LI=Low Intensity resistance group HI=High Intensity resistance group LI-5% BFR=Low Intensity resistance with 5% reducing circumference for Blood Flow Restriction
LI-3% BFR=Low Intensity resistance with 3% reducing circumference for Blood Flow Restriction; WHR; waist-hip ratio.
NS=Not Significant * $p<0.05$ versus CG # $p<0.05$ versus LI Tested 5×2 (group × time) repeated measures analysis of variance

Physical characteristics of the study subjects are shown in Table 1. Average age and height for participants (N=44) were 52.3±7.8 years and 158.6±4.8cm respectively. Differences between groups were not statistically significant at baseline.

A significant ($p<0.05$) interaction effect was observed for WHR, GH, IGF-1, biceps curl, triceps extension, leg curl and leg extension ($p<0.05$). A repeated measure ANOVA revealed a significant ($p<0.05$) main effect over time for percentage body fat, GH, IGF-1, triceps extensions, leg curls and leg extensions. A main effect for the group was also observed for WHR, GH, IGF-1, biceps curls, triceps extensions, leg curls and leg extensions ($p<0.05$). A significant interaction effect ($p<0.05$) was observed for a reduction in WHR in the HI group compared with the LI group. GH showed a significant interaction effect ($p<0.05$) in the HI group compared with the LI and CG group. Elevated GH was observed in the HI group and LI-5% BFR group compared to the CG group ($p<0.05$). In addition, elevated GH was found

in the HI group compared to the LI group ($p<0.05$). Elevated IGF-1 was observed in the LI, HI, LI-5% BFR and LI-3% BFR groups compared with the CG group ($p<0.05$). Moreover, increased IGF-1 was observed in the HI, LI-5% BFR and LI-3% BFR groups compared with the LI group ($p<0.05$). For muscle strength, a significant interaction effect ($p<0.05$) was observed for biceps curls, triceps extensions, leg curls and leg extensions. Muscle strength showed improvement in the HI and LI-5% BFR groups compared with the CG group ($p<0.05$). Furthermore, biceps curls, triceps extensions, leg curls and leg extensions increased in the HI and LI-5% BFR groups when compared with the LI group ($p<0.05$) (Table 2).

DISCUSSION

The main finding of this study was that using both traditional HI as well as LI-BFR resistance exercise with a 5% reduction in circumference result in increased GH, IGF-1, and muscle strength in middle-aged women. Further, a 5% reduction in the length of the portable cuff was more effective than a 3% reduction of circumference for performance of individual BFR resistance exercises.

Findings reported in previous studies have suggested that LI-BFR provides a unique beneficial training mode that promotes muscle hypertrophy and strength (Madarame *et al*., 2008; Loenneke *et al*., 2010; Yasuda *et al*., 2010). Training at intensities as low as 20% of 1RM with moderate vascular occlusion has been reported to result in increased muscle strength within one month because of neuromuscular adaptation (Loenneke *et al*., 2012b). In the current study, using a 5% reduction in belt length lead to improvement in muscle strength ($p<0.05$), GH and IGF-1 levels ($p<0.05$). This suggests that BFR pressure should be applied on an individual basis when using a portable BFR belt. Previous studies reported numerous cuff pressures, such as beginning training pressures of 140 to 160mmHg and final training pressures of 160 to 240mmHg (Takarada *et al*., 2000b; Madarame *et al*., 2008; Abe *et al*., 2010; Yasuda *et al*., 2010; Loenneke *et al*., 2011). However, the pressure of the portable cuffs was unknown, which is why the results of the current study are suitable for individual application.

The potential mechanisms by which BFR exercise stimulates growth include metabolic accumulation, which stimulates a subsequent increase in anabolic growth factors (Pierce *et al*., 2006), fast-twitch fibre recruitment (Takarada *et al*., 2000b), and increased protein synthesis

through the mammalian target of rapamycin (mTOR) pathway (Fujita *et al*., 2007). Increased levels of heat shock protein 72 and nitric oxide synthase-1 and decreased expression of myostatin have also been reported (Kawada & Ishii, 2005).

In general, it is understood that only muscle fibres that are activated during exercise grow because of strength training (Kraemer *et al*., 1996). According to the size principle of motor unit recruitment, small units composed of slow but fatigue-resistant fibres are recruited first; with increasing demands for force or power, increasingly larger units are recruited (Henneman *et al*., 1965). Therefore, the heavy loads typically used in resistance exercise are required to ensure recruitment of the most motor units that are thus exposed to strength training stimulus. However, numerous studies have suggested that recruitment thresholds for motor units decrease during fatiguing exercise at submaximal loads, in order that type II fibres are increasingly recruited as the point of torque failure draws closer (Vøllestad *et al*.,

1984; Sahlin *et al*., 1997; Houtman *et al*., 2002).

Restriction of muscle blood flow has been shown to result in decreased endurance and increased electrical activity of working muscle during performance of low-intensity exercise (Takarada *et al*., 2000b). Thus, it can be postulated that type II muscle fibres are also recruited during very LI-BFR exercise training. These novel theories may explain why an increase in muscle strength was observed in the current study.

Previous studies have demonstrated that circulating GH stimulates synthesis and secretion of IGF-1 within the muscle acting on itself to promote growth (Takarada *et al*., 2000a; Reeves *et al*., 2006; Wilkinson *et al*., 2006; Widdowson *et al*., 2009; Abe *et al*., 2012; Schroeder *et al*., 2013). According to the findings of the current study, LI-5% BFR resulted in enhancement of hormonal responses. The increase in plasma GH concentration was greater in the HI and LI-5% BFR groups than in the CG and LI groups.

Performance of high-intensity resistance exercise can result in acute changes in GH and IGF-1 plasma levels. Changes in the resting levels of GH and IGF-1 after short-term training have also been reported (Kraemer & Ratamess, 2005). In a previous study, performance of LI-BFR exercise training resulted in extensive, acute increases in levels of plasma GH (Takarada *et al*., 2004), which led the authors to speculate that GH may play a part in the muscle hypertrophy observed after this type of training. However, the evidence for a role for GH in exercise- induced muscle hypertrophy is limited.

In terms of this study, there were increases in GH and IGF-1 after HI and LI-5% BFR training. Therefore, it can be speculated that stimulated secretion of GH may play a part in the observed effects of LI-BFR exercise training on muscular hypertrophy.

