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International Journal of Science Culture and Sport
September 2018 : 6(3)
ISSN : 2148-1148
Doi : 10.14486/IntJSCS

TABLE OF CONTENTS

REFEREES OF THIS ISSUE

Dr. Ahmet N. DİLEK
Dr. Andriy VOVKANYCH
Dr. Atahan ALTINTAŞ
Dr. Aydın ŞENTÜRK
Dr. Ayşegül YAPICI
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Dr. Erdal ZORBA
Dr. Ersan TOLUKAN
Dr. Fatih ÇATIKKAŞ
Dr. Fatih YAŞARTÜRK
Dr. Gürhan KAYIHAN
Dr. Hanifi ÜZÜM
Dr. Hikmat ALMADHKHORI
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Dr. Mikail TEL
Dr. Murat AKYÜZ
Dr. Murat SARIKABAK
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Areal Distribution of the Number and Intensity of Steps in Won and Lost Badminton Rallies[1]

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Abstract

Badminton is an Olympic sports branch requiring high performance. This study is conducted in order for revealing how the number of steps of badminton athletes is distributed in front, middle and back courts in each rally, and the role that the number of steps plays in terms of winning or losing the competition. The sample group of the study comprises of 8 single-male and 8 single-female matches in European Junior 19 Championship organized in Turkey in 2013. 56,619 steps in total in 1203 rallies were examined within the scope of the study.

Badminton court was divided into three main parts as front, middle, and backcourts, and all steps were classified and counted according to these three parts. Field length and width of each part is 2.23 m x 5.18 m, and the total of each part was determined as 11.91 m^2. Image recording for this study is accomplished by using two Panasonic SDR-H20 cameras. Percentage, arithmetic average, standard deviations were used in the analysis of data, and Mann Whitney U test was used as a non-parametric test for the significance test of the difference between two averages.

It was revealed in the study that there is a significant gender difference in the number of steps taken on the front and middle courts (z=, 034, P<0.05, z=, 029, P< 0.05). There was no significant difference between genders in terms of the number of steps taken in the backcourt and the total number of steps (z =, 217, P>0.05, z =, 153, P>0.05). When the areal distribution of a number of steps in each won and lost rallies is examined, it is revealed that no significant difference exists in terms of the number of steps (z =, 188 P> 0.05).

Consequently, it is determined that the total number of steps taken in each rally by athletes in international organizations is approximate in terms of won and lost rallies, and front and middle court usage were significantly different between male and female athletes.

Keywords: Badminton, number of steps, rally, gender, match analysis

[1] *This study was presented in 6th Racket Sports Symposium as Oral Presentation, in Kocaeli University in December 2013*

Introduction

Badminton is an Olympic sports branch, which has a characteristic of doing successive, short time loadings requiring high performance (Demirci, 2007). For this reason, elite athletes have to accomplish successive running techniques and fundamental stroke techniques frequently, which push to the limits of speed, agility, durability, and strength in the match (Salman and Salman, 1994; Grice, 1996; BAE, 2002). Duration of these rallies is approximately 6-12 seconds for elite athletes. And resting time between rallies is 15 seconds on average. Elite and highly competitive matches are known to take 45 minutes approximately. In this sense, badminton can be defined as a sports branch requiring aerobic and anaerobic durability due to the short time, high-effort rallies and long duration of games. Badminton is also a sports branch requiring a great deal of explosive power, swiftness, and flexibility (Chin etal., 1995; Omesegaard, 1996; Manrique and Badillio, 2003; Salman, 2007). It has been determined in various studies that some differences exist between male and female athletes in terms of rally durations, resting time between rallies and stroke diversity, although the rules of the games are the same (Salman, 2009; Heller, 2010). In another study, a number of strokes of male and female athletes in each badminton rally was examined, and it is determined that male and female athletes have 12.3 +_8.9 and 10.4 +_ 8.0 strokes, respectively. In addition, It was determined that athletes' lowest number of strokes is 2, and the highest number of strokes is 52 (Salman et al., 2013).

Athletes try to score up in each rally by using movement patterns and stroke techniques, which are, or are not similar to each other. A prerequisite for success in Badminton is to use all stroke techniques accurately and effectively as well as having right timing skills in running techniques. For this reason, stroking skill is not enough to be successful in Badminton sport; applying running techniques in a perfect way is at least as important as stroking skills (Cabello and Gnozalez-Badillo, 2013; Faude et al., 2007). In this sense, it is possible to define this Badminton sport as played with feet (running techniques). Given the fact that the single match area is 31.6 m2 in total (6.10x5.18m), the importance of having a perfect running technique in Badminton is obvious.

In this study, the distribution of the number and intensity of steps in front, middle and backcourts is examined for the rallies, which are won and lost by elite badminton athletes representing their countries in the international arena. In addition, the study searched for an answer to the question of whether the number of steps taken in each rally plays a role in winning or losing the match. The purposes of the study are considered as determining whether the number of steps taken in won and lost rallies creates a difference in winning the rally, and if it does, the level of this difference in male and female athletes.

Method

The study was conducted in European Junior 19 Championship held in Ankara ASKİ Sports Hall between the dates of March 22nd and 31st, 2013 by Turkey Badminton Federation. The population of the study comprises of elite badminton athletes who got to the quarterfinal and will play in the last 16 matches. 8 of these matches are single female, 8 are single male matches.

All steps taken by athletes during the match were counted in and these steps were classified and counted according to three parts. These are front, middle and back main parts. Length and

width of each part are 2.23m x 5.18m, respectively, and the total area is determined as 11.91 m^2.

Necessary permissions for the video recording in European Junior 19 Championship were obtained from Turkey Badminton Federation. Video recordings were carried out from a distance of 27 m to courts and a height of 12 m. Remote recording was made to obtain a clearer view to count the steps of athletes as well as not to disturb athletes' concentration. Two Panasonic SDR-H20 cameras were used to get all the video-recordings for this study, and these cameras were fixed by tripods during the match to obtain a clear view. Data were collected through the records taken by two video cameras. A total of 1203 rallies were analyzed, 581 of which belonged to female and 622 belonged to male athletes. Video-recordings related to each match were transferred to a widescreen through a projection device to analyze the obtained data and the badminton court was divided into 3 equal parts and fixed by establishing a mathematical ratio on the wide screen. Study data were collected through these videos recorded by two cameras. The study searched for an answer to four hypotheses:

There is no difference between

H0= There is no difference between the number and intensity of steps taken by male and female elite athletes in terms of areal distribution.

H1= There is a difference between the number and intensity of steps taken by male and female elite athletes in terms of areal distribution.

H0= There is no difference between the number and intensity of steps taken by male and female elite athletes in won-lost rallies in terms of areal distribution.

H1= There is a difference between the number and intensity of steps taken by male and female elite athletes in won-lost rallies in terms of areal distribution.

Percentage, arithmetic average, standard deviations were used in the analysis of data, and Mann Whitney U test was used as a non-parametric test for the significance test of the difference between two averages.

Findings

Table 1. Areal distribution of the number and intensity of steps in badminton according to the gender variable (16 matches in total, 8 of which are male and 8 are female matches).

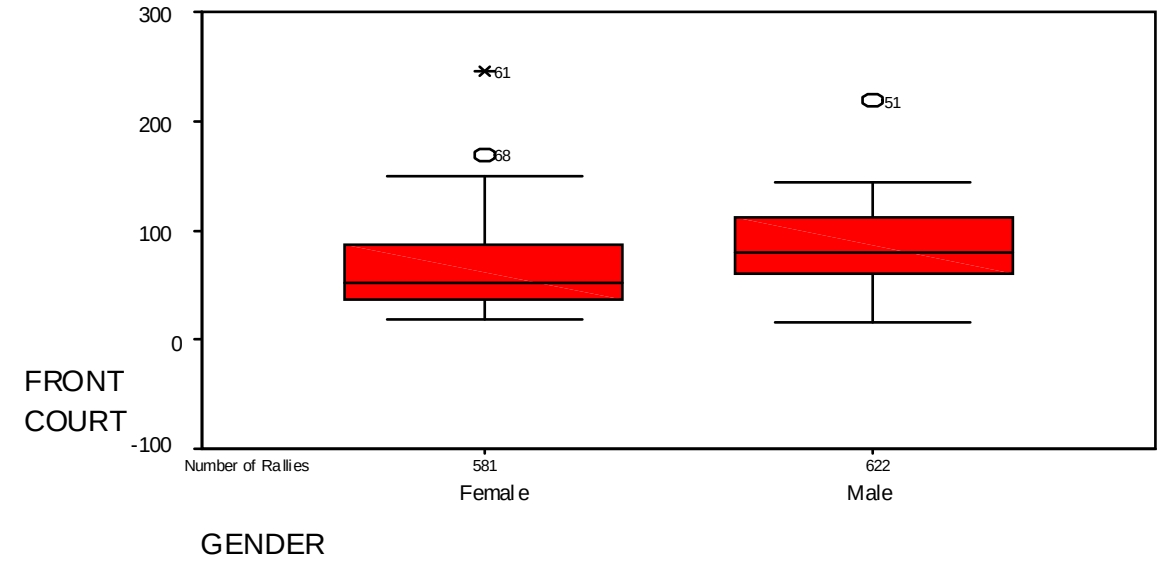
Gender	**Badminton Court Areas**							
	Front Court		Middle Court		Back Court		Total Number of Steps	
	n	%	n	%	n	%	n	%
Female	2378	8,9	15799	59,1	8568	32,0	26745	47,2
Male	3067	10,3	19239	64,4	7568	25,3	29874	52,8
General Total (n: number of steps)							56619	100,0

It can be seen in the Table 1 that 55,619 steps in total were analyzed. Female athletes took 47.2% of total steps and 52.8% were taken by male athletes. Percentages of the front, middle, and backcourt steps in a total number of steps taken by female athletes are 8.9%, 59.1%, and 32.0%, respectively. And the percentage of the number of frontcourt steps in a total number of steps taken by male athletes is 10.3%. Male athletes use middle and backcourts at the percentage of 64.4% and 25.3%.

Table 2. Areal distribution of the number and intensity of steps in won and lost rallies according to the gender variable (16 matches in total, 8 of which are male and 8 are female matches).

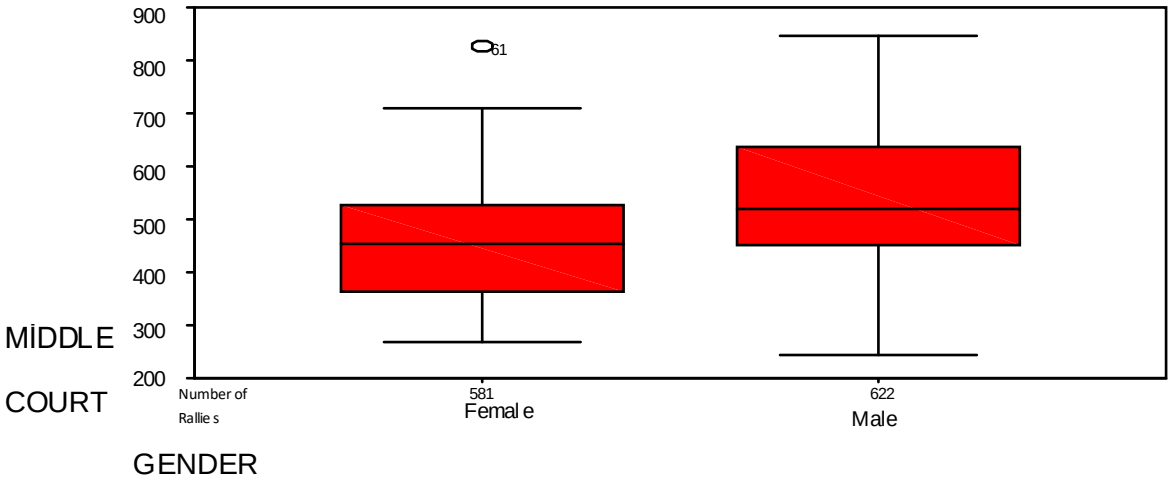
	Gender	**Badminton Court Areas**			
		FRONT	**MIDDLE**	**BACK**	**TOTAL NUMBER OF STEPS**
Number of Steps in Each Rally as $\overline{X}$ and S.S.	**Female**	77,8 ± 45,5	500,5 ± 139,2	230,5 ± 128,5	814,1 ± 207,5
	Male	85,1 ± 39,9	534,4 ± 148,3	210,2 ± 110,8	837,2 ± 221,2
Min.	**Female**	16,0	244,0	11,0	354,0
	Male	17,0	234,0	32,0	374,0
Max.	**Female**	246,0	847,0	762,0	1303,0
	Male	219,0	847,0	441,0	1227,0
Mann-Whitney U		431,500	426,500	507,000	490,500
Z		-2,122	-2,180	-1,234	-1,428
Sig.		,034*	,029*	,217	,153

When we compare female and male athletes on the basis of gender variable in terms of the number and intensity of steps in won and lost rallies, it is revealed that female athletes' number of steps reached $\overline{X}$= 814.1± 207.5 and male athletes took $\overline{X}$= 814.1± 207.5 steps. According to the study findings, it is determined that there is a significant gender difference in the number of steps taken in front and middle courts in won and lost rallies (z=, 034, P<0.05, z=, 029, P< 0.05). No significant difference was found between genders in terms of the number of backcourt steps and totaa l number of steps (z =, 217, P>0.05, z =, 153, P>0.05).



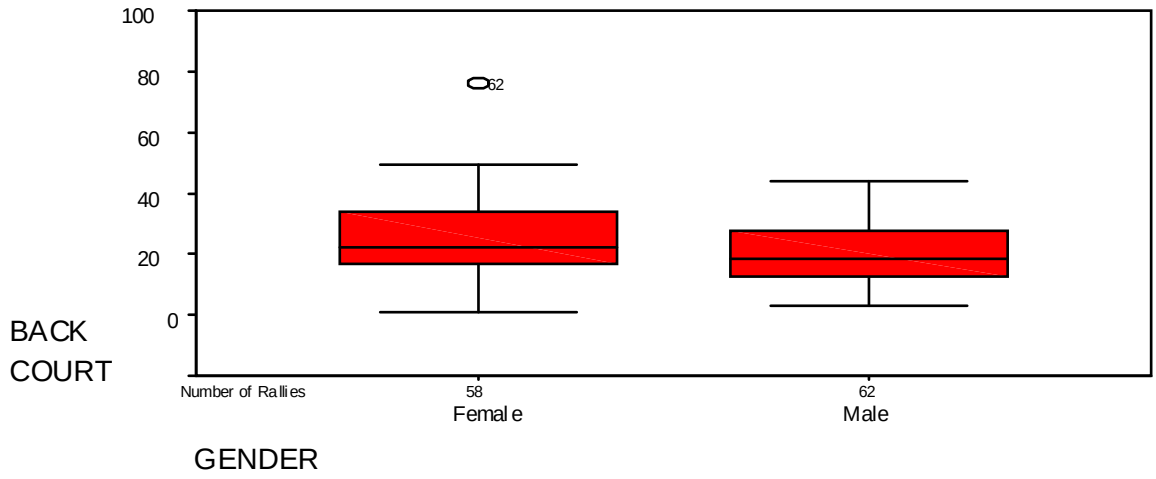
Graphic 1. Front Court Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 2,378 steps on the frontcourt in total. This number accounts for 8.9% of the total number of steps taken by female athletes (Table 1). The number of steps taken in the front area of Badminton court was determined as at least 16 and at most 256. The number of steps taken by female athletes on the frontcourt is $\overline{X}$=77.8 ± 45.5. Male athletes took totally 3.067 steps in frthe ontcourt in eight matches. The number of steps taken by male athletes on the frontcourt is 10.4% of the total number of steps. The number of steps taken by male athletes on the frontcourt in each rally is $\overline{X}$= 85,1 ± 39,9. Accordingly, it is concluded that there is a significant difference in the number of steps taken on the middle court between won and lost rallies based on gender (z =, 034, P<0.05).