CONCLUSION

Using portable elastic belts to reduce arm and thigh circumferences by 5% was effective in improving GH, IGF-1 and muscle strength in middle-aged women. In particular, LI-5% BFR resulted in similar increases in GH and IGF-1 levels compared with traditional high-intensity resistance exercise. It was demonstrated that using LI-5% BFR resulted in similar improvements in muscle strength compared with traditional high-intensity resistance exercise.

These findings have potential implications for exercise specialists who prescribe exercises to improve muscle strength and hypertrophy. In addition, low intensity of resistance exercise with blood flow restriction with portable cuffs has potential application for rehabilitation training programmes for athletes and the elderly. Finally, improvements in muscle strength with low intensity resistance exercise training could also be advantageous during various sport activities.

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LEAN BODY MASS AS A PREDICTOR OF PERFORMANCE OF YOUNG IRANIAN ELITE WEIGHTLIFTERS

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ABSTRACT

The aim of this study was to evaluate the relationships of body composition and anthropometric variables with the performance of young Iranian elite weightlifters. Forty-two subjects (age 16.21±3.22 years) volunteered to participate in the study. All subjects competed at the Iranian National Championship. Body composition and anthropometric variables including lean body mass (LBM), body mass index (BMI), percentage body fat (%BF), height, shoulder circumference, chest circumference, waist to hip ratio (WHR), as well as the performance of the weightlifters (snatch;

clean & jerk; front squat; back squat), were measured. The results showed a strong correlation between LBM and the performance of the weightlifters ($p \leq 0.001$). Moderate correlations between the remaining body composition variables and the performance of the weightlifters were obtained. However, low negative correlations were found between the performance of the weightlifters and the %BF and WHR values. It can be concluded that there was a relationship between LBM and weightlifting performance. However, weak negative relationships existed among %BF and WHR with the performance of weightlifters. Therefore, LBM was the major determinant in weightlifting, while %BF played a very small role in the determination of weightlifting performance.

Key words: Weightlifting performance; Body composition; Elite weightlifters.

INTRODUCTION

Success in performing professional sport depends on motor skills, psychological conditions and body composition variables (Pietraszewska *et al*., 2015). Body composition variables refer to the relative amounts of fat and fat free mass (FFM) (muscle, bone and water) (Newman *et al*., 2006; Ayan *et al*., 2012; Martín-Matillas *et al*., 2014). Basically the human body is composed of fat mass (FM) and FFM (Baumgartner & Jackson, 1998; Wang *et al*., 2001; Siahkouhian *et al*., 2006; Siahkouhian & Hedayatnejad, 2010).

FM which is expressed as a %BF, referred to as relative body fat, is obtained by dividing the FM by the total body mass. The average %BF is 15% for men and 23% for women (Jackson & Pollock, 1985). Exact %BF cannot be precisely determined, but multiple methods (formula, skin fold thickness and bioelectrical impedance calculations), are used to estimate %BF (Adeyemi *et al*., 2009; Martín-Matillas *et al*., 2014).

On the other hand, LBM (Lean Body Mass) is a theoretical value developed by Behnke (1985). LBM is considered as an in vitro entity relatively constant in water, organic matter and mineral content. The terms LBM and FFM are often incorrectly used interchangeably. FFM contains no lipids, whereas LBM includes approximately 2 to 3% and 5 to 8% fat, for men and women respectively (Heyward & Wagner, 2004; Buśko & Lipińska, 2012). Behnke (1985) points out that FFM refers to an in vitro entity appropriate for body analysis. The literature indicates considerable variations in the LBM of different athletes, with values ranging from a low of 48.1kg in some jockeys to over 100kg in football linemen and field-event athletes. Seven elite sumo wrestlers had an average LBM of 109kg (Skinner *et al*., 2014).

It has been established that the relationship between body mass and lifting performance is not linear in Olympic weightlifters. This relationship has been frequently studied in Olympic weightlifting (Cleather, 2006). To determine the extent to which age and body mass of elite Olympic weightlifters are related to and predictive of indirect estimates of absolute and relative muscular power, Ploutz-Snyder (2003) showed that all predictor variables were significantly ($p<0.05$) predictive of the dependent variables, but the magnitude of associations and extent of predictive ability were significantly ($p<0.05$) higher among males than females. According to these results, Ploutz-Snyder concluded that the extent to which age and body mass explain differences in muscular power, differs between female and male

weightlifters, but the rate of decline in power with advancing age is similar and is in agreement with previous reports for world record holders (Ploutz-Snyder, 2003). On the other hand, Stone *et al*. (2005) indicated that independent of body mass and height differences, maximum strength is strongly related to weightlifting performance.

Problems in comparing the performances of Olympic weightlifters arose from the fact that the relationship between body mass and weightlifting results was not linear. Therefore, Kauhanen *et al*. (2002) examined this relationship by using a nonparametric curve fitting technique of robust locally weighted regression on relatively large data sets of weightlifting results from top international competitions. These results have shown that existing formulas commonly used in normalising the performances of Olympic weightlifters did not yield satisfactory results when applied to the present data. It was concluded that the devised formulas may provide objective means for the evaluation of male weightlifter's performances, regardless of their body mass, age or performance levels (Kauhanen *et al*., 2002).

To assess factors that limit human muscle strength and growth, Ford *et al*. (2000) examined the relationship between performance and body dimensions in the world weightlifting champions between 1993 and 1997. Their findings suggest a nearly constant fraction of body mass is devoted to muscle in lighter lifters and a lesser fraction in heavier lifters. Analysis also suggests that contractile tissue comprises ~30% less body mass in female champions (Ford *et al*., 2000).

PURPOSE OF THE STUDY

Despite a wide variety of studies (Byers *et al*., 2008; Koley *et al*., 2010; Tysz, 2010; Giatsis *et al*., 2011; Muhumbe & Van Gent, 2014; Ammar *et al*., 2015), there is no comprehensive data about Iranian World and Olympic weightlifting champions. Due to a lack of data regarding body composition and anthropometric variables and its relationships to the performance of young elite weightlifters, the purpose of this study was to evaluate the relationships of body composition and anthropometric variables with the performance of young Iranian elite weightlifters.