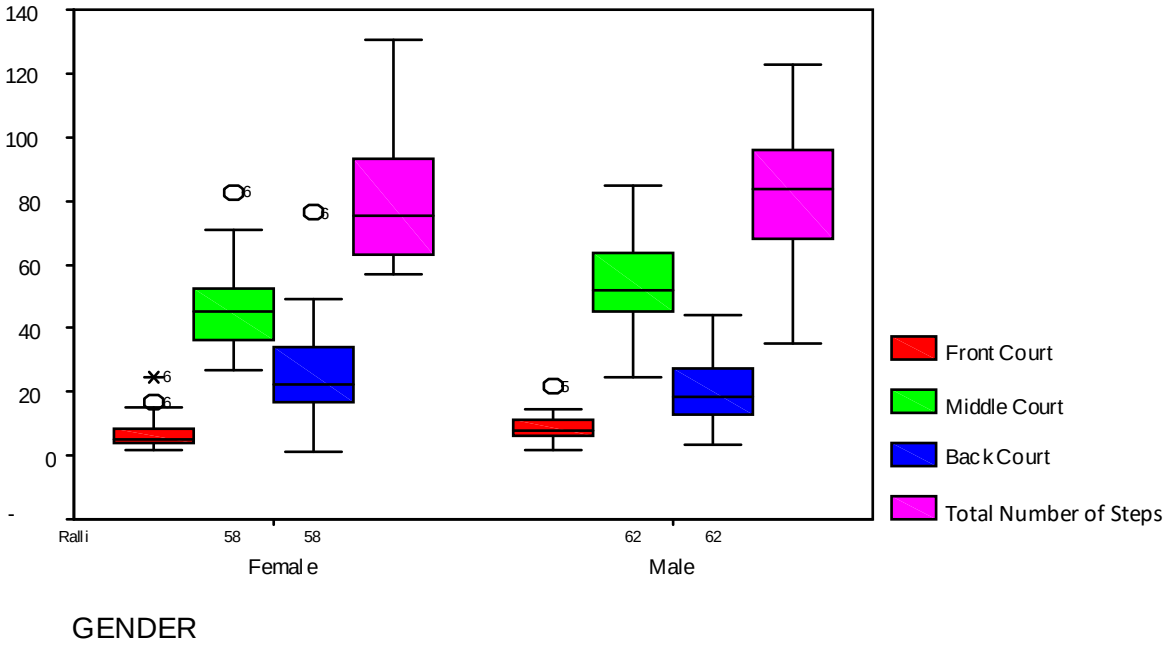
Graphic 2. Middle Court Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 15,799 steps on the middle court in total. This number accounts for 59.1% of the total number of steps taken by female athletes (Table 1). The number of steps taken in the middle area of Badminton court was determined as at least 244 and at most 847. The number of steps taken by female athletes on the middle court is $\overline{X}$= 505.5 ± 139.2. Male athletes took totally 19.239 steps in middle court in eight matches. The number of steps taken by male athletes on the middle court is 64.4% of the total number of steps. The number of steps taken by male athletes on the middle court in each rally is $\overline{X}$= 534.4 ± 148.3. Accordingly, it is concluded that there is a significant difference in the number of steps taken on the middle court between won and lost rallies based on gender (z =, 029, P<0.05).



Graphic 3. Back Court Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 8,568 steps on the backcourt in total. This number accounts for 32.0% of the total number of steps taken by female athletes (Table 1). The number of steps taken in the back area of Badminton court was determined as at least 11 and at most 762. The number of steps taken by female athletes on the backcourt is $\overline{X}$= 230,5 ± 128.5. Male athletes took totally 7,568 steps in bathe ckcourt in eight matches. The number of steps taken by male athletes on the backcourt is 25.3% of the total number of steps. The number of steps taken by male athletes on the backcourt in each rally is $\overline{X}$= 210,2 ± 110,8. Accordingly, it is concluded that there is no significant difference in the number of steps taken on the back court between won and lost rallies based on gender (z =, 217, P>0.05).



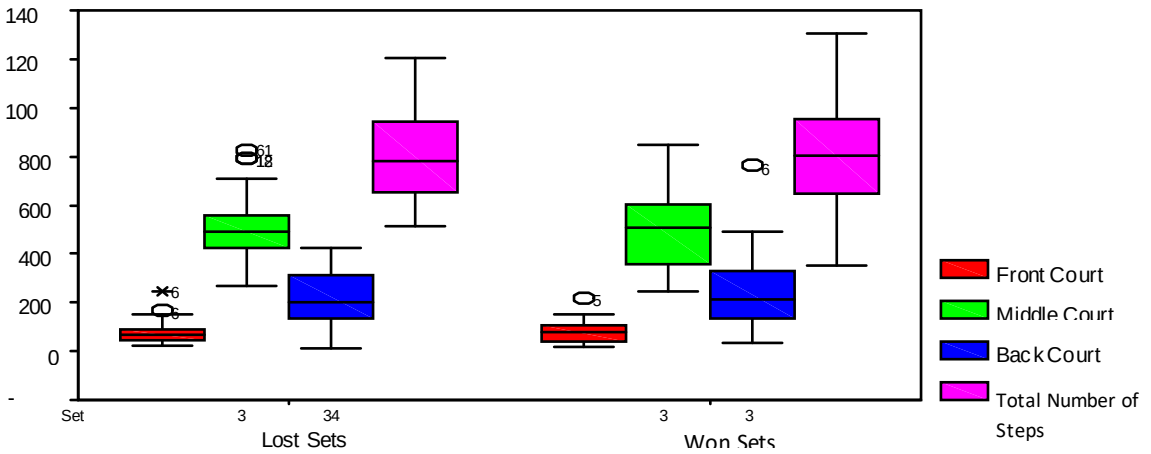
Graphic 4. Overall Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 26,745 steps totally in all parts of badminton court in eight matches. The number of steps taken by female athletes in each match was determined as $\overline{X}$= 814.1 ± 207. And male athletes took 29,874 steps totally in the end of eight matches. The number of steps taken by male athletes in all three parts of the court in each rally is $\overline{X}$= 837.2 ± 221.2. Accordingly, it is determined that there is no significant gender difference between won and lost rallies in terms of the number of steps taken in entire badminton court (z =, 153, P>0.05).

Table 2. Areal distribution of the Number and Intensity of the Steps in Rallies According to the Won and Lost Sets Mann Whitney U Table

Badminton Court Parts	Won/Lost Sets	Set Scores	$\overline{X}$	Std. Dev.	Benches Average	Sum of Bench Values	Mann-Whitney U	Z	Sig.
Front Court	Lost Sets	34	77,8	45,5	34,9	1187,0	592,0	, 235	,814
	Won Sets	36			36,1	1298,0			
Middle Court	Lost Sets	34	500,5	139,1	35,3	1198,5	603,5	-,100	,920
	Won Sets	36			35,7	1286,5			
Back Court	Lost Sets	34	230,5	128,5	34,3	1167,5	572,5	-,464	,643
	Won Sets	36			36,6	1317,5			
Total Number of Steps	Lost Sets	34	814,1	207,5	35,0	1191,0	**596,0**	-,188	,851
	Won Sets	36			35,9	1294,0			

When the areal distribution of the number and intensity of steps in rallies according to won and lost rallies, it can be seen that there are no significant difference in the total number of steps in none of the front, middle and back parts of the court based on winning and losing the match (z =, 188 P> 0.05).



Graphic 5. Overall Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Sets by Genders

It can be seen in Graphic-5 that the number of steps in each set and in all rallies of the step shows no significant difference between front, middle and backcourts (Front Court z = 0,814, P>0.05, Middle Court z = =, 920, P>0.05 and Back Court z = 0,643, P>0.05).

Discussion and Conclusion

Contrary to what is believed, Badminton can be defined as a sports branch not played with a racket, but with feet, because changing direction fast and quickly and having a swiftness to catch the shuttlecock above the net level is required to play Badminton at an elite level. Hence, badminton athletes should move fast and quickly on the court. Therefore, bringing running techniques to perfection is an obligation for the racket and the shuttlecock to meet at optimum height and to be sent to the desired point with an accurate technique. Çümşütoğlu and Kale (1994) and Şenel et al. (1998) emphasized that one of the most important techniques during the Badminton match is stepping technique an stressed the importance of quick start principle, right floor and contact principle, integrative returning, center position, step changes, and the importance of swiftness and quickness in stepping.

According to the study results, female and male athletes take 8.9% and 10.3% of their steps on the frontcourt. Female athletes use 59.1%, and male athletes use 64.4%, of their total number of steps on the middle court. Accordingly, it is determined that there is a significant difference in the number of steps taken on the front and middle courts in terms of won and lost rallies based on gender variable (z =, 034, P<0.05, z =, 029, P<0.05). According to these data, male athletes stay longer than female athletes on the front and middle parts of the court during the match and take more steps. This situation can be explained as male athletes want to make a stroke in front and more offensive tactically (particularly net drop and smash).

The number of steps taken on the backcourt in a match is determined as $\overline{X}$= 230,5 ± 128,5 for female athletes and $\overline{X}$= 210,2 ± 110,8 for male athletes. The proportion of the number of steps on the backcourt to the total number of steps is 32.0% for female athletes and 25.3% for male athletes. According to these findings, it is determined that there is no significant difference in the number of steps taken on the back court based on genders between won and lost rallies (z =, 217, P>0.05, z =, 153, P>0.05). It is concluded that the winner and the loser reach close scores based on the number of total and back court steps and there is no significant difference between groups in terms of the intensity of steps on the backcourt. Salman et al. (2013) analyzed rally stroke diversities, loading and resting relationship for the Olympic Badminton athletes and determined that female badminton athletes use high service stroke 17.3 times, and clear stroke 3.8 times more than male badminton athletes. Given the both types of stroke are the ones which require making strokes on the back court, it is surprising that even though female athletes have to make strokes from the back court to return these kinds of strokes; there is no significant difference between groups.

When examined the areal distribution of the number of steps in rallies by won and lost rallies, it is concluded that there is no difference in the total number of steps depending on winning or losing rallies in front, middle and back parts of the Badminton court. The most important conclusion to reach here is that all athletes in the study group have high-level running and stepping techniques to the degree that has no effect on winning or losing rallies. Therefore, giving due importance to make the athletes gain less than stellar stepping and running techniques is an obligation for coaches.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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Express Determination of the Level of Fatigue Athletes during the Competition and Its Reduction by Means of Kata[1]

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Abstract

In this work, an analysis of the level of fatigue of athletes - monitors during the participation in competitions with kumite in karate kyokushinkai.

More than twenty years of experience in competitions of different levels, refereeing and training of athletes in tournaments, analysis of victories and defeats led to the search for and development of new techniques to determine the level of weariness of the athlete in the participation in various types of tournaments and ways of their rapid recovery after significant psychophysical loads. Research questions the psycho-physical condition of the athlete during the competitions involved specialists in various sports, means, and methods of restoration devoted a lot of works as domestic and foreign experts. However, methods of rapid diagnostics of the level of weariness of the athlete during the competition and its rapid recovery in karate kyokushinkai were not investigated before.

The purpose of this work is to analyze the level of fatigue athletes - karate as in preparation for the competition and directly during participation in the competitions themselves. And also a decrease in the level of fatigue of the caretaker by means of kata.

To achieve this goal, the following tasks were solved: they determined the degree of fatigue of athletes - monoliths by non-invasive methods for heart rate (PAC "Omega-C"), using the method of the Japanese professor-psychiatrist Akioshi Kitaka, and the level of pH of the saliva, as in competitions from kumite in karate kyokushinkai and on training during preparation for matches.

The physical loads we have selected are similar (adequate) competitive on the body of the athlete, made it possible to investigate the level of weariness of the athlete, which is as close as possible to the competitor, directly in the training room, with the use of more equipment and specialists. The influence of some kata on reducing the level of psychosocial tiredness of an athlete is determined.

Keywords: Karate, kiokushinkai, kata, fatigue

[1] *This article was orally presented in the 6th ISCS Conference held in Lviv, April 2018.*

Introduction

The urgency of the research is due to the need to find means of restoration of karate after significant training, in the pre-adversary period, and significant competitive loads (kumite). Were simulated loads close to competitive conditions (kumite), the selection was made using PAC "Omega-C". The evaluation of heart rate and ECG athletes is conducted. The dynamics of changes in heart rate (pulsometry) indices were detected in karate sportsmen of high qualification of kyokushinkai style, performed by "Sanchin" kata, after considerable loads Kindzer B. Guziy O. (2013). The obtained research results confirm that proposed loads can serve as a model of competitive exercises. It was also found that the execution of the "Sanchin" kata allows accelerating the restoration of the cardiovascular system performance and can be used during training exercises during the preparation for responsible competitions in karate Kyokushin. Tests to quickly determine the level of weariness of an athlete directly during competitions are selected and successfully used (Luscher tests, Schulte tables, Akios Katiok's technique).

Formulation of the problem: Physical and mental qualities are interrelated parties of the same process of psychophysical development. With participation in high-level competitions quite often, all preliminary training is being overtaken by factors such as the "influence" of a more titled athlete, authoritative judges, the presence of famous people in competitions and spectators as a whole. Athletes who have reached a quarter-final match and then quite often fall into a difficult situation, as these stages have already been selected stronger and usually in battles, there is opponents level at almost all parameters. Therefore, in most cases, the duration of the bouts may be maximum in time according to the rules of the competition, which respectively leads to physical and psychological exhaustion of the athlete. The time to recover to the next sparring is becoming smaller. In this connection, there is a need for constant monitoring of the psychophysical state of the athlete, as well as the ability to use and apply different technologies for the rapid recovery of the body. An optimal way of self-control of an athlete is the ability to clearly and quickly determine the heart rate and, if necessary, to apply the method proposed by us to restore it. In order to improve the psycho-physical condition and training of a highly skilled athlete for various competitions including the main competitions (Championships of Ukraine, European Championships, etc.) various scientists are offered various means of psychophysical training. However, the possibility of harmonious physical and mental development of highly skilled athletes by means of kata (formal complexes) Kyokushinkai karate was not considered.

Analysis of recent research and publications: Problems of complex control over the psychophysical state of athletes in various sports are devoted to a number of scientific publications Iermakov, S.S., Podrigalo, L.V. & Jagiełło, W. (2016). The justification of the peculiarities of the functional state of the athlete's body is very well disclosed in work on athletics Korobeynikov, G., Korobeinikova, L., Mytskan, B., Chernozub, A. & Cynarski, W.J. (2017), sports games, boxing Savchin M.P (2003) various types of struggle, including the Eastern uniforms Nakayama M. (2001), Markov V. V. (2003); Oyama M.(2006) ; Saenko V.G. (2008), Berezhany V. Kindzer B (2015). In the works of domestic scientists, various aspects of the training process of kyokushinkai karate were investigated Royama H. (2002); Kindzer B. (2015), but the problem of the influence of kata on the functional state of the athlete's body when performing large psychophysical loads in karate kyokushinkai was not sufficiently studied.

Recovery processes play an important role after the athlete performs significant competitive loads. The high requirements for the functional state of athletes, the lack of coverage in the scientific literature, the possibility of using separate kata to accelerate recovery processes and correction of psychoemocentric condition, their use in the preparation for competitions on kumite, led us to research on the possibility of using the Sanchin kata at the pre-stage stage Preparation in Kyokushin Karate.

The aim is to study the effectiveness of the use of "Sanchin" kata as a means of accelerating recovery processes after significant physical activity at the stage of direct preparation for the main competitions of kumite in karate kyokushinkai. Choose a set of tests to quickly determine the level of athlete fatigue during the competition.

Method

Organization of the research

The studies were conducted in two stages. At the first stage, loadings were collected, which, according to their psychophysical load, were consistent with the adversary in the activities of karate. For this, the indicators were registered before the start of the competition (in a state of rest) and after a very high load - a battle in the mode of 1-time time (hikivake) + 2nd additional time (hikivake) -weight (difference in weight no more than 3 kg) +3 - additional time, as a rule, such a regime passes on the boundary of limiting psychophysical loads. To simulate the competitive load, we picked up physical exercises with a limiting load, similar in the duration of execution to the maximum duration of combat. The complex developed by us is called "Pyramid of endurance". The set of exercises has the following scheme of execution: 10 clicks on fists, after which 50 squatting exercises are performed alternately, then according to the presented (Table 1). The complex was performed continuously, at the expense of the coach, during 5 approaches, the dosage of exercises was changed Kindzer B. (2013)

Table 1. Complex "Pyramid of Endurance"

Approach No.	The name of the exercise	
	Pushing on fists (Saiken)	Squat with kick strokes (Kin-geri)
1	10	50
2	20	40
3	30	30
4	40	20
5	50	10

The duration of the complex (in continuous execution) takes 9-10 minutes and it is adequate in terms of its physical and emotional load of about 3 continuous battles (springs) with an equal partner. We have shown that the proposed load allows you to simulate the conditions of competitive activity. Therefore, at the second stage, it was used to study the restorative effect of the Sanchin kata. In the testing, control (KG) and experimental (EG) groups of 14 highly qualified athletes of karate of different age groups, age 18-25, at least 5 years of experience, sports qualification from 2nd Kyu to 3 given on the Japanese scale, KMS, MS on the scale of Ukrainian sports qualification. Indicators were researched in a state of tranquility, after completing the Pyramid of Endurance exercise, and after the Sanchin kata (EG) or passive rest of similar duration (CG).

To determine the performance of the cardiovascular system, the software-hardware complex "Omega-C" was used with the ability to examine 7 athletes at the same time, which made it possible to track the reliable changes that occurred in the body of athletes under the same testing conditions. We performed ECG recording in the 2nd standard excerpt using the Omega-C system and evaluated the amplitude and form of the T wave, the duration of the interval R-R, the interval S-T, and the heart rate. In addition, biochemical tests were carried out that confirmed our hypothesis about the positive effect of the execution of the Sanchin kata on the rapid restoration of the body of the athlete after considerable stresses.

Results and Discussion

From the level of fitness of the athlete to the main competitions, his subsequent successes in sporting activities, self-sufficiency, and well-being, which greatly affect his mental and physical health Dunets-Lesko, A., Vovkanych, L. & Kindzer, B. (2009), depending on him. Those athletes who have not reached the appropriate level of physical fitness, the process of adaptation to participate in the preparation for the competition is accompanied by the high tension of the physiological systems of the organism B. Dyky, L. Vovkanych, A. Vlasov, B. Kindzer (2013). Rapid recovery of the body after the loads in single events is very important, since the closer the athlete moves to the final bouts, the less time for rest between the battles and the restoration of the psychophysical state he remains. At the same time, self-control and self-regulation of a psychophysical state are extremely necessary for highly skilled athletes.

Our results indicate that competitive activity is accompanied by significant changes in the functional state of athletes-karate Kindzer B.(2014). An example of athlete testing results is provided in (Figure 1).

Figure 1. Test results after performing physical activity close to competitive

Note: A - the level of adaptation to physical activity,%; B - level of trenirovannosti organism,%; mark; C - level of energy supply,%; D -psychoemotional state,%; 100% corresponds to the maximum level of the relevant indicators.

A1 - the level of adaptation to physical activity after the complex,%; B1 - level of trenirovannosti organism after the complex,%; mark; C1 - level of energy supply after the complex,%; D1 - psychoemotional state after the complex execution,%; 100% corresponds to the maximum level of the relevant indicators.

A2 - level of adaptation to physical activity after performing EG kata and 5 minutes of rest KG,%; B2 - the level of trenirovannosti organism after the execution of kata EG and 5 minutes rest KG,%; mark; C2 - level of energy supply after execution of kata EG and 5 minutes rest of KG,%; D2 -physhomoetic condition after performing EG kata and 5 minutes resting KG,%; 100% corresponds to the maximum level of the relevant indicators.

To characterize the functional state of the cardiovascular system and to identify signs of physical strain on athletes, we evaluated the electrical processes that arise during the operation of the heart by electrocardiography. The athletes engaged in Kyokushin Karate investigated the parameters of the electrocardiographic examination in a state of rest after the use of the "Pyramid of Endurance" complex and after 2 minutes of passive rest (KG) or the execution of "Sanchin" kata (EG).

The processes of depolarization of the ventricular myocardium, on the ECG, recorded in the form of a QRS complex at athletes EG is within the normal range and lasts 0.08 ± 0.01 s, in a state of rest, at the peak of the load and after the execution of the kata, indicating that there is no conduction violation along the beam Gisa and his legs.

Tine T reflects the processes of rapid ultimate ventricular myocardial repolarization. Pathological changes of this tooth without simultaneous changes in the QRS complex indicate a violation of restorative, metabolic processes in the ventricular myocardium and may be the primary signs of violation of repolarization.

In athletes, the amplitude of the waveform T in the state of rest is 3.75 mm, which is 2.25 mm below the norm and indicates the absence of violations of processes in the contaminated contingent of the athletes

After loading, the amplitude of the T wave is 3.50 mm, which is 0.25 mm below the resting state, and two athletes have found asymmetrical tooth T, indicating signs of disruption of metabolic processes in the myocardium.

After performing the "Sanchin" kata by the athletes EG, the amplitude of the T wave increased by 0.8 mm in comparison with the resting state and by 1.13 mm in comparison with the peak of the load, indicating a positive effect of the kata on the processes of myocardial repolarization from 0, 5 - 1.0 mm. At athletes of the surveyed group (EG), the tooth T was normal, indicating no violation of the repolarization processes in the myocardium, both in a state of rest and during physical activity Kindzer B. Guziy O. (2013).

Table 2. Indicators of electrographic examination of qualified athletes (EG) were obtained with the help of PAC "Omega-C"

Indexes	**Normative value**	**The state of peace**	**After loading**	**After performing the kata**
R.(мм)	5-20 мм	6,50± 0,02	4,25 ±0,03	6,13 ±0,02
T, (мм)	5- 6 мм	3,75 ±0,05	3,50 ±0,02	4,63 ±0,05
QRS (с)	= 0,1 с	0,08 ± 0,01	0,08 ±0,01	0,08 ±0,01
S-T. (мм)	+ 0,5-1	0,06 ±0,01	0,01 ±0,03	0,01 ±0,01
P-Q	0.12 - 0.20	0,76 ±0,01	0,52 ±0,01	0,60 ±0,01
R-R	0,80 - 0,86	0,76 ±0,02	0,52 ±0,03	0,60 ±0,02
ЧСС	74 - 78	81,38 ±0,05	116 ±0,05	96,13 ±0,01

The S-T segment, which represents the initial period of ventricular repolarization, is normally located on the isolation or shifted up or down. Athletes of the study group showed no pathological bias of the S-T segment as in rest, at loading and after loading.

The amplitude of the R wave reflects the bioelectric potentials of the free walls of the left and right ventricles and tops of the heart. Normally, the amplitude of the tooth R in standard leads is more than 5 mm. In the examined individuals in the contingent, we observed a change in the ratio of the amplitude of the tooth R (state of rest, loading, after the execution of the kata). The amplitude of the R wave in the resting state is 6.5 mm, at the peak of the load there is a slight decrease in the amplitude of the wave R and is 4.25 mm, but after executing the kinematic amplitude, the tooth R returns to 6.13 mm.

Heart rate is correct, heart rate ranged from 81 beats/min. in a state of rest, to 185 bs / min. at peak load and up to 96 beats/min. after kata execution.

Thus, the amplitude indices of ECG in athletes-karate did not reveal signs of chronic physical strain on the side of CSS organs and proved the positive effect of kata on the processes of myocardial repolarization Bogdan Kindzer, Volodymyr Saienko, Anna Diachenko (2018).

Confirmation of positive influence of "Sanchin" kata gave the indexes of biochemical analysis of pH of saliva obtained using "pHep®+ Waterproof Pocket pH Tester" as shown in Figure 2.

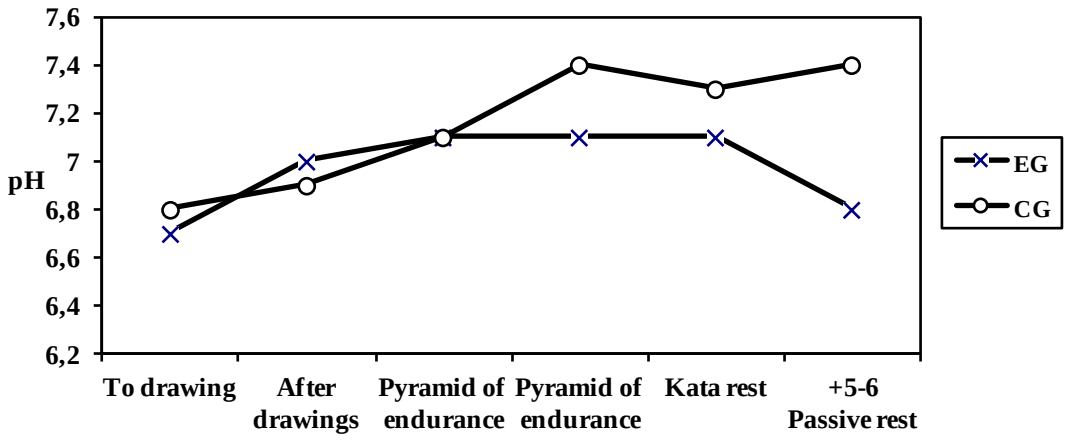
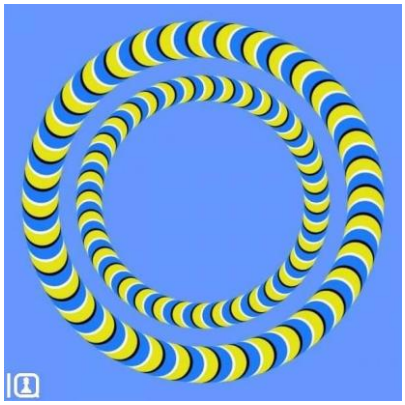


Figure 2. Indicators of biochemical analysis of pH of saliva athletes: EG (effect of Sanchin kata), CG (passive rest after significant physical activity)

In order to prevent the risk of high injury and significant damage to the athlete's health, it is essential to apply an express fatigue determination. One of the effective methods is developed by the Japanese psychiatrist Atoshi Katioka, which we used in our research. However, it requires a deeper study to obtain objective results precisely in the sport.



A test for mental and physical fatigue

This illusion was invented by the Japanese psychiatrist AkioshiKitaoka. According to him, "visual illusions" as nothing else help determine the mental state of a person at a given moment. Look at the static image above (this is not an animation).

• If the image is completely motionless - you do not have to worry about, mental health is in order. Such a result is possible in a person who is balanced, calm and rested.

• If the image is moving slowly - you need rest, both physical and moral. Especially important is full-fledged sleep, which is the best antidepressant.

• Active movement of the image serves as a symptom of accumulated fatigue, a high level of stress and deterioration of health. You need a rest - maybe even in a medical-preventive

institution. Perhaps you need to adjust your lifestyle or stereotypes a little to create harmony and health.

Akioshi Kitaoka, professor of psychology at Ritsumeykan University in Kyoto, Japan, specializes in visual perception and visual illusions. His optical illusion "The Rotating Snake" brought the talented psychologist world fame, and the works were repeatedly awarded prizes for original research.

Conclusions

The use of modern digital technologies has made it possible to reveal the real influence of Sanchin kata on the psycho-physical state of an athlete-karate player, which confirms our hypothesis and is recommended for use in the training process during the training of highly skilled athletes for kumite competitions. The heart rate in EG varied from 81 beats/min. in a state of rest, to 185 bs/min. at peak load and up to 96 beats/min. after kata execution. The pH of the saliva in the EG after the kata is reduced to the baseline level at the same time in KG it continues to be high for a long time.

The use of PAM "OMEGA-C" and "POLAR 800" for controlling the training process for the training of highly skilled athletes for the kumite competitions in Kyokushinkai karate gives a very significant effect. As it promotes the implementation of the athlete's and coach's intentions, the purpose of which is a significant result of the competitions. At the same time, it enables the operative correction of the training process individually for each athlete.

Further research should be devoted to a deeper and more detailed study of the influence of Kata on the formation of the required level of physical and mental readiness of highly skilled Karate sportsmen and their interrelation with the performance of performances at prestigious competitions with kumite in Kyokushinkai karate.

It has been experimentally verified and proved that performing Sanchin kata after accelerated recovery processes in the cardiovascular system at the stage of direct preparation for the main competitions of kumite in karate Kyokushin.

The given actual material can serve as a prerequisite for optimizing the training process of highly qualified athletes of Kyokushin Karate.

In addition, it is worth devoting to a more detailed study of the impact of other "higher" karate kata and their role in the formation of the necessary level of physical and mental readiness of highly skilled athletes at different stages of preparation for the main competitions.

Prospects for future research are the formation of a set of tests for the study of functional fitness of athletes kyokushinkai karate in laboratory conditions and in conditions of sports activities, in so-called "field conditions".

Conflict of Interest

The author has not declared any conflicts of interest.

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Prevention of Negative Effects of Nervous and Psychic Stress on the Driver's Cardio-Respiratory System[1]

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Abstract

Nervous and psychic stresses on the drivers' body as a result of intense analytical and synthesizing mental activity cause corresponding physiological responses and require a high level of functional preparedness. Investigating the frequency of cardiac contractions in the drivers - representatives of motor sport – during races show that its average (160-180 contraction/min.) and maximum (200-220 contraction/min.) values significantly exceed those calculated by oxygen consumption per minute, which indicates a high psychological pressure of a such kind of professional activity. One of the main causes of accidents is drivers' fatigue, which leads to a decrease in concentration of attention; therefore, the proper level of their functional readiness for nervous and psychic occupational stress can significantly increase the level of active traffic safety. The results of complex studies show that many years of professional activity of drivers leads to a significant decrease in a number of their motor function indices, which requires constant physical training aimed at the prevention of injuries and drivers' functional capabilities. The endurance necessary for drivers is recommended to be developed by non-stop and uniform running or jogging without rest, skiing, swimming, cycling or rowing for at least 30 minutes. However, considering the constant vertical overload on the drivers' spinal column, running along a hard track and riding a bike through rugged country are worth limiting in favor of swimming which combines the functional load on the cardio respiratory system and an even moderate load on all muscle groups with unloading and restoration of the spinal column.

To increase the level of the drivers' physical fitness, to prevent overweight and to treat obesity, we recommend a complex of simple exercises consisting of walking with the knees pressed to the chest, the torso of the trunk forward, touching the toes from the initial position standing legs apart, hands on hips, lifting of the trunk with bending forward from the initial position lying on the back and bending and unbending the arms lying down. Each exercise should be performed at a maximum pace for 30 seconds with a further 30-second rest. The daily performance of this complex significantly improves the functionality of the cardiovascular system. This complex is convenient to do during morning gymnastics, in terms of lack of time or in terms of limited opportunity for special physical training.

Keywords: nervous and psychic stress, a driver, cardio-respiratory system, negative influence, prevention

[1] *This article was orally presented in the 6th ISCS Conference held in Lviv, April 2018.*

Introduction

The specifics of drivers' modern professional activity consist in the sharp increase in the speeds of vehicles and their number on the roads, large amounts of information from the system "driver - car - road", which are processed by the driver in the conditions of time deficit and increased risk of accidents, cause significant nervous and psychic stresses on a driver's body that have a detrimental effect on the cardio respiratory system, and that pressure level can be compared with the mental loads of pilots, dispatchers, athletes and representatives of other types of extreme activity (Ryachinsky, 2001; Rybak, 2013). Stressed analytical and synthesized mental work requires a high level of the drivers' functional readiness to this type of overload and causes the corresponding physiological response of the organism (Rybak, 2002; Rybak, 2005).

The labor pressure as a harmful occupational factor often affects the employee in parallel with other factors (noise, vibration, microclimate, physical overload, etc.). Simultaneous influence of these factors enhances those adverse deviations of physiological and pathological nature, which arise under the influence of only the nervous and psychological load itself (Bus Drivers, 1996). The pressure during the labor process as a harmful occupational factor subjects to hygienic norm-setting. According to the authors' classification (Zanko, 2004), the mental pressure on the drivers as for the content of the work that is heuristic (creative) activity and requires solving algorithms of actions, individual control in complex situations, perception of signals and information with the following complex assessment of related parameters and a comprehensive assessment of all occupational activity – is referred to harmful working conditions (work under pressure) of the second degree. By the distribution of functions and the degree of a task complexity - the processing of a task, its performance and control over its performance are considered as harmful working conditions (work under pressure) of the first degree. Sensory loads over the duration of focused observation (over 75% of the work duration), as well as the hour density of signals and messages (over 300) - is a work in a time and information deficit, and increased responsibility for the final result. The number of points for simultaneous observation (11-25) is considered as work in a time deficit. Emotional pressure on drivers as the risk of their own life (possible), the degree of responsibility for the safety of others (the risk is possible) and the monotony of the stress (the number of techniques needed to complete a simple task - less than three) - taking into account the degree of responsibility for the final outcome of their own activity and significance of the error is the sole responsibility for the functional quality of the task, when there may be a danger to life. Therefore, professional activity of drivers can be attributed to the most stressful, which requires effective prevention of harmful nervous and psychological influences (Burlayev, 2010; Szczepaniak, 2015).

Method

Choosing out of all theoretical methods we applied in our research the following ones: analysis and generalization of special literature, WEB-pages of the Internet network, abstraction and idealization; classification and systematization of theoretical and experimental data; induction and deduction; specification of theoretical knowledge and forecasting.

We used such empirical methods of research as pedagogical observation of drivers' professional activity, method of rating, and experimental pulsometry.

According to many experts (Trofimets, 1977; Kuznetsov, 2007), the intensity of the drivers' actions can be objectively estimated by the value of his heart rate (HR) as an organism's response to the psychic stress.

The heart rate of professional drivers involved in our survey was recorded using the portable pulsometer "PC 800" made by SIGMA SPORT. This is a modern recording device, which consists of sensors, designed in a single block with an elastic breast strap, and a recording-set-up unit in the form of a wristwatch. The connection between the sensor unit and the recording unit is radio-telemetric (the maximum distance between them is 1.2 m). The pulsometer is activated and controlled by buttons located on the recording unit. The device allows real-time control of the visual average heart rate for the last 5 contractions of the myocardium, as well as to memorize the duration of training for 60 minutes in three zones of loading at the heart rate, which are given by the experimenter. The device is lightweight, convenient, powered by three batteries (48 hours of continuous operation).