METHODOLOGY

Experimental design and subjects

Young elite male weightlifters (N=42), who volunteered to participate in the study signed an informed consent document prepared and approved by the Board for Protection of Human Rights affiliated at the University of Mohaghegh Ardabili. They were healthy volunteers with no history of cardiovascular disease, orthopaedic problems or other medical conditions that would contra-indicate exercise (age 17.56±2.78 years; height 169.43±6.36cm; mass 71.08±16.39kg). All the subjects were professional weightlifters with an average of 4 years lifting experience in the weightlifting championships. Snatch, clean and jerk, front squat and back squat attempts of the weightlifters were measured during the last pre-competition micro- cycle.

Procedure

All of the subjects completed a 15-minute warm up at 60 to 75% of their personal records, before physical test protocols were performed. Each training session was conducted and monitored by the researchers. The subjects were encouraged to exert maximal effort on all tests. Following the initial evaluations, subjects were instructed to maintain the same level of physical activity (PA).

Anthropometric and body composition measurements

The %BF was predicted by the 3 points skinfold measurement (chest, abdomen and thigh), which was taken on the right side. Measurements were taken when the skin was dry and not sweaty. To eliminate inter-observer variability, only 1 highly trained investigator performed these procedures. The Lafayette standard calliper was used to measure the skinfold thickness in millimetres. Relative body fat was calculated using the Siri equation (Siri, 1961). All anthropometric and body composition variables were measured 14 hours after the last training session. Pollock and Wilmore methods were used to measure anthropometric values (Jackson *et al*., 1978). All subjects were encouraged to use a balanced fluid intake before the body composition measurements.

Height was measured to the nearest centimetre using a Seca stadiometer. To measure the height, the subjects stood erect with their backs touching the stadiometer, their arms held laterally by their sides and their feet closely together. The mass of each subject was measured to the nearest kilogram using a Seca scale. The body mass index (BMI) was calculated using the height (m) and mass (kg) measures [mass/height^2]. The shoulder, chest, waist and hip circumferences were measured to the nearest centimetre using a measuring tape, while the subject was standing erect (Siahkouhian & Hedayatnejad, 2010).

Lifting performance measurements

During normal training, consisting of 2 workouts per day, each weightlifter warmed-up for 15 to 20 minutes and the recording process followed. All lifting exercises were performed under supervision of 3 international level judges.

Statistical analysis

The data were analysed using descriptive and inferential statistics for anthropometric, body composition and performance variables. Pearson correlation coefficient (R) was applied for understand the overall relationship between body composition, anthropometric and performance variables. All data were tested for normality using Kolmogorov-Smirnov test.

RESULTS

The mean values of the anthropometric and body composition characteristics of the subjects are listed in Table 1.

Table 1. **CHARACTERISTICS OF THE SUBJECTS: ANTHROPOMETRIC, BODY COMPOSITION AND PERFORMANCE MEASURES**

Variables	Mean±SD
Age (year)	17.56±2.78
Height (cm)	169.43±6.36
Mass (kg)	71.08±16.39

Body fat (%)	19.47±9.75
Lean body mass (kg)	51.91±13.49
Waist to hip ratio	0.79±0.069
Body Mass Index (kg/m^2)	23.91±4.85
Shoulder circumference (cm)	111.45±18.25
Chest circumference (cm)	95.11±16.22
Snatch record (kg)	79.85±25.71
Clean & Jerk record (kg)	98.23±23.47

Analyses by means of the Pearson correlation revealed significant positive high correlations of LBM with the snatch, clean and jerk, front squat and back squat records (Figure 1). On the other hand, weak negative relationships among %BF and WHR with the performance of the weightlifters were found. The results also revealed moderate relationships of body composition and anthropometric variables with the performance of the weightlifters (Table 2).

DISCUSSION

A low %BF has been shown to improve performance in endurance activities, while a large muscle mass is important during strength and power events (Heyward & Wagner, 2004). Despite low negative %BF and WHR correlations with the performance of the weightlifters, except for LBM, results revealed moderate significant positive correlations of body composition and anthropometric variables with the performance of the weightlifters. The strong positive correlation between the performance of the weightlifters and LBM implies that this parameter is the major determinants in the weightlifting.