Results

During training sessions of the top motor racers in the mode of minute oxygen consumption in the range of 2.0 l/min, their heart rate, which was supposed to be about 130 contraction/min, rose to 160-165 contraction/min. During the race on the same highway, their heart rate increased to 180 and more contraction/min. (Rybak, 2005), which can be explained by the high intensity of work (stress).

During the most intense automobile racing, the minute volume of oxygen consumption by qualified athletes is 0.5-0.6 l/min, which is 4-5 times less than in motocross. However, during the ring races, their average heart rate ranges from 160 to 170 contraction/min., and the maximum reaches 200-220 contraction/min. (Trofimets, 1990). Karters' heart rate before the control race start is 120-125 contraction/min. and reaches a maximum of 207-210 contraction/min. (Gradusov 2005) (at a simulator - up to 90 contractions per minute (Keller, 1980).

Examination of the heart rate of the representatives of motor and extreme sports (Ospinnikova, 2003; Singurindi, 1982) and drivers of special units of the Ministry of Internal Affairs during special operations (Zudin, 2004) made it possible to determine its average and maximum values (Table 1).

Table 1. Heart rate recorded among representatives of various kinds of extreme activities

№	Kind of activity, contingent	Heart rate (contraction/min.)		
		At start	Average	Maximum
1	Alpine skiers	120 – 140		170 – 180
2	Cross country motorcycle race, training races		160 – 165	
3	Cross country motorcycle race, competition races		over 180	
4	Ring motor races		160 – 170	200 – 220
5	Carting, at simulator		80 – 90	
6	Carting, control races	120 - 125		207 – 210
7	Cross country motorcycle race with a sidecar, driver		170 – 180	to 200
8	Cross country motorcycle with a sidecar race, passenger		180 – 190	to 200
9	Motorcycle football, field player-forward		170 – 180	to 200
10	Rally raid, pilot		140 – 150	183
11	Driving APC (extraordinary maneuvering)			to 200
12	Chauffeurs of diplomatic corps		136	

Discussion and Conclusion

The analysis of the results given in Table 1 shows that the hard work of drivers requires a high level of functional preparedness to negative influence of regular and extreme nervous and psychic stress on their cardio-respiratory system. The prevention to such type of stress can significantly increase the level of active traffic safety.

The drivers themselves recognize that one of the main causes of accidents is fatigue and due to the reduced concentration of attention, therefore, good health, proper level of physical and functional preparedness of the driver is the basis of traffic safety. However, the results of complex studies show that many years of professional activity of drivers of various vehicles cause a peculiar change in the functions of their organism. And if indices such as the ability to differentiate signal parameters, accuracy and speed of response, etc., increased three times, then some indices of motor functions significantly reduced. This requires compulsory physical activity, which could provide an adequate level of ability to overcome regular and extreme professional nervous and psychic stresses.

Physical training of professional drivers should primarily be aimed at preventing injuries by avoiding mistakes that can lead to accidents and, consequently, injuries (active safety). However, it should also increase their passive safety - the ability to overcome high mechanical and nervous and psychic professional overload on the body as at the regular and extreme situations, and quickly recover after occupational stresses, overload and possible injuries.

So, necessary drivers' stamina should be developed by such means of general physical training as uniform running, walking, cross, skiing, swimming, cycling or rowing. The load must be carried out continuously and without rest for 30 minutes or longer. However, taking into account the constant vertical professional load and overload on the drivers' spinal column, running along hard tracks and bike riding through country should be limited in favor of swimming, which combines the effect of the functional load on the cardio respiratory system and a uniform moderate load on all muscle groups on the one hand, and unloading and restoration of the spine column on the other.

The driver must be able to behave correctly – when he knows what to do, and is sure enough that he is physically prepared to withstand the load, more stable mentally, does not hesitate and panic at the last second before accident.

To improve the level of physical and functional preparedness of drivers, to prevent overweight and treat obesity, the complex of the simplest exercises designed by authors (Singurindi, 1982), is recommended to do (Figure 1).

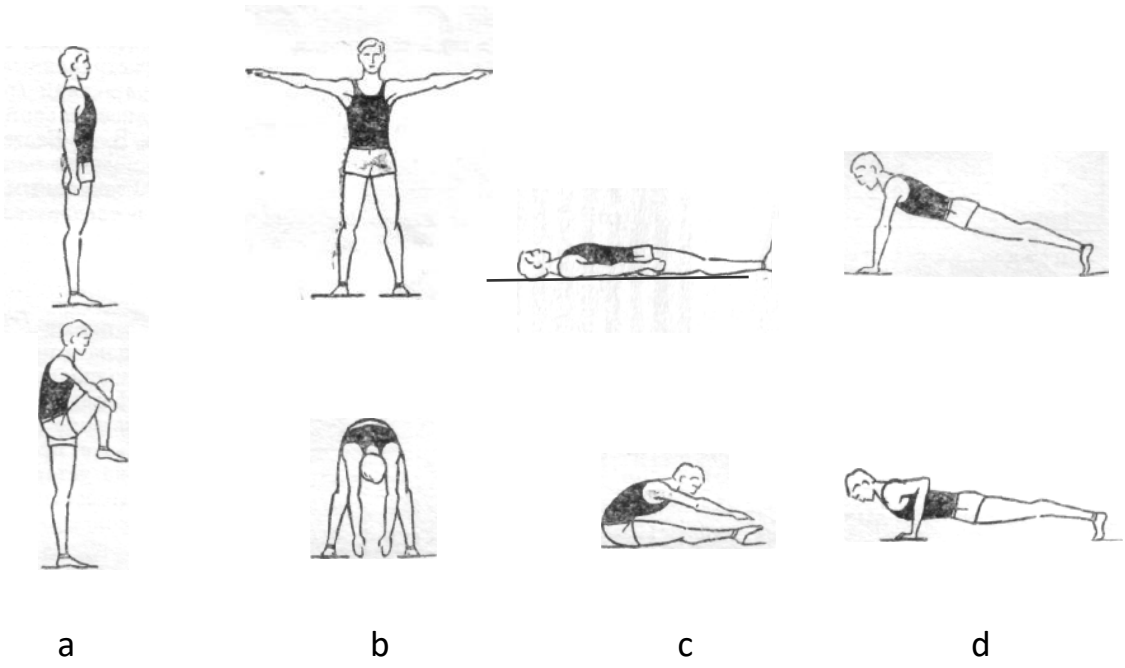

Figure 1. Complex of physical exercises recommended by physicians for increasing the level of physical fitness and prevention of excessive mass: a - walking with knees pressed to the chest; b – bending the torso of the trunk forward touching the toes from the initial position standing legs apart, hands on hips; c - lifting the trunk with bending forward from the initial position, lying on the back; d - bending and unbending the arms lying down (push-ups) (Singurindi, 1982, modified).

Each exercise is performed at a maximum pace for 30 seconds with a further thirty-second rest. It is advisable to establish such a sequence of their performance, so that the peak of the load was after the fourth exercise – bending and unbending the arms lying down.

Our tests showed that daily performance of this complex of exercises is not only a sufficient training load for the development of power and speed qualities, but also greatly improves the functionality of the cardiovascular system (heart rate after all four exercises reaches 150-180 contractions/min.) The described complex is very convenient to use in conditions of shortage

of time, or limited opportunities for special training. It can also be added to the morning exercises and to the individual physical training of individuals with a hypodynamic mode of activity. In this case, the complex must be performed at a rate of 60-80% out of the maximum.

The results obtained during the study indicate that:

a) the simultaneous influence of nervous and psychic professional stresses on the body of the drivers in parallel with other factors (noise, vibration, microclimate, physical overload, etc.), which increase the adverse deviations of the physiological and pathological nature, which arise under the influence of only the nervous and psychological load, create a harmful influence on their cardio-respiratory system;

b) the level of heart rate of drivers and representatives of other kinds of extreme activities significantly exceeds the calculated per minute oxygen consumption, which indicates the high pressure of their activities, and the performance of professional duties in such regimes is not feasible for untrained persons and requires special functional training;

c) prevention of the harmful effects of nervous and psychic stresses and overloads on the cardio-respiratory system of professional drivers is to maintain an adequate level of their functional preparedness by means of general physical training, such as continuous (for at least 30 minutes) uniform running, walking, cross-country skiing, cycling, rowing or swimming, which combines the effect of the functional load on the cardio respiratory system and a uniform moderate load on all muscle groups – on the one side, and unloading and restoration of the spine column - on the other;

d) daily exercising the complex of simple exercises, consisting of walking with knees pressed to the chest; bending the torso of the trunk forward touching the toes from the initial position standing legs apart, hands on hips; lifting the trunk with bending forward from the initial position, lying on the back; bending and unbending the arms lying down (push-ups), significantly improves the functionality of the cardiovascular system. Each exercise should be performed at a maximum pace for 30 seconds with a further 30-second rest.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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The Effect of Aerobic and Core Stability Training Combination on Respiratory Volume and Balance of Children with Congenital Deafness

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Abstract

Introduction: According to previous studies, it has been shown that weakness in balance and low capacity of pulmonary capacity is one of the main problems in people with congenital deafness. There is a close and meaningful relationship between pulmonary function. Also, balance is one of the factors affecting the quality of life. Its improvement improves the quality of life. The simultaneous strengthening of respiratory and balance improvement functions should be emphasized in order to bring a quality of life closer to normal. The purpose of this study was to investigate the effect of a combination of aerobic training and central stability on respiratory volume and balance of congenital deaf students. Methods: This study was a single-blind clinical trial performed at a Deaf School in Qazvin, Iran. The present study was a post-test and pre-test design was performed on 24 congenital deaf students who were randomly assigned to the experimental and control groups (each group of 12). The experimental group performed exercises for 6 weeks and 3 sessions per week for 60 minutes. During the same period, the control group did not participate in any training program. Before and after training, the volume and pulmonary capacities were measured by a Spirometer, static balance using the (BESS) and dynamic balance test using Star Balance Test (SEBT) was measured. Data were analyzed by the independent samples t-test and ANCOVA test ($P \leq 0.05$). Results: According to the results of this study, there was a significant difference in the mean post-test of dynamic and static balance and respiratory functions after carrying out training program in the intervention group. Conclusion: It seems that the aerobic and core stability combination training can improve respiratory volumes as well as a static and dynamic balance in hearing impairment and can be used in conjunction with other training programs.

Keywords: Core stability, Diaphragm, Respiratory Volume, Balance, Congenital Deafness

Introduction

Hearing is an important sensation that makes it possible for us in part of our communication with the outside world. The child learns to speak with audible notes. If a child does not hear from the beginning, he will not be able to speak. Hearing impairment is a form of hidden disability and one of the most common abnormalities in the birthplace, and about %10 of the world's population is hearing impaired and 130 million people are moderate to severe. 65 million of these births are affected by this problem. Hearing loss can be one-way or two-way, mild to full, low or high frequencies, congenital or after birth. Its prevalence in our country is 5 per thousand. Deafness is called silent disability. In the results of Ali et al., Zwierzchowska et al., Lieberman et al., Zebrowska et al., and Houwen et al., low levels of cardio respiration and muscular endurance of the disabled have been reported in comparison with their healthy partners (Vali-Zadeh et al., 2014). The low level of aerobic fitness in deaf children has been explained by the lack of acquiring verbal skills that have a positive effect on the development of the lungs due to the use of lungs to sing or yell, obtaining lower aerobic fitness index (Zebrowska et al., 2007). In other words, natural breathing is done approximately and in a unique way by the diaphragm. During the breech operation, the diaphragm contraction causes lower levels of the lungs to come down during the exhalation, the diaphragm is only relaxed and the lung, chest wall and abdominal structure are pushed to the lungs, causing the air to flow out. However, during more intense breathing, the reactionary forces do not have enough power to create deep exhalation, as a result, additional force is needed by the abdominal muscle contraction, which pushes the internal structures of the abdomen up to the lower diaphragm surface and thereby causes pressure on the lungs (Hislop, 2002). Although the development of airways at birth is complete, the proliferation of alveoli continues continuously until 2-3 years of age. The volume of airways continues to rise to adolescence (Hislop, 2002). One of the factors that will affect the development of pulmonary function is exposure to several environmental factors such as cigarette smoke, ozone, infection, and a combination of these, and the importance of their effects on the growth of lung function is explored (Finkelstein and Johnston, 2004). The decrease in muscle strength affects the respiratory system and lung function and decreases spirometric variables in the deaf. This weakness may be due to a lack of pronunciation and no talking (Shadle and Mair, 1996). Problems with hearing impairment are often examined only in terms of communication. Although communication problem is the main defect caused by hearing impairment, other physical problems may also be associated with hearing impairment. This regard, delay in postural growth as well as motor development is a common sensory-motor disorder in deep deaf children. The vestibular extremities and the cochlea are both very close to each other both anatomically and functionally. Embryonic injuries, during birth or afterbirth, can damage the vestibular or the cochlea, or both. Vestibular system is essential for fixing the look (the ability to stare at something); therefore, damage to the Vestibular system causes disability in balance and stare functions (Pajor and Jozefowicz-Korczynska, 2008). Balance is an inseparable component of everyday activities and a key part of daily actions (Punakallio, 2005). Gambetta and Gary have argued that balance is the most important part of the ability of athletes and is involved in almost every form of activity (Gary and Gambetta, 2000). The balance is a complex motor skill that describes the body's postural dynamics in preventing falls (Hessari et al., 2011). The importance of postural and balance in independence in activities such as sitting, standing and walking from the point of view of the scientists is undeniable and under discussion. Different types of exercises are used to improve balance which can be referred to as deep-sensory exercises using the balance board. In recent years,

the core body and the exercises related to the strengthening and stability of this area has found many people in different fields. The lumbar-pelvic-leg area with its surrounding muscles is called the core area of the body. And considering that the anatomical position of the center of gravity is in this area, and human movements are caused by it, the stability of this area is very important. Core stability is known as the motor control and muscle capacity of the core area to maintain the stability of the area in various postures and external forces (Hessari et al., 2011). In fact, core stability is affected by three inactive, active and nervous systems which are in close communication and interaction so that if one of the systems gets disturbed, other systems are trying to compensate for the disruption. The central area instability occurs when the impairment does not resolve (Hessari et al., 2011). Studies have shown the role of core stability on improving performance and athletic performance as well as preventing injury. Clark et al. showed that core stability prevents the occurrence of false movement patterns by maintaining the posture and proper body position during functional activities, thereby improving exercise performance (Clark and Reuteman, 2000). The core stability of the body is considered to be one of the factors associated with lower limb injury (Leetun et al., 2004). In order to study the effect of core stability training on balance, Johnson et al. The effect of 4 weeks of trunk muscle strengthening program on the balance of healthy subjects and reported a significant effect on balance after the training program (Johnson et al., 2007). Most existing studies have examined the effect of the central stability training program on the balance of athletes and In addition, a different report is provided on the duration and type of exercise program (Samson, 2007). According to the research, we know that absolute and deep deaf people, Due to the inability to speak and participate in physical activity at childhood, it is weak in the diaphragm and is interrupted by decreasing respiratory capacity, and on the other hand, due to a defect in its vestibular system, the ability to maintain balance and control poorer posture than Have healthy people; And with an overview, it has been observed that no studies have been done to evaluate the effect of aerobic training on respiratory capacities of the deaf while deaf people, in comparison with those with normal hearing, are less responsive to respiratory capacity and balance, and maybe research in this sample More priority. Therefore, the present study was conducted to evaluate the effect of six weeks of combined aerobic training and central stability on respiratory and balance volumes in the deaf.

Materials and Methods

This study was a single-blind clinical trial performed at a Deaf School in Qazvin, Iran. The present study was a post-test and pre-test design and was conducted after obtaining permission from the Committee on Research and Ethics of Qazvin University of Medical Sciences, Iran. The statistical population of this study was all deaf students from Qazvin province. Of these, 24 qualified subjects were selected by non-randomized targeting method. After assessing the balance and respiratory capacity, based on the obtained score, they were matched and divided into two equal and experimental groups by the researcher. According to the medical records available at the school, the most important criteria are the absence of any neurological or harmful effects that affect the balance of function and the absence of diversions in the spine (such as scoliosis, kyphosis) and lower extremities (such as flat foot, short legs), Having a normal vision without the use of glasses (Ferber-Viart et al., 2007). Not having any illness in deep-vision and vision systems, not performing surgery and cochlear implantation, and not having an accident or falling from the height and fractures leading to skeletal injuries (Rinaldi and Barela, 2009). There was no history of diseases such as convulsion and lack of exercise history and regular physical activity; the subjects' premiums

were determined by the desire of the subjects to shoot soccer (Hessari et al., 2011). All subjects voluntarily participated in this study based on parental consent form and co-operation between teachers and principals of the Qazvin Exceptional School for Deaf.