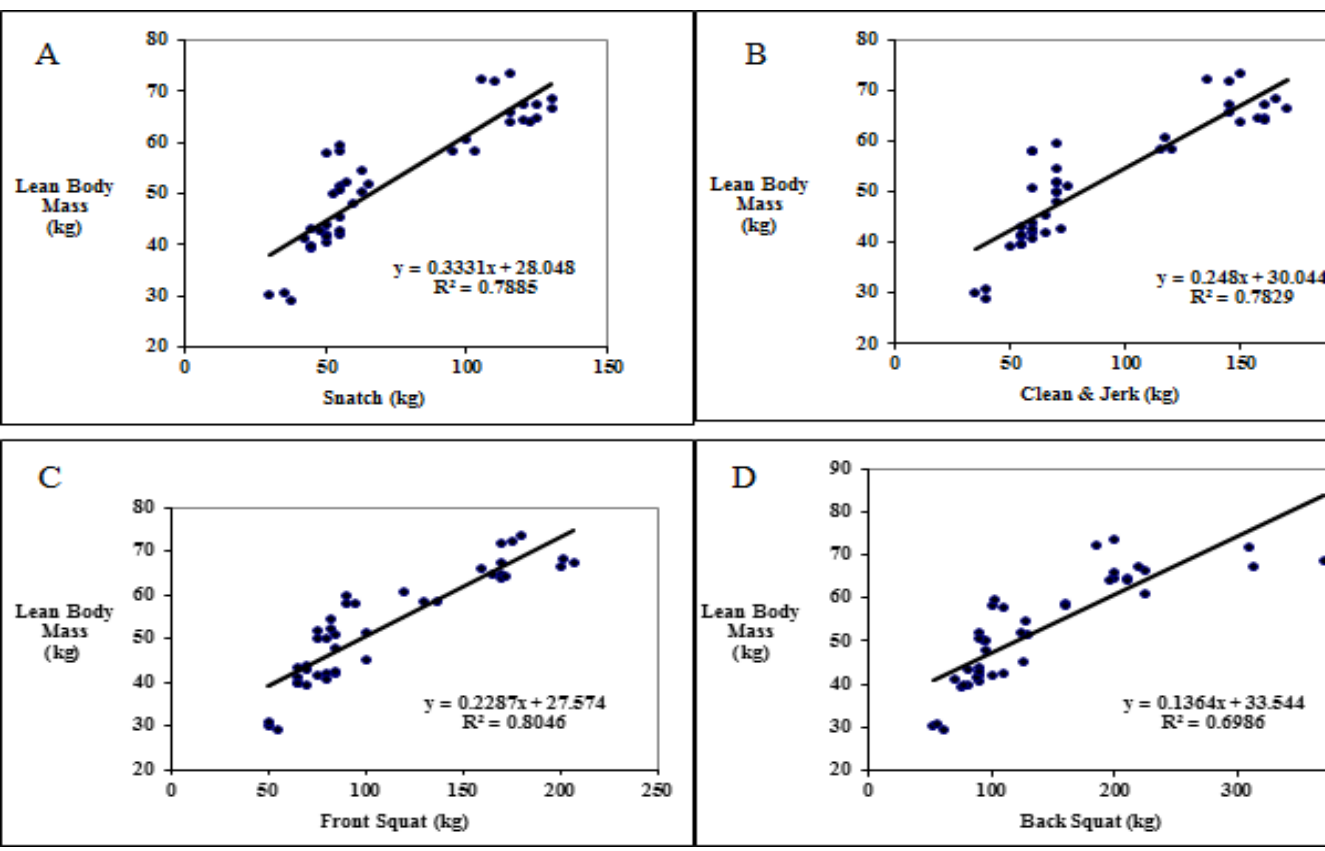

Figure 1. **PEARSON CORRELATION COEFFICIENT OF LBM WITH THE SNATCH (A), CLEAN & JERK (B), FRONT SQUAT (C) AND BACK SQUAT (D) RECORDS**

Table 2. **CORRELATION AMONG ANTHROPOMETRIC, BODY COMPOSITION AND PERFORMANCE VARIABLES**

Variables	Snatch	Clean & jerk	Front squat	Back squat
Body Fat (%)	-0.244	-0.235	-0.180	-0.183
WHR (%)	-0.220	-0.194	-0.148	-0.142
Mass (kg)	0.450**	0.459**	0.511***	0.465**
BMI (kg/m^2)	0.375*	0.374*	0.442**	0.393**
Shoulder circumf. (cm)	0.544***	0.544***	0.741***	0.674***
Chest circumf. (cm)	0.544**	0.544***	0.571***	0.507***

WHR=Waist to Hip Ratio BMI=Body Mass Index Circumf.=Circumference
Significance: * $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

Negative correlations of %BF and WHR were observed regarding the performance of the weightlifters. This result was in contrast with findings of Stone *et al*. (2005), who assessed the relationship of maximum strength to weightlifting ability using established scaling methods. Their results indicated that maximum strength is strongly related to weightlifting performance, independent of body mass and height differences. Also, regarding the relationship between body mass and weightlifting abilities, Kauhanen *et al*. (2002) showed that the devised formulas may provide objective means for the evaluation of performances of the male weightlifters, regardless of their body mass, age or performance ranks.

These findings, while not congruent with those obtained by Kauhanen *et al*. (2002) and Stone *et al*. (2005), correspond with the findings of Ford *et al*. (2000), who revealed that maximum mass lifted by elite weightlifters varied almost exactly with height squared. This suggests that muscle mass scaled almost exactly with height cubed and that muscle cross-sectional area was closely correlated with body height, possibly because height and the number of muscle fibres in a cross-section are determined by a common factor during maturation. The ratio of mass lifted to a mean body cross-sectional area was approximately constant for body-mass classes of ≤83kg for men, which decreased abruptly for higher mass classes. The findings suggest a nearly constant fraction of body mass devoted to muscle in lighter weightlifters and a lesser fraction in heavier weightlifters.

Insignificant negative relationships of %BF and WHR with the performance of the weightlifters are notable. These relationships may be due to the relatively small sample and magnitude of standard deviations. It should also be noted that weightlifting is a power and strength-based sport and it is obvious that increased power and strength result in increased performance. Similarly, strong positive relationships between weightlifters' performance and LBM indicate the importance of LBM in the weightlifters' performance predictions.

CONCLUSION

According to the results, it could be concluded that there is a relationship between LBM and weightlifting performance. However, weak negative relationships exist among %BF and

WHR with the performance of the weightlifters. Therefore, LBM is the major determinant in weightlifting, whereas %BF plays a very small role in the determination of weightlifting performance.

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ENGAGEMENT AS A SOURCE OF POSITIVE CONSUMER BEHAVIOUR: A STUDY AMONGST SOUTH AFRICAN FOOTBALL FANS

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ABSTRACT

Football in South Africa (SA) has enjoyed significant commercial growth in recent years. No research has been conducted on the properties of fan engagement of South African football fans. In this study, the reliability and validity of the Fan Engagement Scale (FES) in a context of South African football fans were explored. Further, the potential of fan engagement as a predictor of positive consumer behaviours (match attendance and merchandise expenditure) was evaluated. Participants were 806 football fans who support various teams in the Premier Soccer League (PSL). Information was obtained through self-report measures that participants completed. The research was conducted at stadiums during football matches. A cross-sectional, quantitative research design was implemented. Structural equation modelling revealed a reliable and valid three-factor structure for the FES. The structural paths between fan engagement and match attendance, as well as fan engagement and expenditure on team merchandise, were established. The results strengthen the theory of fan engagement, which flows from customer engagement theory by providing contextual literature specific to South African football fans. A case in terms of the need for focused fan engagement strategies to further promote the industry was put forward and a number of strategies were proposed.

Key words: Fan engagement; Customer engagement theory; Consumer behaviour; Structural equation modelling; Football; South Africa.

INTRODUCTION

Football remains SA's most prominent sport from a spectator perspective, attracting millions of viewers annually through live and television (TV) audiences (Gedye, 2007). The Department of Sport and Recreation (2014) has outlined that the sport continually entices large numbers of people, who share a deeply rooted passion for the game and are willing to invest significant resources to display their support for it. Inspired by the heightened emphasis brought about through the 2010 FIFA World Cup, which was hosted in SA, football has seasoned as a strategic economic resource and sustains its momentum as a business where direct investment and product consumption can occur (Cornelissen *et al*., 2011).

Saayman and Rossouw (2008) elucidated that a percentage as large as 54% of the entire South African population follows the sport. Adonis (2011) has commentated that the business

of football in SA is evolving unremittingly, despite challenging economic circumstances.

This is illustrated by extended investment through the private sector, such as internationally recognised sport broadcaster SuperSport, who invested R1.6 billion in securing sole distribution rights to the PSL, the flagship professional football competition in the country; and ABSA bank, a member of the international Barclays Group, who invested more than R500 million in 2007 to ensure its servicing of the PSL as title sponsor. Large corporations generously contribute to the sport through sponsorships in an effort to strategically leverage the forerunning football clubs in the country's well-documented fan following.

Parallel to the global development of the sport industry, football in SA has benefitted from large numbers of loyal consumers who continue to engage through meaningfully interacting with and investing resources in the sport despite difficult economic circumstances (Hanold, 2012). Yet, no research has been conducted to investigate fan engagement in the realm of South African football. The sport, which has proven a vehicle to which direct investment is attracted, is a key strategic commercial resource within the broader tourism and leisure sector, and enjoys sustained consumer engagement from its fans; yet no research has attempted to gauge the properties of such fan engagement. This represents an important research and pragmatic gap.

Conceptualising sport fan engagement

A sport fan refers to someone who has a key interest and is investing, either financially or emotionally, in a particular sport, team or individual athlete (Wann *et al*., 2001). Yoshida *et al*. (2014) were the first authors who attempted to formally outline the phenomenon of sport fan engagement. The concept, which essentially emerged from the customer engagement theory, is rooted in the notion that consumers make both a cognitive and behavioural decision to invest resources in a particular product (Brodie *et al*., 2011). In the domain of sport, the consumer refers to the fan; who invests monetary and other resources in their following of sport, experience such investment as meaningful and rewarding and participate in consumption with a broad range of stakeholders - from their co-fans to the management teams of their favourite teams. Fan engagement is postulated in relation to a specific sport team that the fan chooses to support (Cialdini *et al*., 1976). It entails a firm commitment of an individual to promote the interests of his or her chosen sport team (Yoshida *et al*., 2014). According to Yoshida *et al*. (2014), three dimensions of sport fan engagement can be distinguished, namely management cooperation, prosocial behaviour and performance tolerance.

Management cooperation

Management cooperation describes the willingness that sport fans display to make a cooperative and constructive contribution to the management of their preferred sport teams. This may refer to abiding by the code of stadium conduct that the team's management prescribes, actively giving feedback as to how fan experiences can be enhanced or contribute to make a specific event more enjoyable (Auh *et al.*, 2007). Sport fans have the need to perceive their input on the strategic decisions of their teams or clubs as important and will be more engaged when they perceive community between themselves and the management teams of their favourite teams (Doherty, 2013; Kanosue *et al*., 2015).

Prosocial behaviour

Prosocial behaviour refers to the meaningful interaction sport fans seek with fellow spectators; either directly through attending games together at the stadium, or indirectly

through interface on social media platforms. It refers to the level of communication that occurs between fans on various discussion platforms. Prosocial behaviour manifests in building networks with other fans, either in person or virtually, in an effort to share information about the team or to attract more fans (Brodie *et al*., 2011; Doherty, 2013; Yoshida *et al*., 2014).

Performance tolerance

Performance tolerance as a dimension of sport fan engagement implies the willingness sport fans have to engage with their favourite sport teams regardless of the success that those teams achieve. Kanosue *et al*. (2015) refer to this as the loyalty that engaged fans have to their preferred teams. It manifests in observable behaviours, such as wearing the merchandised apparel of such a sport team, or displaying the logo of such a team, even during a season without many wins (De Ruyter & Wetzels, 2000).

In an effort to empirically assess the fan engagement dimensions, Yoshida *et al*. (2014) developed the Fan Engagement Scale (FES), a psychometrically valid and reliable three-factor instrument designed specifically to measure levels of fan engagement in fans from different sporting codes. The measure assesses the fan engagement dimensions by investigating responses on multiple statements loading onto a particular dimension. These fan engagement dimensions have been found to be reliable (Yoshida *et al*., 2014). To add to its scientific robustness, the FES must be investigated in a South African context, where sport plays a critical economic role. In this study, the FES will be applied in a sample of South African football spectators who are fans of the most followed sport in SA. Based on the psychometric properties of the FES established in previous studies, as well as the literature, the following hypotheses are proposed:

Hypothesis 1: FES will hold a three-factor structure in a sample of South African football fans.

Hypothesis 2: FES will be reliable and valid for use in a South African football fan context.

Sport fan engagement and positive consumer behaviour

An increasing body of research knowledge suggests that fan engagement plays a significant role in facilitating positive consumer outcomes amongst spectators of sport (Bristow & Sebastian, 2001; Humphries & Smith, 2006; Allison, 2013). The engaged fan is likely to display desired behaviours that are directed at benefitting his/her favourite sport or team, such as consuming its endorsed products, frequently attending key events and interacting with fellow fans on a level that creates social community (Swanson *et al*., 2003). From the perspective of consumerism, the link between fan engagement and positive consumer behaviour is best explained by the model of Hawkins *et al*. (1998). This model argues that the decision to exhibit particular positive consumer behaviour is influenced by both long term rational decisions and short term affective considerations.

When there is an alignment between these factors and the sport team the fan supports, such a fan will be engaged and subsequently enticed to display positive behaviours, such as purchasing branded merchandise of that team (Hawkins *et al*., 1998). This model is in line with customer engagement theory, which suggests that a consumer will induce a behavioural action following a cognitive or affective connection to a product (Brodie *et al*., 2011). In this study, the relationship between fan engagement, match attendance and team merchandise

expenditure in the context of South African football fans, will be investigated.

Sport fan engagement and match attendance

Match attendance refers to the frequency with which football fans attend games at the stadium, thus selecting to rather physically attend a game as alternative to following it on the TV. Hall (2009) has argued that several factors influence the decision of a sport fan to go to the stadium, ranging from enjoyment value to the motive of socially interacting with other people at the event. The engaged fan will more likely attend games at the stadium, as this provides the fan with the platform to meaningfully contribute to the dimensions of engagement (Yoshida *et al*., 2014).