Training program

Intervention group in aerobic exercise program, observing the safety tips and recommendations of the College of Sports Medicine (Colberg et al., 2010), under the supervision of the researcher. Before starting the training, the 10-minute warm-up program included aerobic exercises (3minute of fast walking and slowly running), and then static stretching. After the main workout, Cool Down was performed, which included slow walking and stretching movements. The aerobics training program included running exercises with an intensity of %50-70 heart rate reserve (Table 1). The target heart rate was calculated using the Caronen method (Hoffman, 2006).

Age (years) - 220 = Maximum heart rate
Rest heart rate - maximum heart rate = heart rate reserve
Resting heart rate + desired intensity × (heart rate reserve) = heart rate target

Progressive core stability training from the Jeffrey Core Exercise Program, which was made up of three levels and combined, was attended by 6 sessions per week and 3 sessions per session for 60 minutes each session (Jeffreys, 2002). The control group was engaged in normal study period (6 weeks), but the experimental group performed the planned training program, details of which are given in Table 1. Of course, after the completion of the study, the training program and its movements were taught to the control group and the program was used by the teacher for their training.

Table 1. Aerobic training program

Week	Training period	Exercise intensity (percentage of heart rate reserve)
First	20	%50-60
Second	20	%50-60
Third	25	%50-60
Fourth	25	%60-70
Fifth	30	%60-70
Sixth	30	%60-70

Table 2. Core stability training program

Week / Training	First	Second	Third	Fourth	Fifth	Sixth
Plank	3 Rep 10 S	3 Rep 15 S	2 Rep 30 S	3 Rep 30 S	2 Rep 45 S	2 Rep 45 S
Side Plank	3 Rep s 10	3 Rep s 15	2 Rep s 30	3 Rep s 30	2 Rep s 45	3 Rep s 45
Crunch	1 Set 10Rep	1 Set 15 Rep	1 Set 20 Rep	1 Set 25 Rep	2 Set 15 Rep	2 Set 20 Rep
Cycling	1 Set 15Rep	1 Set 20 Rep	1 Set 25 Rep	2 Set 20 Rep	2 Set 20 Rep	2 Set 24 Rep
Oblique Crunch	1 Set 10 Rep	1 Set 15 Rep	1 Set 20 Rep	1 Set 25 Rep	2 Set 15 Rep	2 Set 20 Rep

Test Star Excursion Balance

It is used to measure dynamic balance. This test is a valid and reliable tool for quantization of dynamic balance. In this test, 8 directions that are starred on the ground are aligned at 45 degrees. Because the similarity of the results of the balance tests Y with our balance test, we used the Y balance test (Cote et al., 2005). The subject stops at the center of the subject's directions in the center of the direction, then sets one on one and ends with the other leg to achieve the goal and returns to normal on two legs. The subject touches the farthest point in each of the designated directions; the distance from the contact point to the center is the distance to be measured, which is measured in centimeters. In order to minimize the learning effects of each subject, he trains this test in three directions (Figure 1).

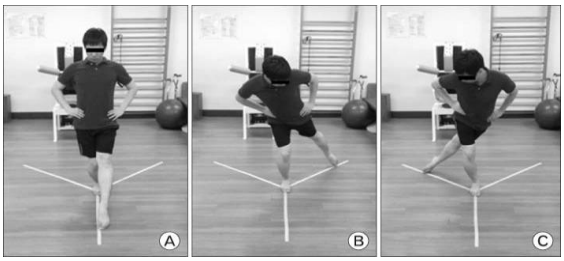

Figure 1. Components of the balance test Y

To obtain a dynamic balance score in each direction, we use the following formula:

$$\text{Score: } \frac{\text{Achievement distance}}{\text{Length of limb}} \times 100$$

Balance Error Scoring System

In this test, which is used to measure static, six different situations have been considered, including three positions standing on the hard surface and three standing positions on the soft surface. Hard surfaces include carpet or flooring and a soft surface, including a padded foam cushion with a size of 41 x 50 x 6 centimeters. Standing positions also include standing on both legs in pairs, standing together on both legs, one way back and standing on the same. In all situations, the eyes of the subjects are closed and the hands stick to the sides. The subject performs each situation for 20 seconds and calculates the total number of errors that occur in these six states as his grade. Errors include: detaching the hands from the waist, opening the eyes, lifting the heel or toes, relying on the ground, attaching or abducting more than 30 degrees of thumb, a collision of the foot with the ground, or a collapse of balance for any reason. Before performing the test, each subject performs three tests to getting known with the test (Bressel et al., 2007).

Figure 2. Balance error test (BESS) in six different situations

Spirometry

Pulmonary static and pulsed dynamic volumes and capacities were measured by spirometry machine with Pony FX desktop spirometer labeled Italy with validity and reliability of 0.982; After exercising the subjects and emphasizing on maintaining the focus and severity of the maximum effort during maneuver testing or lung tests for each person three times with 1 to 2 minutes, spirometry (flow-volume curve) and after five minutes of rest two The load was performed with a 2 minute spirometric test (maximum voluntary ventilation), and the best pulmonary functions were recorded, recorded and stored (Attarzadeh et al., 2006).

In this study, Shaipiro-Wilk's statistical test was used to assess the normality of the data and then, the independent samples t-test and Ancova test were used for data analysis. All statistical tests were performed with SPSS version 23 and assumed significant $P \leq 0.05$.

Results

Descriptive characteristics of the research samples, including height, weight, and age by groups are presented in Table 3. The Independent t-test was used to determine the equality of groups in age, height and weight indices. The results of the field tests of these variables showed that there was no significant difference between the groups and the groups were equal in these variables.

Table 3. General Characteristics of Subjects (mean ± SD)

Group	Number	Age	Height (CM)	Weight (kg)
Control	**12**	17.33±0.98	1.69±3.47	55.58±5.63
Experimental	**12**	17.41±1.37	1.73±5.41	56.50±5.40

According to the present research, ANCOVA analysis method was used to analyze the data and to control the pre-test effect. To analyze homogeneity of variance in two groups, Levin's variance analysis was used. As shown in Table 4, Levine's test was not statistically significant for any of the variables studied.

Table 4. Test of Homogeneity of Variances

Variable	Pretest group (F)	P
Anterior	1.597	0.219
Posteromedial	2.777	0.110
Posterolateral	0.591	0.450
BESS Balance	2.068	0.164
FVC	4.259	0.051
FEV_1	0.754	0.394
MVV	2.916	0.102
VC	3.239	0.086

The Ancova test was used for comparing the mean scores of post-test, dynamic balance and static balance and respiratory function after controlling the pre-test effect in the two groups, its results are presented in Tables 5 and 6.

Table 5. Results of Ancova analysis for comparing post-test dynamic balance in two groups

Variable	Source	Sum of Squares	df	Mean square	F	sig
Anterior	Pretest	410.20	1	410.20	45.38	*0.000
	Group	113.59	1	113.598	12.569	0.002*
	Error	189.79	21	9.038	-	-
Posteromedial	Pretest	1587.492	1	1587.492	42.349	0.0001*
	Group	467.813	1	467.813	12.480	0.002*
	Error	787.201	21	37.486	-	-
Posterolateral	Pretest	1549.441	1	1549.441	143.217	0.0001*
	Group	256.485	1	256.485	25.363	0.001*
	Error	212.367	21	10.113	-	-

* Significance level is $P \leq 0.05$

As shown in Table 5, there is a significant difference between the mean scores of post-test dynamic balance in the anterior excursion after the elimination of the pre-test effect [(p = 0.002) and (F = 1, 21)]. There is a significant difference between the post-test scores for the Posteromedial excursion after the elimination of pre-test effect [(p = 0.002) and (F = 1, 21)], and post-test scores for Posterolateral excursion after the elimination of the pre-test effect were significantly [(p = 0.001) and (F = 1, 21)]; therefore, the mean scores of post-test the intervention group was significantly higher in the Y balance test than in the control group.

Table 6. Results of Ancova analysis for comparing post-test static balance in two groups

Variable	Source	Sum of Squares	df	Mean square	F	sig
BESS Balance	Pretest	9.375	1	9.375	9.623	*0.005
	Group	56.801	1	56.801	58.305	*0.001
	Error	20.458	21	0.974	-	-

* Significance level is P≤0.05

As shown in Table 6, there is a significant difference between the mean scores of post-test static balance after the elimination of the pre-test effect [(p = 0.002) and (F = 1, 21)].

Table 7. Results of Ancova analysis for comparing post-test respiratory functions in two groups

Variable	Source	Sum of Squares	df	Mean square	F	sig
FVC	Pretest	0.334	1	0.334	36.843	*0.0005
	Group	0.566	1	0.566	62.476	*0.001
	Error	0.190	21	0.009	-	-
FEV_1	Pretest	0.285	1	0.285	16.772	*0.001
	Group	0.290	1	0.290	17.052	*0.0004
	Error	0.357	21	0.017	-	-
MVV	Pretest	443.369	1	443.369	140.132	*0.001
	Group	102.340	1	102.340	32.346	*0.0001
	Error	66.443	21	3.164	-	-
VC	Pretest	0.412	1	0.412	32.978	*0.0001
	Group	0.282	1	0.282	22.582	*0.001
	Error	0.262	21	0.12	-	-

As shown in Table 7, there is a significant difference between the mean scores of post-test FVC after the elimination of the pre-test [(p = 0.001) and (F = 1, 21)]. Also, there was a significant difference in post-test FEV1 scores after the elimination of the pre-test (p = 0.0004) and [(F = 1, 21)], and post-test scores after eliminating the pre-test effects were significantly different [(p = 0.0001 (F = 1.21); and finally, after the elimination of the pre-test,

there was a significant difference in the mean scores of the post-test VC; therefore, the mean scores of post-test the intervention group was significantly higher in the respiratory functions than in the control group.

Discussion

The purpose of this study was to investigate the effect of aerobic combination program and core stability on respiratory volume and balance of children with congenital deafness. The results showed that performing aerobic combined exercises and improving the core stability of respiratory capacities and maintaining the balance of congenital deaf individuals. Here, before examining the effect of aerobic combined exercises and core stability on respiratory volume and balance, first it is necessary to consider the relationship between deafness and balance and respiratory weakness of these individuals. The results of some researches show a significant relationship between the two categories it was mentioned (Rajendran and Roy, 2011). Congenital deaf people have similar physical, emotional and physical characteristics compared to those with normal hearing, but deaf people are normally deprived of the auditory system, a fact that in many cases limits their activities, especially during childhood. (For example, when playing), and ultimately their physical-motor development slowly slows down and delays (Rajendran and Roy, 2011). Fear of injury because of the incomplete understanding of the environment in deaf children, which is inspired by their parents, can be among the factors that reduce the depression of deaf children to heavy physical activity such as running, jumping, climbing and jumping, etc. In this period, it will affect the growth and coordination of the muscles. Continuing participation in physical activity can compensate for this delay in physical-motor development in the deaf. In general, many studies have investigated the effects of different exercises (balance, resistance, strength, core stability exercises, and the like) on the balance situation. Overall, their results indicate the positive effect of training and participation in sports activities on static and dynamic balance. Several studies have attempted to manipulate the sensory systems involved in the postural control process, but few studies have been conducted on posture control and balance of the disabled, and despite researches, there has been no research on the effect of aerobic combined exercises on respiratory capacities and balance in the deaf. Concerning the relationship of the results of the research with other studies that examined a specific type of exercises that focused on balance, with the results of Derlich et al. (2011), Johnson et al. (2007), Hessari et al. (2011), aligned; and with the results of Sato research that the exercise does not affect the improvement of balance, it is disagreeable that the possible differences in the results can be attributed to the specifications of the exercise (type of exercise, intensity and duration of training, how to perform exercises). In the Sato study, subjects were healthy, while subjects were hearing impaired people (Sato and Mokha, 2009). Among the respiratory maneuvers, MVV is more of a dynamic test of ventilation capacity, which reduces MVV in neuromuscular and cardiac patients, as well as those with airway obstruction or stenosis. Therefore, the amount of MVV depends on the individual's physical capacity and strength as well as on the limitation of the shortness of breath. An increase in the MVV of the hearing impairment in this study was aligned with the findings of Thaman et al. (2010). FVC and FEV1 maneuvers are one of the most important pulmonary functions. Any factor that changes the TCL and RV will also change the FVC values. Changes in airway obstruction or respiratory muscle weakness including diaphragm, intervertebral muscles, and abdominal muscle groups alter FVC and FEV1 levels. According to the findings of this study, FVC and FEV1 values increased significantly in the training group after participating in the training

program; these findings were matched to the results of Attarzadeh et al. (2006) and Huang and Osnesse (2005). Based on the findings of the FEV1 study, it has been introduced as an independent predictor of longevity and instrumentation as a general human health assessor (Huang and Osness, 2005). In general, exercise has increased metabolic activity and in order to respond to it, both ventilatory and cardiac devices should be activated by simultaneously increasing the ventilation and cardiac output (Schunemann et al., 2000). Kisner suggests that changes in the muscular, cardiovascular and pulmonary system occur as a result of aerobic exercises, which leads to an increase in the patient's tolerance. These changes include changes in circulation, increased heart rate, increased arterial pressure, increased oxygen demand, and increased respiratory rate and depth resulting from the onset of secondary respiratory muscles. Increased body temperature, increased stimulation of the muscles and joints stimulates the respiratory system during the first one of the exercise, which results in increased ventilation and increased frequency and total lung volumes. The positive impact of exercise on pulmonary volume can be attributed to the association between increased aerobic capacity and pulmonary volume (Kisner and Colby, 2002).

Conclusion

The results of this study showed that performing combined aerobic training and core stability can improve balance and respiratory volume in hearing impaired people. Although the results of this study were about hearing impaired people, according to most of the research findings, it has been shown that these exercises have a positive effect on the balance and respiratory volumes of individuals affected by any anomalies in the leg or respiratory tract. It was found that central stability exercises, in addition to strengthening muscles, by overloading on the transmission of information through the sensory systems of the central nervous system (Vestibular, Visual, Somatosensory), as well as the motor system, improved the sense of deepness and increased muscular coordination And, as a result, improves in maintaining the balance of the individual. Finally, aerobic exercises increase blood circulation, speed and depth of respiration, as well as increased diaphragm, resulting in improved respiratory volume; Therefore, when a deaf person improves his respiratory rate by participating in a sports rehab program, he can better handle daily tasks.

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Conflict of Interest

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Correlation between Anthropometric, Physical Fitness Traits and Lung Capacities with Success of Iranian Elite Greco-Roman Wrestlers

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Abstract

The aim of present study was to evaluate the relation of anthropometric, physical fitness traits and lung capacities with success of Iranian elite Greco-Roman wrestlers. Twenty five Iranian elite Greco-Roman wrestlers (22 ± 4 years old) (both of light and heavy weights) participated in present study. Anthropometric characteristics, physical fitness traits and lung capacities were tested in the exercise physiology laboratory. Our results showed a significant and positive correlation between arm spam, as only anthropometric trait, and success of Iranian elite Greco-Roman wrestlers. Also, maximal oxygen consumption, dead lift, squat, bench press, agility, shoulder and-wrist elevation, sit and reach, reaction time-eye/left hand, reaction time-eye/foot, reaction time-ear/left hand, reaction time-ear/foot have positive correlation with their success. Furthermore, there were a significant and positive correlations between inspiratory reserve volume, tidal volume, forced vital capacity, forced expiratory volume (second), maximal voluntary ventilation and success. In contrast, we observed a negative and significant correlation between body fat (%) and success of Iranian elite Greco-Roman wrestlers. Physical fitness traits and lung capacities have greater potential than anthropometric characteristics in the prediction of Greco-Roman wrestler's success in championship levels.

Keywords: Anthropometric characteristics, Physical fitness traits, Lung capacities, Wrestler's success, Greco-Roman wrestling.

Introduction

Greco-Roman wrestling is one of the more popular events of the modern Olympic Games (Mirzaei et al., 2009; Mirzaei et al., 2011). It is an aerobic and anaerobic exercise that allows only upper body moves and last a bout duration of 6 min (2*3-min bouts) (Mirzaei et al., 2011; Demirkan et al., 2014).