When a sport fan is engaged with the offerings of his/her preferred club, such a fan is likely to experience a higher level of allegiance to the club, which in turn harnesses identification and moves the person to more frequently look for opportunities to attend matches (Wann *et al*., 2004; Funk *et al*., 2012). Stadium attendance for sport events is a major creator of revenue, to both cities and regions, as well as the host teams of events, however, in recent years it has been in steep decline (Ross, 2006). By investigating the relationship between fan engagement and match attendance in the context of South African football fans, this study aims to make a contribution in providing a framework to develop engagement strategies to attract fans to the stadium. The hypothesis is:

Hypothesis 3: Fan engagement predicts match attendance.

Sport fan engagement and merchandise expenditure

Regarding match attendance, this study also postulates that fan engagement will predict higher levels of merchandise expenditure amongst South African football fans. Merchandise refers to products that are unique to the particular sport team the fan supports and includes clothing bearing the logo and colours of such team, the team match apparel, unique artefacts and branded consumer items that displays support for such sport team. It is the licensed products that commercially belong to the sport team and from which an income is generated through retail.

Martin (2013) has proven that the commitment, loyalty and motivation of sport fans are directly related to their level of expenditure as pertaining to licensed team products and merchandise. Funk *et al*. (2012) argue that engagement is a key motivator of expenditure on team merchandise amongst sport fans, as engagement represents an emotional attachment between the fan and the brand of his/her preferred team, kindling a sense of reward as perceived by such a fan when purchasing merchandised product.

Merchandising forms an integral part of the business generated through the sport industry. PricewaterhouseCoopers (2011) predicted that revenue generated from sport merchandising will amount to US$20.1 billion in 2015. Although no such forecasts are available for SA, one can reasonably argue that merchandising also fulfils an important role in the commercial success of local football. Based on the theory and literature outlined above, this paper argues that:

Hypothesis 4: Fan engagement predicts expenditure on merchandise.

Figure 1 serves as a schematic representation portraying the research model.

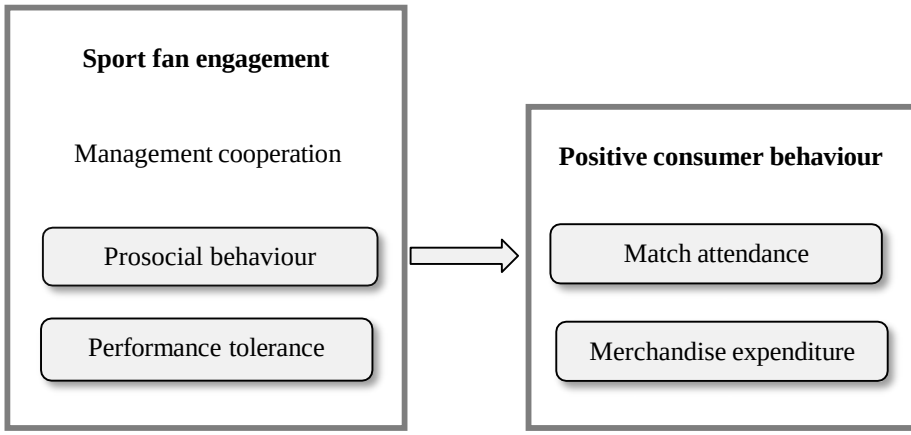

Figure 1. **RESEARCH MODEL**

METHODOLOGY

Research design and participants

This research was conducted by means of a quantitative, cross-sectional design. Participants were fans from different football teams.

A diverse sample of participants was gathered through the research. The research was conducted on site at PSL games at the stadiums. The mean age of the participants was 35.06±10.62. The detailed demographic information of the participants is revealed in Table 1. With reference to gender, the majority of the participants were male (543, 70.80%). Concerning ethnicity, the majority were black people (685; 91.80%) followed by coloured people (34, 4.56%). In terms of education the majority had general high school education (Matric; 301, 46.45%), followed by less than a general high school education (less than Matric; 198; 30.56%). Furthermore, the majority of the sample attended 4 or more matches per year (565; 75.43%).

Table 1. **DEMOGRAPHICS OF PARTICIPANTS**

Variables	Category	Frequency	%
Gender	Male	543	70.80
	Female	224	29.20
Ethnicity	Asian people	6	0.80
	Black people	685	91.80
	Coloured people	34	4.60
	White people	15	2.00
	Other people	6	0.80
Education	Less than higher certificate	198	30.50
	Higher certificate	301	46.40

	Degree	96	14.80
	Post-graduate degree	53	8.20
Match attendance	One match per year	49	6.50
	Two matches per year	76	10.10
	Three matches per year	59	7.60
	Four or more matches per year	565	75.40
Expenditure	< R1000 per year	263	35.30
	> R 1000 but < R 2000 per year	221	29.70
	> R 2000 per year	260	34.90

% = Valid percentage taking missing values into account

Measuring instruments

Fan Engagement Scale (FES)

The FES, developed by Yoshida *et al*. (2014), was used to assess the levels of fan engagement of the participants. The FES measures fan engagement on its 3 dimensions by asking respondents to answer 3 items per dimension. An example item for the dimension of management cooperation is, "I do things to make my team's event management easier". The dimension of prosocial behaviour is, for example, assessed through the item "I often advise other fans on how to support my team". For the dimension of performance tolerance, an example item is "I display the logo of my team on my clothing even if they have an unsuccessful season". The FES is measured on a 7-point Likert type scale with responses ranging from *strongly disagree to strongly agree.* Yoshida *et al*. (2014) has established internal consistency of 0.86 for the FES through Cronbach alpha coefficients. [A copy of the FES is provided in the Addendum as reference for the readers.]

Biographical questionnaire

This questionnaire compiled by the researchers, was utilised to assess levels of match attendance and merchandise expenditure of the fans participating in the study. Stadium attendance was measured through a 4-point frequency scale. The participants could select either, *1 game per year, 2 games per year, 3 games per year* or *4 or more games per year*. Merchandise expenditure was measured through a 3-point ordinal scale. Participants were asked to indicate the amount (in Rand) that they spend annually on the merchandise of their favourite football team. The possible responses included, *less than R1000 per year, more than R1000, but less than R2000 per year* and *R2000 or more per year*.