Knowing of physiological and physical factors contributing to successful Greco-Roman wrestling is a challenge confronting sport scientists (Mirzaei et al., 2009). A significant portion of the studies have been used physiological/anthropometrical profiles (Mirzaei et al., 2011; Demirkan et al., 2014) and physical fitness tests to reveals wrestler's current physiologic capability to competition (Horswill et al., 1988; Mirzaei et al., 2009). It has been shown that elite Iranian (Mirzaei and Ghafouri, 2007) and Canadian wrestlers (Sharratt et al., 1986) have an anthropometric and physiological profile similar to elite wrestlers from other countries. Also, elite junior wrestlers compared to elite senior wrestlers have a lower and higher aerobic and anaerobic power, respectively (Horswill et al., 1988). Furthermore, top-level wrestlers had significantly more aerobic and anaerobic power, muscle strength, muscle endurance (Roemmich and Frappier, 2002) and flexibility (Yoon, 2002) compared to lower level wrestlers. In addition, physiological profile of elite wrestlers has been used as training targets for developing athletes (Callan et al., 2000). Also, wrestlers showed higher level of muscular strength, aerobic and anaerobic power 7 months before a major event (Utter et al., 2002).

For progress in wrestling, it is necessary that all of physiological, anthropometric aspects and bio-motor abilities are evaluated. So far, there are insufficient studies that have investigated the relationship between anthropometric, physical fitness traits and lung capacities with success of wrestlers. In one studies, it has been shown that motor ability (Cvetkovic et al., 2005) contributed to success and technical efficiency in wrestling competition. Since the information regarding top level wrestlers in Greco-Roman wrestling is limited, there is not a distinct criterion for coaches and athletes in this style of wrestling to establish a necessary foundation for competitive success. The results of present study will provide useful information to identify important factors involved in talent process for Greco-Roman wrestling. Hence, the aim of the present study was to evaluate the relation of anthropometric, physical fitness traits and lung capacities with success of Iranian elite Greco-Roman wrestlers.

Material and Methods

Twenty five Iranian elite Greco-Roman wrestlers (22 ± 4 years old) (both of light and heavy weights) participated in this study and signed an informed consent statement in adherence with the human subject's guidelines of Iran's National Olympic Committee research center. Wrestlers were tested in the exercise physiology laboratory of Shahid Chamran University of Ahvaz (Iran).

Anthropometric measurements including wrist circumference, shin circumference, height from hip joint to the top of the head, height from iliac crest to the top of the head, and arm span to height ratio were determined by tape measure. The subject's height was also recorded by wall-mounted stadiometer (YG-200; Yagami, Nagoya, Japan). Body weight was measured using a digital scale with light clothing and without shoes (TBF-551; Tanita, Tokyo, Japan). Body mass index (BMI) is calculated as weight in kilograms divided by the square of height

in meters. Also, body fat percentage, fat and muscle weight were measured by body composition analyzer (Olympia 3.3: Jawon Medical Co., Gyeongsangbuk-do, Korea). Length and circumference of limbs were determined by tape measure.

Also, grip strength and dead lift were determined by biodex dynamometer (Yagami Co, Japan). Flexibility of muscles and reaction time were determined by digital biodex flexible gauge and reaction timer (Yagami Co, Japan), respectively. Squat and bench press were determined by free weights based on one repetition maximum. Evaluation of the maximal oxygen consumption (VO_2max) was determined by the Astrand test on treadmill (h/p/cosmos, mercury® med, Germany). Agility in the present study was determined by a 4 × 9-m shuttle run test. Lung capacities were measured by a digital spirometer (HI-601, Japan).

The wrestler's success was rated based on their success in provincial and national competitions, official tournament and Asian games during three years ago. For first to third positions in official tournament and Asian games, points of 100, 90 and 85 were allocated, respectively. Also, for the first to third positions in national competitions, points of 80, 70 and 65 were assigned, respectively. In addition, points of 60, 50 and 45 were allocated for first to third positions gained during provincial competitions, respectively. Finally, in order to control the number of attendance in competitions by each athlete in the last 3 years, their scores were multiplied in numbers of attendance and divided on sum of number's attendance.

Data were analyzed in SPSS software (version 16.0) and presented in terms of means ± SD. Initially, Shapiro-Wilk's test was performed to test normality. Then, Pearson's correlation coefficient was calculated to determine the relationship between variables. The significance level was set at $P < 0.05$.

Results

Means and standard deviations of anthropometric measurements and physical fitness traits are presented in table 1 and 2, respectively. The wrestler's success based on their success in competitions was 68.94 ± 15.14. Results showed, among anthropometrics characteristics, arm spam (Positive) and body fat (%) (Negative) significantly correlated with success of elite Greco-Roman wrestlers, respectively (Table 1). Also, dead lift, squat, bench press, VO_2max, agility, shoulder and-wrist elevation, sit and reach, reaction time-eye/left hand, reaction time-eye/foot, reaction time-ear/left hand, reaction time-ear/foot and success of elite Greco-Roman wrestlers have positive correlation (Table 2). Furthermore, there are significant and positive correlations between inspiratory reserve volume (IRV), tidal volume (VT), forced vital capacity (FVC), forced expiratory volume (second) (FEV1), maximal voluntary ventilation (MVV) and success of elite Greco-Roman wrestlers (Table 3).

Table 1. Correlation of anthropometric traits with elite Greco-Roman wrestler's success

Anthropometric characteristics	Mean ± SD	Correlation coefficient	Significant
Height (cm)	175 ± 9	0.30	0.13
Weight (kg)	78 ± 15	0.07	0.72
Body mass index (m/kg^2)	25 ± 3	0.24	0.23
Body fat (%)	14 ± 3	-0.42	0.03*
Fat weight (kg)	11 ± 4	-0.22	0.27
Body muscle (%)	79 ± 3	0.35	0.07
Muscle weight (Kg)	62 ± 11	0.18	0.36
Humeral length (cm)	33 ± 3	0.19	0.35
Forearm length (cm)	30 ± 1	0.26	0.19
Femoral length (cm)	42 ± 4	-0.33	0.10
Calf length (cm)	41 ± 4	0.01	0.99
Wrist circumference (cm)	19 ± 1	0.38	0.06
Waist circumference (cm)	82 ± 8	-0.04	0.84
Hip circumference (cm)	98 ± 6	-0.07	0.72
Femoral circumference (cm)	57 ± 5	0.02	0.89
Calf circumference (cm)	38 ± 3	0.14	0.47
Ankle circumference (cm)	24 ± 3	-0.03	0.86
Sitting height (cm)	74 ± 4	-0.08	0.68
Arm span (cm)	181 ± 10	0.61	0.01*

The asterisk (*) indicates a significant correlation between two corresponding variables

Table 2. Correlation of physical fitness traits with elite Greco-Roman wrestler's success

Sport performance tests	Mean ± SD	Coefficient correlation	Significant
Grip strength-right hand (N)	49 ± 9	0.36	0.07
Grip strength-left hand (N)	48 ± 9	0.36	0.07
Dead lift (kg)	168 ± 23	0.86	0. 01*
Squat (kg)	148 ± 45	0.42	0.03*
Bench press (kg)	110 ± 28	0.42	0.03*
Maximal oxygen consumption ($ml.kg^{-1}.min^{-1}$)	50 ± 7	0.78	0. 01*
Agility (second)	7.4 ± 0.46	0.37	0.04*
Shoulder and-wrist elevation (cm)	24 ± 9	0.74	0. 01*
Sit and reach (cm)	33 ± 11	0.74	0.01*
Reaction time-eye/left hand (S)	0.51 ± 0.22	-0.53	0.01*
Reaction time-eye/right hand (S)	0.47 ± 0.07	-0.12	0.09
Reaction time-eye/ foot (S)	0.40 ± 0.12	-0.43	0.03*
Reaction time-ear/left hand (S)	0.54 ± 0.12	-0.41	0.04*
Reaction time-ear/right hand (S)	0.59 ± 0.10	0.37	0.06
Reaction time-ear/ foot (S)	0.47 ± 0.17	-.046	0.01*

The asterisk (*) indicates a significant correlation between two corresponding variables

Table 3. Correlation of lung capacities with elite Greco-Roman wrestler's success

Lung capacity characteristics	Mean ± SD	Coefficient correlation	Significant
Inspiratory vital capacity (IVC)	3.4 ± 0.64	0.001	0.99
Inspiratory reserve volume (IRV)	2.3 ± 0.66	0.58	0.01*
Expiratory reserve volume (ERV)	1.04 ± 0.48	-0.23	0.26
Tidal volume (VT)	0.98 ± 0.52	0.43	0.02*
Forced vital capacity (FVC)	4.40 ± 0.67	0.55	0.01*
Forced expiratory volume (second) (FEV1)	4.04 ± 0.62	0.88	0.01*
Peak expiratory flow (PEF)	7.42 ± 1.79	0.36	0.07
Forced inspiratory flow (FIF)	5.38 ± 1.72	-0.07	0.73
Maximal voluntary ventilation (MVV)	163 ± 23	0.87	0.01*

The asterisk (*) indicates a significant correlation between two corresponding variables

Discussion and Conclusions

Knowing of anthropometric and physical fitness traits in each sport is an important and decisive factor that determinate athletic performance. Elite athletes have special anthropometric and physiological characteristics in their sports that determined their successes (Bourgois et al., 2000). In present study, we showed relationship between anthropometric and physiological traits with success of Iranian elite Greco-Roman wrestlers. Collectively, it does not seem that anthropometric traits to be determining factor in the success of Greco-Roman wrestling, but it seems that physical fitness traits to be definitive factors influencing on success of wrestlers.

Arm spam, as anthropometrics characteristics, positively correlated with success of Iranian elite Greco-Roman wrestlers. Also, measurements of arm-span were 6 cm more than his height (175 cm versus 181 cm). Because having long arms is a mechanical advantage in Greco-Roman wrestling, this trait is probably one of the reasons for successful performance of the subject in techniques such as the reverse lift, back arch and gut-wrench (Mirzaei et al., 2011). The subject's body fat (%) was higher than subjects of other study (Mirzaei et al., 2011) that investigated 55 kg weight class Greco-Roman wrestling (14 % versus 8.4 %). However, body fat (%) in present study determined in both of light and heavy weights Greco-Roman wrestling. In contrast of Roemmich and Frappier's (1993) study, our finding showed a negative correlation between body fat (%) and success of our subjects. This contradiction may be due to difference in the method of measuring body fat.

In line with other researchers (Roemmich and Frappier, 1993; Yoon, 2002; Mirzaei et al., 2011), results showed that higher levels of strength (dead lift, squat, and bench press), endurance (VO_2max), flexibility (shoulder and-wrist elevation, sit and reach) and reaction time are associated with higher levels of success in companions. Also, it is suggested that

changes in body composition induced by strength training have positive effect on muscle performance (Roemmich and Sinning, 1997). In addition, senior successful wrestlers had significantly more relative grip strength, pull-ups, oxygen consumption, and peak anaerobic power of upper and lower limbs (Nikooie et al., 2015). Furthermore, having high levels of agility and reaction time can dramatically help wrestlers to use rapidly their techniques against faster opponents' movements. Finally, a wrestler can earn better results due to high endurance and muscle strength that provides more stability in defense and attack positions (Yoon, 2002).

For the first time, we showed significant and positive correlations between lung capacities and success of elite Greco-Roman wrestlers. Collectively, these correlations may be due to high levels of strength and endurance of the respiratory muscles and low levels of airway resistance (Rong et al., 2008).

Collectively, according to our findings, physical fitness traits and lung capacities have greater potential than anthropometric characteristics in the prediction of Greco-Roman wrestler's success in championship levels. Thus, Greco-Roman wrestler's talent identification programs should place greater emphasis on the physical fitness traits and lung capacities than anthropometric measurements.

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Conflict of Interest

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Evaluation of the Factors Affecting Participation in Recreational Court Tennis in Terms of Gender and Age[1]

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Abstract

The aim of this study was to evaluate the factors which affect participation in recreational court tennis in terms of gender and age. 105 males (age: 30.37±11.74 years, height: 178.37±7.36 cm, and mass: 79.05±11.81 kg) and 101 females (age: 27.22±8.70 years, height: 166.59±6.72 cm, and mass: 60.60±9.24 kg), who participated in court tennis recreationally, made up the sample of the study. The factors which affect participation in court tennis recreationally were determined by the Recreational Exercise Motivation Measure which was originally developed by Rogers and Morris (2003) and adapted into Turkish by Gürbüz et al. (2006). The Independent Samples T-Test revealed that the female participants had higher scores in the health and body-appearance subdimensions of the scale than the males ($p<0.05$). No statistically significant differences were found in terms of gender in the other subscales ($p>0.05$). Differences between participants' demographic characteristics (monthly income, marital status and level of education) were assessed by Chi-square test and there was no difference between groups in terms of demographic characteristics ($p>0.05$). Pearson correlation analysis revealed a weak, negative correlation ($r= -0.179$) between age and competition scores of the scale. There was no correlation between age and the other sub-dimensions of the scale ($p>0.05$). Female participants were more involved in tennis for physical appearance than men. In both males and females, as age increased, participation in tennis aiming at competition decreased.

Keywords: Court tennis, Exercise motives, Gender, Age

[1] *This study was generated from the master's thesis of Neşe AYDEMİR, Trakya University, Institute of Social Sciences, Department of Recreation Management, Edirne, TURKEY (2018).*

Introduction

Physical inactivity is one of the most important health problems of the 21st century (Kruk, 2014). Physical inactivity ranks among the four most important causes of death in the world (Kohl et al., 2012). With regular physical activity, the risk of health problems such as cardiovascular diseases, some types of cancer, type 2 diabetes and osteoporosis is reduced (Özkan et al., 2013). To prevent chronic diseases linked to inactivity, a physical activity and exercise pyramid can be taken as a guide.

The physical activity and exercise pyramid is made up of strength exercise, aerobic exercise and flexibility components (Heyward and Gibson, 2010). Another component of the physical activity and exercise pyramid is recreational activity. Çağlar et al. (2009) stated that activities like football, basketball, volleyball, table tennis and swimming are the main recreational sporting activities. Another of these activities is court tennis.

Tennis is a world-class sporting activity. The Association of Tennis Professionals (ATP) and the Women's Tennis Association (WTA) organize 60-80 tournaments in 40 different countries every year and many people participate in these tournaments both as spectators and as players (Fernandez et al., 2006). The tennis world extends from Wimbledon to Roland Garros, from America to the Olympic Games (http://www.teniskortlari.gen.tr/tenis-tarihi.html). In the 2015 study at the USA Physical Activity Council, it was revealed that the number of tennis players in the USA had reached 17.9 million (http://www.tennisindustry.org/cms/index.cfm/news/tennis-participation-in-the-us-grows-to-179-million-players/).

Although there are no data in our country that determine the exact number of people playing court tennis for recreational purposes, the fact that about 100,000 tennis racquets are sold every year and also that the total number of courts in hotels and clubs, as well as municipal courts, is 2,000 shows that the sport of tennis is popular and developing (Ulagay, 2015). Moreover, according to the statement by the Turkish Tennis Federation, it is reported that the total number of licensed sportsmen and women is 36,900 and that the number of tennis players aged 20 and under is more than 19,000 (http://www.haberturk.com/spor/tenis/haber/1225947-turkiyede-lisansli-tenisci-sayisi-her-yil-katlanarak-artiyor). Therefore, the aim of this study is to evaluate the motivational factors that affect participation in recreational court tennis in terms of gender and age.

Material and Methods

Research group

The study sample consisted of 105 male participants (age: 30.37 ± 11.74 years, height: 178.37 ± 7.36 cm, and body mass: 79.05 ± 11.81 kg) and 101 female participants (age: 27.22 ± 8.70 years, height: 166.59 ± 6.72 cm, and body mass: 60.60 ± 9.24 kg) who took part in recreational court tennis. An age of over 18 was determined as an inclusion criterion of the study. Being a professional tennis player was defined as an exclusion criterion of the study. The convenience sampling method was used for sample selection. Questionnaires were sent by post or cargo to individuals who played tennis recreationally or to their coaches (Public Training Centres or Provincial Directorate of Youth Services and Sports) in the provinces of Istanbul, Edirne, Tekirdağ, Izmir and Kırklareli, and the completed questionnaires were retrieved by the same means.