Procedure

Permission was obtained from a large South African professional football club to conduct the research at the stadium during a number of the home games. A research station was set up at the stadium. This station operated for 2 hours before a game, as well as 1 hour afterwards. Prospective participants were approached by the researchers and were asked to complete the surveys. Participants were thoroughly briefed on the nature, intent and outcomes of the research. They were also briefed on the confidential nature of their responses, which would only be utilised for research purposes. The research was entirely voluntary and participants were informed that they were under no obligation to complete the survey, and could withdraw from the research at any time. An informed consent letter accompanied the instrument, outlining the nature and scope of the research project and participants had to sign such informed consent letter before participating in the study.

Statistical analysis

Structural equation modelling was implemented with Mplus 7.31 (Muthén & Muthén, 2015). Firstly, to investigate the factor structure of the FES, confirmatory factor analysis was applied with the maximum likelihood estimator (Brown, 2015). Comparing the models and the fit of the models would be considered by means of the chi-square value (lowest value indicating the best fitting model), comparative fit index (CFI), Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). For the CFI and TLI acceptable values are 0.90 and above, whereas the RMSEA value is considered acceptable at values of 0.08 and below (Van de Schoot *et al*., 2012).

For the structural model, the outcome variables (match attendance and expenditure on merchandise) were added to the model. Specifically, the dimensions of fan engagement were regressed on the outcomes variables, and the beta coefficient values would be used to determine the size and direction of the relationships. The fit of the model to the data was also considered in terms of the fit indices specified above. For the correlation coefficients, values of 0.30 and above would be considered as medium practical effect, 0.50 and above as large practical effects, and values of 0.85 and above as problematic in terms of construct validity, specifically discriminant validity (Brown, 2015). Shared variance and average variance extracted by constructs will also be considered (Farrell, 2010). All parameters in the model are considered statistically significant at an alpha level of 0.05 ($p \leq 0.05$).

RESULTS

Confirmatory factor analysis of the FES

Table 2 presents the results of the competing models.

Table 2. **RESULTS OF CONFIRMATORY FACTOR ANALYSES**

Description	χ^2	df	CFI	TLI	RMSEA
One-factor model	785.93	27	0.79	0.72	0.20
Three-factor model	128.18	24	0.97	0.96	0.07

χ^2=Chi-square; df=degrees of freedom; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index; RMSEA=Root Mean Square Error of Approximation

As can be seen from the results, the 3-factor model was the best-fitting model. The CFI (0.97), TLI (0.96), and RMSEA (0.07) were below the set cut-off points. It has been stated that universal cut-offs for fit indices should not be stringently adhered to and only be used as rules of thumb. The correlations between the 3 factors were below the threshold 0.85 set as cut-off for discriminant validity concerns (rs=0.63-0.78), and the shared variance between the constructs were below the average variance extracted by each construct (Farrell, 2010). Therefore, these results support H_1.

Table 3. **FACTOR LOADINGS FOR FES CONSTRUCTS**

Latent variable	Item	Standardised Loading	Standard Error	p-Value	R-square
MC	FES1	0.80	0.02	0.001	0.64
	FES2	0.83	0.02	0.001	0.70
	FES3	0.82	0.02	0.001	0.68
PB	FES4	0.77	0.02	0.001	0.60

	FES5	0.82	0.02	0.001	0.67
	FES6	0.53	0.03	0.001	0.28
PT	FES7	0.88	0.01	0.001	0.77
	FES8	0.88	0.01	0.001	0.78
	FES9	0.85	0.01	0.001	0.71

MC=Management Cooperation; PB=Prosocial Behaviou; PT=Performance Tolerance

In terms of the factor loadings (λ), it can be seen that all of the items loaded significantly on their corresponding factor. The items with the lowest factor loading was item FES6 (λ=0.53). This item reads, "I spend time on social media (Facebook, Twitter) sharing information with other fans of my team", with the latent variable explaining 28% of the variance in that item. The highest factor loading was for items FES7 and FES8, both with standardised factor loadings of 0.88, and the latent variable declaring 77% and 78% of the variance in those items respectively. Thus, given the significant factor loadings and explained variances, as well as the overwhelming better fit of the 3-factor model (significantly better fit), compared to the 1-factor model, it was decided to continue with the 3 components for the structural model.

Fit statistics, reliabilities, correlations and regressions for the structural model

The structural model was also shown to be a good fit to the data with the addition of the 2 outcome variables, namely match attendance and expenditure on merchandise. Specifically, the following values were shown: CFI (0.98), TLI (0.96), and RMSEA (0.06) indicating superior fit.

Based on this well-fitting model, the following results are reported, namely the correlation matrix with Cronbach's alpha reliabilities and then a table containing the outcome of the regression analysis. As can be seen from Table 4, the 3 FES dimensions had acceptable reliability estimates ($\alpha \geq 0.70$) attesting to the internal consistency of the scales (supporting H_2). As match attendance and expenditure was measured by 1 item, calculating reliability coefficients was not practical and was, therefore, not applicable. Furthermore, the correlation coefficients were all statistically significant. Specifically, the 3 FES variables were all practically significantly correlated with each other with large effects. Attendance had a borderline medium correlation with performance tolerance (r=0.29). Expenditure was correlated with management cooperation (r=0.31), prosocial behaviour (r=0.32) and match attendance (r=0.46) with medium effect sizes. The structural regression values are given in Table 5.

Table 4. **RELIABILITY COEFFICIENTS AND CORRELATION MATRIX**

Variable	Reliability α	r 1	2	3	4	5
1. MC	0.85	—				
2. PB	0.70	0.77**	—			
3. PT	0.90	0.63**	0.78**	—		
4. Match attendance	n/a	0.18	0.23	0.29	—	
5. Expenditure	n/a	0.31*	0.32*	0.27	0.46*	—

n/a=Not applicable; * =medium effect; ** =large effect; All correlations $p < 0.001$;
MC=Management Cooperation; PB=Prosocial Behaviour; PT=Performance Tolerance

Table 5. **REGRESSION PATHS OF RESEARCH MODEL**

Regression relationships	Standardised Estimate	Standard Error	p-Value	Significance
MC → Attendance	-0.001	0.075	0.990	None
PB → Attendance	0.016	0.106	0.879	None
PT → Attendance	0.275	0.075	0.001	Significant
MC → Expenditure	0.155	0.074	0.036	Significant
PB → Expenditure	0.171	0.105	0.103	None
PT → Expenditure	0.039	0.075	0.605	None

MC=Management Cooperation; PB=Prosocial Behaviour; PT=Performance Tolerance

Table 5 reveals only 2 significant results, namely performance tolerance had a positive relationship with match attendance (β=0.275; p=0.001), which confirmed H_3 partially. The other significant result was management cooperation having a positive relationship to expenditure on merchandise (β=0.155; p=0.036), which supported H_4 partially.