Data collection tools

The demographic characteristics of the participants were determined with a data collection form created by the researcher. With the aim of determining the factors affecting participation in recreational court tennis, the Recreational Exercise Motivation Measure (REMM), originally developed by Rogers and Morris (2003) and made valid and reliable for Turkey by Gürbüz et al. (2006), was used. The original scale consists of 73 items. The items numbered 9, 26, 52, 54, 65, 71 and 72 were removed from the Turkish version of the scale since their factor loadings were below 0.40 (Gürbüz et al., 2006). After removal of the seven items, the Turkish version of the Recreational Exercise Motivation Measure consists of a 66-question scale. The scale is a 5-point Likert-type. In the scale, the questions numbered 23, 31, 30, 22, 20, 19, 10, 32, 37, 6, 18, 28, 40, 58, 55, 29, 65, 21, 11, 52, 46 and 36 represent the health sub-dimension, those numbered 47, 45, 48, 42, 66, 44, 27, 56, 33, 15, 57, 4, 25 and 61 reveal the competition sub-dimension, those numbered 12, 26, 14, 60, 34, 49, 59, 41, 8, 13 and 54 show the physical appearance sub-dimension, those numbered 62, 53, 38, 63, 35, 7, 24, 51, 5, 43 and 9 reveal the socialising and enjoyment sub-dimension, and those numbered 2, 3, 1, 16, 50, 39, 17 and 64 represent the skill development sub-dimension. The Cronbach's Alpha values of the scale are 0.93 for health, 0.88 for competition, 0.85 for physical appearance, 0.88 for socialising and enjoyment, and 0.84 for skill development (Gürbüz et al., 2006). The scoring of the sub-dimensions is 1 for "strongly disagree", 2 for "disagree", 3 for "undecided", 4 for "agree" and 5 for "strongly agree", and the mean point value was determined by adding up the points for the participants' answers given for each sub-dimension and dividing this total by the number of questions for that sub-dimension. The scoring of the scale was done in accordance with its guidelines (Gürbüz et al., 2006; Çağlar et al., 2009; Ardahan, 2013).

Statistical analysis

The data were evaluated for normal distribution with the Kolmogorov-Smirnov test. The differences in the demographic characteristics and the sub-dimensions of the scale with regard to gender were evaluated with t test for independent groups. Correlation between age and the sub-dimensions of the scale was measured with the Pearson correlation coefficient. The relationships among the participants' monthly income levels, educational statuses, marital statuses, frequency of playing and time spent playing tennis were assessed with the Chi-square test. Statistical significance level was taken to be $p < 0.05$.

Results

The participants were identified as 51% males (n=105) and 49% females (n=101). The male participants' mean age, height and body mass were determined as 30.37 ± 11.74 years, 178.37 ± 7.36 cm, and 79.05 ± 11.81 kg respectively, while those of the female participants were found to be 27.22 ± 8,70 years, 166.59 ± 6.72 cm, and 60.60 ± 9.24 kg respectively. Statistical differences between male and female participants in terms of age, height and body mass in favour of male participants were determined at levels of $p< 0.05$, $p< 0,001$ and $p< 0,001$ respectively. 11.5% of male participants were postgraduates, 82.7% were university graduates, and 5.8% were high school graduates. 7.9% of female participants were postgraduates, 84.2% were university graduates, and 7.9% were high school graduates. No statistically significant difference was found between male and female participants in terms of educational status ($p>0.05$). As regards marital status, 34.3% of male participants were

married and 65.7% were single, while 26.7% of female participants were married and 73.3% were single. No statistically significant difference was found between male and female participants in terms of marital status (p>0,05).

In Table 1 participants' income levels, in Table 2 their tennis experience, in Table 3 their frequency of playing tennis, and in Table 4 the length of time they spent playing tennis are given. Table 5 shows the scores obtained from the sub-dimensions of the recreational exercise motivation questionnaire, while Table 6 shows the level of correlation between participants' ages and the factors that motivated them to take part in tennis.

Table 1. Participants' Income Levels

Variable	Male	Female	p
1000 TL and under	33 (31.4%)	41 (40.6%)	0.51
1001-2000 TL	12 (11.4%)	11 (10.9%)	
2001-3000 TL	13 (12.4%)	17 (16.8%)	
3001-4000 TL	20 (19.0%)	14 (13.9%)	
4001-5000 TL	12 (11.4%)	8 (7.9%)	
5001 TL and over	15 (14.3%)	10 (9.9%)	

No statistically significant difference was found between participants' income levels (p>0.05).

Table 2. Participants' Tennis Experience

Variable	Male	Female	p
Less than 1 year	40 (38.1%)	69 (68.3%)	<0.001*
1-2 years	18 (17.1%)	10 (9.9%)	
2-3 years	8 (7.6%)	7 (6.9%)	
3-4 years	13 (12.4%)	5 (5.0%)	
5 years and over	26 (24.8%)	10 (9.9%)	

*p<0.001

A statistically significant difference (p<0.001) was found between participants' levels of tennis experience (number of years they had played). It was determined that male participants were more experienced than female participants (3-4 years and 5 years and over).

Table 3. Frequency with which Participants Played Tennis

Variable	Male	Female	p
1-2 days	83 (79.0%)	87 (86.1%)	0,22
3-4 days	17 (16.2%)	13 (12.9%)	
5-6 days	5 (4.8%)	1 (1.0%)	

No statistically significant difference was found between participants in terms of the frequency with which they played tennis (number of days per week) ($p>0.05$).

Table 4. Length of Time Participants Spent Playing Tennis (in one Session)

Variable	Male	Female	p
0-20 mins.	4 (3.8%)	5 (5.0%)	0.01*
21-40 mins.	9 (8.6%)	13 (12.9%)	
41-60 mins.	34 (32.4%)	50 (49.5%)	
61 mins. or more	58 (55.2%)	33 (32.7%)	

*$p<0.05$

A statistically significant difference ($p<0.05$) was found between participants in terms of the length of time they spent playing tennis in one session (one tennis training session). It was determined that male participants spent longer periods (61 minutes or more) playing tennis than female participants.

Table 5. Scores Obtained by Participants from Sub-Dimensions of Exercise Motivation Questionnaire

Variable	Male	Female	p
Health	3.83±0.72	4.11±0.62	0.003*
Competition	2.99±0.98	2.99±1.00	0.956
Appearance	3.27±0.92	3.63±0.88	0.005*
Socialising/enjoyment	3.70±0.75	3.77±0.64	0.450
Skill development	3.92±0.82	4.03±0.63	0.284

*$p < 0.001$

A statistically significant difference ($p<0.001$) was found between participants in favour of female participants in the scores they obtained from the health and appearance sub-dimensions of the exercise motivation questionnaire. No statistically significant differences were found between participants for the other sub-dimensions. This finding shows that female participants take part in the sport of tennis more for reasons of health and physical appearance when compared to men.

Table 6. Correlation Levels between Scores Obtained by Participants from Sub-Dimensions of Exercise Motivation Questionnaire and their Ages

	Health	Competition	Appearance	Socialising and Enjoyment	Skill Development
Age (years)	0.075	-0.179*	-0.053	-0.010	-0.013
Health	1	0.309**	0.591**	0.656**	0.677**
Competition/ego		1	0.685**	0.480**	0.388**
Appearance			1	0.566**	0.524**
Socialising/ enjoyment				1	0.600**

* $p<0.05$, ** $p>0.05$

A weak, negative statistical correlation was found between participants' ages and the competition sub-dimension ($r= -0.179$), ($p<0.05$). No correlation was determined between age and the other sub-dimensions. This finding shows that as participants' ages increased, the scores obtained from the competition sub-dimension of the exercise motivation questionnaire decreased.

Discussion and Conclusions

The aim of this study was to evaluate the factors that affect participation in recreational court tennis for the purpose of utilising free time, in terms of gender and age. The main findings obtained from the study are a) that female participants take part in the sport of tennis more for reasons of health and physical appearance when compared to men, and b) that there is a weak, negative correlation between age and the scores obtained from the competition sub-dimension of the scale. This finding shows that as the age of participants increases, the scores obtained from the competition sub-dimension of the exercise motivation questionnaire decrease.

Although studies about the factors that motivate people to take part in recreational tennis are difficult to find, Crespo and Reid (2007) stated that young tennis players play tennis to improve their levels of play, to stay physically fit, to increase their skill levels and to form new friendships. Furthermore, Crespo and Reid (2007) revealed that male tennis players play

tennis more for competition, rivalry, status, enjoyment and winning prizes compared to female tennis players.

From the viewpoint of age, it can be seen that players aged 12 and over play tennis more for reasons like being popular, using new tennis equipment and pleasing their parents when compared to players aged under 12 (Crespo and Reid, 2007). Crespo and Reid (2007) reported that participation in tennis before the age of 12 is related more to internal factors (competition, rivalry, etc.) and that participation in tennis due to external factors (looking good, staying fit, etc.) increases with age.

Garyfallos et al. (2013) stated that children aged 8-9 participate in tennis more for skill development, whereas in the adolescent period, participation in tennis is aimed more at being social and spending energy.

Pauline and Pauline (2009) stated that there are no age or gender differences with regard to factors that motivate participation in tennis for recreation, and that individuals aged 35-65 take part in tennis tournaments for material gains (winning tournament t-shirts, coupons, parking vouchers, meal tickets, etc.)

Aaltonen et al. (2014) identified the factors that motivate individuals towards physical activity as physical fitness, expertise, the social aspect of physical activity, psychological state, enjoyment, willingness and being/appearing better than others. Moreover, Aaltonen et al. (2014) state that health is the most important reason for doing exercise, independently of age and gender.

Examining the studies conducted in this field, it is striking that different findings have been obtained. The reason for this is that in our study, the physical appearance and health factors were more important for women's participation in recreational court tennis than they were for men. Molanorouzi et al. (2015) stated that the factors motivating people to do exercise change according to age and gender and that women are more motivated by appearance and physical state than men are. Considering the findings obtained from our study, these show similarity with Molanorozi et al.'s (2015) study with regard to physical appearance.

It is determined that women who do regular exercise mostly do so to be healthy (34.8%), and to look beautiful and strong (13.3%) (Polat, 2014). In another study, it is stated that in the health sub-dimension, female participants had higher scores than male participants (Güngörmüş et al., 2014). Similarly, according to Çağlar et al. (2009), it was observed that in the health sub-dimension, women's scores were higher than those of men. In our study, it was determined that the most important factors for female participants' playing court tennis were physical appearance and health.

At the same time, according to Molanorouzi et al. (2015), the most important factor motivating females to take part in exercise is health, whereas competition is the least important factor. Koivula (1999) stated that men take part in exercise more for competition compared to women, while the most important reason for women to participate is appearance. Similarly, in another study, it was determined that women are motivated towards exercise more for appearance and for psychological reasons, whereas for men, expertise and competition motivated them towards exercise (Molanorouzi et al., 2015). When the results obtained from our study are compared with the study of Molanorouzi et al. (2015), it can be understood that similar results were obtained with regard to appearance.

Karakaş et al. (2015) stated that the factors that affect women's participation in swimming exercise are health, skill development, physical appearance, socialising-enjoyment and

competition in that order. Çağlar et al. (2009) revealed that the scores obtained from the REMM scale differed according to age, that the scores obtained from the health sub-dimension among individuals aged 21-24 were higher than those obtained by individuals in the 15-17 age group, and that this case was also true for the socialising and enjoyment sub-dimension. When the results obtained from our study are compared with the study of Çağlar et al. (2009), it is seen that different results were obtained. The reason for this difference is the single difference in our study in which competition decreases as age increases. There is no difference in the other sub-dimensions.

In one study, it was determined that there is a linear relationship between age and the competition, physical appearance, socialising/enjoyment and skill development sub-dimensions, and that as age increases, participation in recreational sports decreases in relation with the desire for competition, physical appearance, socialising/enjoyment and skill development (Ardahan, 2013). Similarly, Karakaş et al. (2015) stated that as age increases, the skill development, competition and physical appearance participation factors decrease, while the participation factor for health increases.

According to Biddle and Mutrie (2007), the two most influential factors for participation in exercise among individuals aged 16-74 were looking good and protecting their health. It was determined that the most motivating factors for physical activity among young adults are health benefits together with bodily image and appearance (Aaltonen et al., 2014). When the results obtained from our study are compared with the study of Biddle and Mutrie (2007), it can be seen that different results were obtained. The reason for this is that in our study, the age factor is effective only in the competition sub-dimension and that as age increases, competition decreases.

In conclusion, it can be understood that the factors that motivate physical activity show differences according to age and gender. In our study, it was determined that compared to men, women participate in recreational court tennis more for reasons of physical appearance and health. At the same time, it was determined that as age increases, competition decreases, and that there is a weak correlation between age and competition. Nowadays, when chronic illnesses are rapidly increasing in number due to inactivity, research into factors that motivate individuals towards exercise with larger samples may be beneficial for competent and effective trainers, physical education teachers, doctors and politicians in directing people towards physical activity.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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Assessment of Physical Fitness: Focusing on Grade 8th to 10th Class Students

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Abstract

In developed countries of the world, a variety of test batteries have been developed in accordance with their own environment. With the help of these test batteries, they are successfully selecting players for different games or event. We in Pakistan are starving in term of test and consequently failing in achieving satisfactory performance in various sports activities. Hence, a study was conducted with the aim to develop test batteries for the assessment of fitness level. For this purpose, 2184 students of 8th to 10th classes were conveniently selected and participated in the study. For analysis of data mean and standard deviation were used. The researcher found poor physical fitness among the students. Therefore, it is recommended that the teachers and parents should make it obligatory to take proper care of their students/children's physical fitness by providing a healthy diet and also allow them to participate in sports activities.

Keywords: Terms; Assessment, Physical Fitness, Students, Test battery

Introduction

Physical fitness is very important for all age groups (Blair et al., 2001) it maintains blood pressure, lipid profile and controls cardiovascular infirmities (Kell et al., 2001; Soteriades et al., 2011& Vina et al., 2012). Physical fitness and activity reduce the risks of cardiovascular diseases in adolescence and the decrease in physical activities and fitness can increase the risks of cardiovascular diseases in adolescence. Physical fitness is usually measured in relation to functional expectations that are, typically, by measuring endurance, strength, agility, coordination, and flexibility (Fragala-Pinkham et al., 2005). Similarly, stress testing, which determines the body's settlement to powerful, constant physical stimuli, is utilized to examine fitness and states that If individuals are able to accommodate to the stressors, they are supposed to be fit (Brown et al., 2013 & Hargie et al., 2015).

The key objectives of youth fitness and action advancement are to expand the likelihood that young will receive customary physical action propensities and keep up satisfactory levels of physical fitness to add to ideal wellbeing and capacity all through life. By applying the through physical training programs, we accept there is a more noteworthy chance that youngsters will grow up to end up dynamic and solid grown-ups.

Imperativeness and criticalness of physical fitness have generally been recognized independent of the age, field or calling whether it is games, cultivating or exchange, wellbeing or any stroll of our daily life. In this context, Ntoumanis (2001) states that physical fitness has been one of the pre-essentials of effective games and sports profession whereas, satisfactory and successful performance in the field of physical education, sports and athletics is specifically subject to level of physical fitness of the competitor (Smith, 2003). The author further states that the more one is fit the better achievement can be accomplished.

Presently the issue is the way to prescribe reasonable individual to an appropriate diversion or occasion e.g. who is fit for tossing events, hopping events and running events. For the full of feeling location of the issue, distinctive tests and test batteries have been created in the propelled nations in accordance with their own surroundings. On the premise of these tests, they have been entirely fruitful in conveying the proper player to the suitable game or event.

We in Pakistan have been deficient as far as our specialized and advanced way to deal with games related issues. Nonaccessibility of the appropriate test batteries created in similarity with our own financial, physiological and socio-cultural state of the general public has been amongst the center issues of the games field. On the other hand, we are still lacking in developing of battery that could be applied considering economic, physiological and socio-cultural condition of the country.

Keeping in view this starving situation, the researcher decided to conduct a study to evaluate the physical fitness of 8th to 10^{th} class students. The researcher is of the opinion that this study carries vital significance on the ground that as a result of this study the researcher developed test battery for measuring the physical fitness level of 8^{th} to 10^{th} class students of Khyber Pakhtunkhwa (KP).

Problem statement

Universally various test batteries and standards have been created which have viable been serving in determining the fitness level of the competitors. It is likewise a reality that the greater part of the accessible test batteries and standards are produced in the created nations where the financial, physiological and socio-cultural conditions are very not quite the same as our nation. We are as yet ailing in creating of battery that could be connected considering

financial, physiological and socio-cultural state of the nation. Keeping in view the deficiency, the researcher intended to develop a similar type of test battery to evaluate the fitness level of 8^{th} to 10^{th} class students of KP, Pakistan.

Literature Review

Fitness and its significance

Physical fitness does allude to being physically fit, as well as alludes to a man's mental state also. On the off chance that a man is physically fit, yet rationally unwell or disturbed, he or she won't have the capacity to work ideally (Raedeke & Burton, 1997). Several studies proved that mental wellness must be accomplished if your body is working great and one can unwind your own brain and take out burdens by practicing consistently and eating right (Borg et al., 2005; Sieberg, 2011). Individuals who are physically fit are likewise more beneficial, can keep up their most ideal weight, and are additionally not inclined to cardiovascular and other wellbeing issues (Scheuer & Tipton; Ekelund et al., 1988 & Tapia et al., 2007). It is also research that a man who is fit both physically and rationally is sufficiently solid to confront the high points and low points of life, and is not influenced by extraordinary changes in the event that they occur (Boin & Hart, 2003).