DISCUSSION

The aim of this study was to ascertain (a) whether the Fan Engagement Scale (FES) will be reliable and valid for use in a context of South African football fans and (b) whether fan engagement of South African football fans will predict positive consumer behaviours, such as match attendance and expenditure on team merchandise. The empirical results revealed a clear three-factor structure for the FES, with sufficient internal consistency, thereby supporting the work of Yoshida *et al*. (2014), and through this ensuring that the FES can be used with scientific rigour and value in a South African sport context. Subsequent to the establishment of the properties of the scale, this study found that some fan engagement

dimensions predicted positive consumer outcomes. The authors provide insight on these dimensions and explore practical interventions.

Firstly, in the case of match attendance, the fan engagement dimension of performance tolerance was revealed as a direct predictor of South African football fans making an effort to support their teams at the stadium. When one considers the history of the best supported professional football clubs in SA, it is evident that these clubs have benefitted from having rich and extended histories of loyal fans, who have frequently attended games even during unsuccessful periods in the performance of their teams on the field.

This research reveals that the management teams of such clubs must design engagement strategies directed at leveraging this loyalty of their fans. For example, individual supporters can be rewarded for being active members of the organised supporter branches of their teams for a prolonged period of time, through initiatives that provide greater rewards to fans that have proven to support the team throughout years of mixed success on the field. Furthermore, the management teams of these football clubs can also direct a concerted effort towards celebrating loyalty amongst its fans, such as sharing stories of stalwart fans on the social media properties of their clubs. Platforms to enhance fan loyalty, such as regional branches of supporters, which have been introduced by SA's major football clubs, can be valuable in this

regard. By providing platforms for performance tolerance sustained investment in football can be facilitated (Ross, 2006).

The second positive consumer behaviour investigated through this study was expenditure on merchandise. Results revealed that the fan engagement dimension of management cooperation was a strong predictor of merchandise expenditure amongst South African football spectators. Management cooperation refers to behaviour that exhibit a high level of collaboration with the management teams of a person's favourite sport team (Yoshida *et al*., 2014). It implies an active effort to be involved in the events management of those teams and playing an intricate part to promote the interests of such team (Auh *et al*., 2007).

In South African football, a clear example of the value of management cooperation is evident in the Carling Black Label Cup. This once-off, annual game is contested between the country's two most prodigious professional football clubs, Kaizer Chiefs and Orlando Pirates. The uniqueness of the competition is that fans of the respective clubs vote for the players to represent their teams on the day of the event, by purchasing a specially endorsed beer, which holds a unique number to which the choice of the team is then communicated by the fan through short messenger system (SMS). The event has been immensely successful, with a total of 22.2 million votes being recorded in the 2013 competition (South African Info Reporter, 2014). Fans feel engaged and involved in the management of the team, and in turn invest resources to promote the interests of that team; in this case being able to vote for the players they regard as the most likely to achieve success on the day.

To ensure sustainable expenditure on merchandise, the management teams of South African professional football clubs must continually provide platforms where fans can contribute to the management of their teams. Examples of such interventions may include having a dedicated fan forum on the website of the clubs where fans can provide the club with their

feedback, pertaining not only to the selection of players but also advising on general affairs of the management of their teams.

In practice, fans may be provided with the opportunity to vote for the design of a new match jersey of their favourite team at the beginning of the season, rather than the club deciding on it and merely communicating to the fans. The results of this study suggest that such level of management cooperation should lead to higher numbers of purchase of such a jersey amongst the fans. Finally, a further engagement strategy pertaining to management cooperation can be regional indabas, where the formal supporter structures (such as branches) can debate and brainstorm innovative ideas to promote the commercial interests of their club. The best ideas generated at these indabas can then be fed back into the management structures of the club. This form of research has been successfully applied in various consumer sectors, but is yet to be implemented in the realm of sport marketing, particularly in South African football.

CONCLUSION

This study contributes to the literature of sport fan engagement by establishing a valid and reliable three-factor structure for the Fan Engagement Scale (FES) in the context of South African football fans, by means of statistically scrutinising the psychometric properties of the instrument. This ensures the scale can be utilised effectively with scientific integrity in future studies and would further bolster customer engagement theory. Direct paths between the fan

engagement dimension of performance tolerance and match attendance were revealed, as well as between management cooperation and merchandise expenditure. Based on this information, practical suggestions were put forward for interventions that can be utilised effectively by the management teams of professional football fans to leverage on these dimensions of fan engagement amongst South African football fans.

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ADDENDUM
FAN ENGAGEMENT SCALE

(Yoshida *et al.*, 2014:405)

Please answer the following questions that explore how you feel about your **favourite professional football team**:

FES Items	Strongly disagree	Disagree	Disagree slightly	Neutral	Slightly agree	Agree	Strongly agree
1 I try to work cooperatively with my team	1	2	3	4	5	6	7
2 I do things to make my team's event management easier	1	2	3	4	5	6	7
3 The employees of my team get my full cooperation	1	2	3	4	5	6	7
4 I often interact with other fans to talk about issues related to my team	1	2	3	4	5	6	7

5 I often advise other fans on how to support my team	1	2	3	4	5	6	7
6 I spend time on social media (Facebook, Twitter) sharing information with other fans of my team	1	2	3	4	5	6	7
7 I wear apparel which represents the fans of my team even if the team has an unsuccessful season	1	2	3	4	5	6	7
8 I display the logo of my team on my clothing even if they do not perform well	1	2	3	4	5	6	7
9 I wear clothing that displays the name of my team even if they have an unsuccessful season	1	2	3	4	5	6	7

The clustering of items for the FES is as follows:

Dimension	**FES Item nr.**
Management support	1, 2, 3
Prosocial behaviour	4, 5, 6
Performance tolerance	7, 8, 9

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