Turning out to be physically fit requires an adjustment in way of life too (Hellison, 2000) whereas, Naidee (2016) in his book “Foundation for health promotion” demonstrates that one needs to join a standard activity routine in life. Furthermore, balanced diet, proper sleep, and strenuous physical activity participation are very beneficial for the promotion and development of fitness. Similarly, numerous studies affirmed that staying away from garbage nourishments, fizzy beverages, negative behavior patterns like smoking and liquor and by getting satisfactory measure of rest, you will have the capacity to end up physically and rationally fit (Palmer, 2015). The author suggested that participation in angling, bicycling, swimming, trekking, and notwithstanding playing football with your children ought to be a piece of your physically fit way of life.

Physical Fitness Components

Muscular strength

This is the "force" that helps you to lift and convey overwhelming items. Without strong quality, your body would be frail and not able to stay aware of the requests set upon it. The best approach to build quality is to prepare with overwhelming weights, working in the 4 - 6 or 12 - 15 rep ranges. The heavier the weight, the fewer reps you ought to perform.

Muscular endurance

Muscular endurance is the capacity of your muscles to perform constrictions for augmented timeframes. As opposed to simply lifting or conveying something for a few moments, the muscles are utilized for a considerable length of time. The best approach to expand quality is to prepare with light weights, working in the 20 - 25 rep range. Working with lighter weight will prepare the muscle strands required for strong perseverance, and the higher rep range prompts a more extended time of activity.

Cardiovascular endurance

Cardiovascular endurance is your body's capacity to stay aware of activity like running, running, swimming, cycling, and anything that strengths your cardiovascular framework (lungs, heart, and veins) to work for broadened timeframes.

Together, the heart and lungs fuel your body with the oxygen required by your muscles, guaranteeing that they have the oxygen required for the work they are doing. The Cooper Run (running quite far in 12 minutes) is a test generally used to survey cardiovascular continuance; however, numerous coaches utilize the Step Test (venturing onto a stage for 5 minutes). Both are precise measures of a subject's cardiovascular.

Flexibility

Flexibility is a standout amongst the most essential, yet regularly neglected, segments of physical wellness. Without adaptability, the muscles and joints would develop hardened and development would be restricted. Adaptability preparing guarantees that your body can travel through its whole scope of movement without torment or firmness.

To test your flexibility, incline forward and attempt to touch your toes. Those with great adaptability will, as a rule, have the capacity to touch their toes, while those with restricted adaptability won't. The sit and achieve test (sitting on the floor and coming toward your toes) is another great approach to evaluate your flexibility. The more adaptable you are, the nearer you will come to touching your toes and past.

Materials and Methods

For reaching at certain findings and conclusion with the help of gathered data, the researchers used following procedures.

Study participants

The population for this particular study comprised of all the students at 8^{th} to 10^{th} class studying in government boy's high schools in the province of KP, Pakistan. It was very difficult rather impossible for the researcher to contact each and every student in the province. For the purpose, the researcher confined his study to 13 districts which were randomly selected from the province. After this, 52 schools were recruited from the selected districts and 2184 students of 8^{th} to 10^{th} classes were conveniently selected and participated in the study.

Data collection tool

The researcher selected four items which were validated through pilot studies. For this purpose, 40 students of 8^{th} to 10^{th} classes were selected with in the vicinity of Dera Ismail Khan (DIK). The test battery consisted of Sit ups in 30 seconds, Standing broad jump, V sit reach and 1000 m run

Data collection procedure

The 52 copies of the test battery with full procedure of conducting each test item and 52 Performa's for students' scores in each test item were distributed in 52 schools. Demonstration of the test items was also given to the concerned Physical Education Teachers/ teachers. They were given three days' time to collect the data from their school.

Data analysis

The data collected by the researcher was analyzed by using SPSS version 20. For analysis of data, Percentile Scale, Mean and Standard Deviation were used. Further, the scores were classified into five grades i.e. very good, good, average, poor and very poor.

Findings

Table 1. Mean, standard deviation and grading of students in 30 seconds sit up

Mean and Standard deviation				
No of Students	**Mean**		**Standard Deviation**	
2184	19.23		4.957	
Grading				
Very Poor	Poor	Average	Good	Very Good
>9 sit-ups	9-13 sit-ups	14-24 sit-ups	25-29 sit-ups	<29 sit-ups

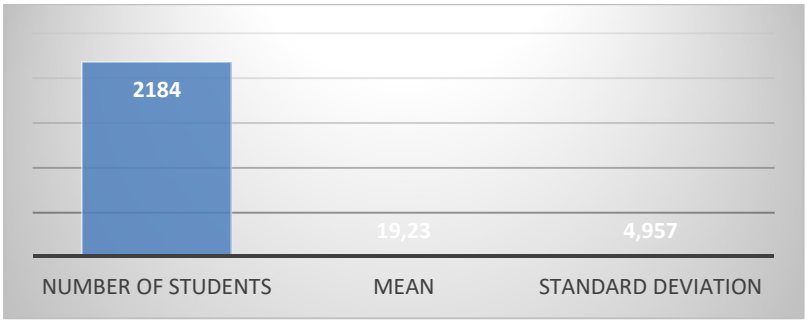

Figure 1. Showing Mean and Standard Deviation in 30 Seconds Sit up Test

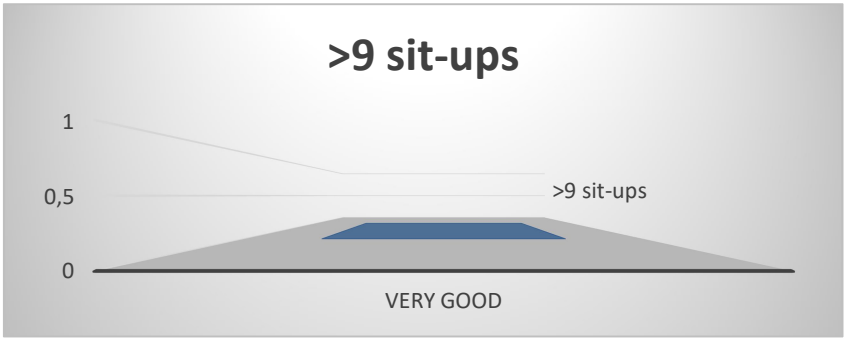

Figure 2. Showing Grading in 30 Seconds Sit up Test

Table 1 and Figure 1 and 2 illustrate that in sit-up test, the mean score is 19.23 and standard deviation score is 4.957. similarly, In sit-up test, the scores below 9 sit-ups in 30 seconds are considered very poor, from about 9 to 13 is considered poor, 14 to 24 is considered average, 25 to 29 is considered good and the scores above 29 are considered very good.

Table 2. Mean, standard deviation and grading of students in V-Sit Reach Test

Mean and Standard deviation				
No of Students	**Mean**		**Standard Deviation**	
2184	2.997		2.82	
Grading				
Very Poor	Poor	Average	Good	Very Good
>-3 inches	-3-(-0.5) inches	0-6 inches	6.5-9 inches	<9 inches

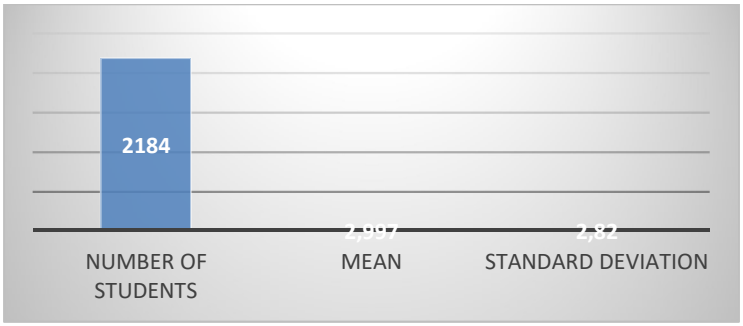

Figure 3. Showing Mean and Standard Deviation in V-Sit & Reach Test

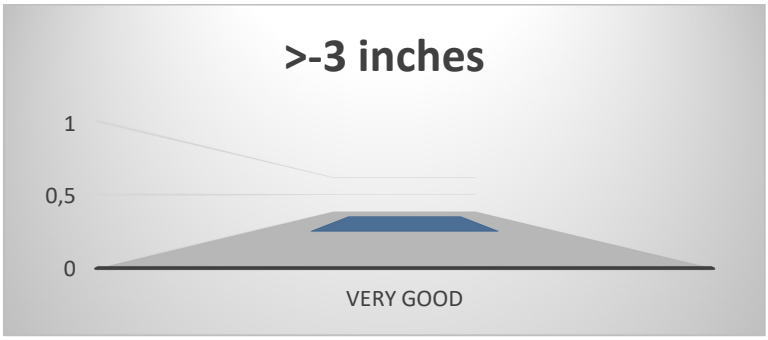

Figure 4. Showing Grading of Students in V-Sit & Reach Test

Table 2 and Figure 3 and 4 depict that in V-sit reach test, the mean score was 2.997 and standard deviation score was 2.82. In V-sit reach test, the scores below -3 inches are considered very poor, from about -3 to -0.5 inches is considered poor, 0 to 6 inches is considered average, 6.5 to 9 inches is considered good and the scores above 9 inches are considered very good

Table 3. Mean, standard deviation and grading of students in standing broad Jump

Mean and Standard deviation				
No of Students	**Mean**		**Standard Deviation**	
2184	69.72		12.95	
Grading				
Very Poor	Poor	Average	Good	Very Good
>44 inches	44-56 inches	57-83 inches	84-96 inches	<96 inches

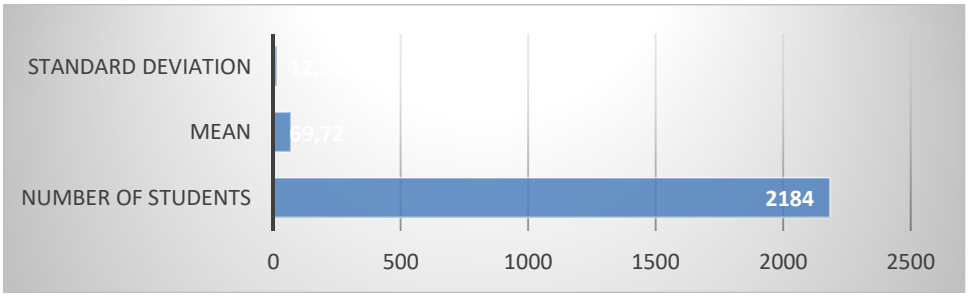

Figure 5. Showing Mean and Standard Deviation in standing broad jump

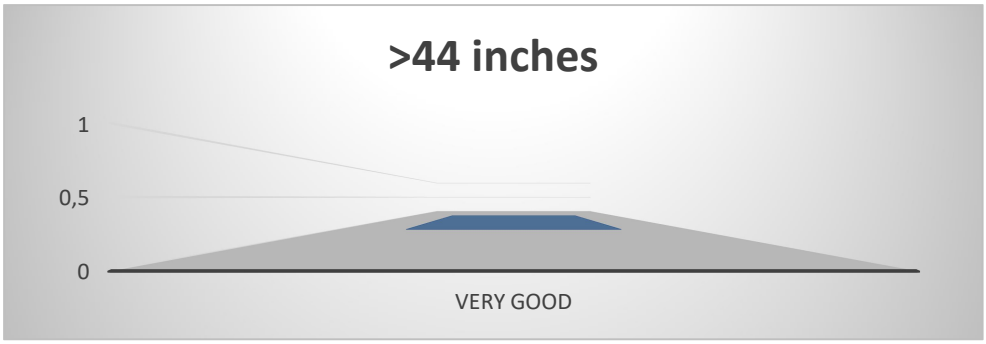

Figure 6. Showing Grading of Students in standing broad jump

Table 3 and Figure 5 and 6 show that in standing broad jump, the mean score was 69.72 and standard deviation score was 12.95. In Standing Broad jump, the scores below 44 inches are considered very poor, from about 44 to 56 is considered poor, 57 to 83 is considered average, 84 to 96 is considered good and the scores above 96 are considered very good.

Table 4. Mean, standard deviation and grading of students in 1000 M Run

Mean and Standard deviation of Norms				
No of Students	**Mean**		**Standard Deviation**	
2184	289.59		54.36	
Grading of Norms				
Very Poor	Poor	Average	Good	Very Good
<398 seconds	398-345	344-235	234-181	>181 seconds

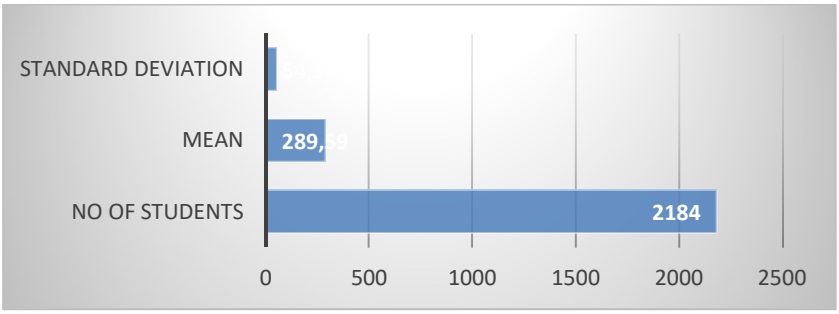

Figure 7. Showing Mean and Standard Deviation in 1000 M run

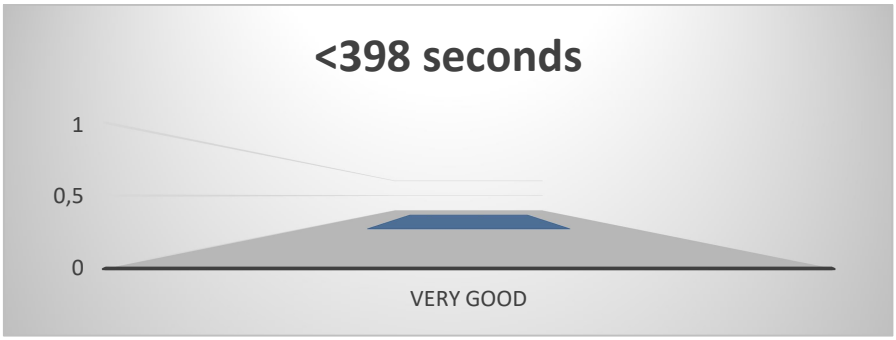

Figure 8. Showing Grading of Students in 1000 M run

Table 4 and Figure 7 and 8 illustrate that in 1000 M run test, the mean score was 289.59 and standard deviation was 54.36. In 1000 M run test, the scores above 398 seconds are considered very poor, from about 398 to 345 seconds is considered poor, 344 to 235 seconds is considered average, 234 to 181 seconds is considered good and the scores below 181 seconds are considered very good.

Discussion and Conclusions

1. The researcher found that in sit-up test, the mean score was 19.23, in V-sit reach test 2.997, in standing broad jump, 69.72, in shuttle run test 10.84, and in 1000 meter run test, the mean score was 289.59.

2. The researcher found that in sit-up test, standard deviation score was 4.957, in V sit reach test 2.82, in standing broad jump 12.95, in shuttle run test 1.08 and in 1000 meter run test standard deviation was 54.36.
3. Thirty-second Sit-up test. In this test, the researcher offered five categories to the population to check their performance {very poor (below 9 sit-ups), poor (9 to 13 sit-ups), average (14 to 24 sit-ups), good (25 to 29 sit-ups) and very good (above 29 set ups)}.
4. V-Sit reach test. In this test, the researcher offered five categories to the population to check their performance {very poor (below -3 inches), poor (-3 to -0.5 inches), average (0 to 6 inches), good (6.5 to 9 inches) and very good (above 9 inches)}.
5. Standing Broad jump. In this test, the researcher offered five categories to the population to check their performance {very poor (below 44 inches), poor (44 to 56 inches), average (57 to 83 inches), good (84 to 96 inches) and very good (above 96 inches)}.
6. 1000 Meter run test. In this test, the researcher offered five categories to the population to check their performance {very poor (above 398 seconds), poor (398 to 345 seconds), average (344 to 235 seconds), good (234 to 181 seconds) and very good (below 181 seconds)}.

Practical Implications

1. The findings of the study will help the understudies would know about their physical fitness level. Therefore, the selectors, coaches as well as teachers would need to educate the techniques and approaches to reinforce and safeguard their fitness.
2. Furthermore, physical educators after establishing out the fitness levels of the children could outline fitness programs in accordance with their abilities and capabilities.
3. Apart from these, the parents will be in a position to arrange or plan of more viable systems for the counteractive action of wellbeing.

Recommendations

In the light of the findings and conclusion the researcher put forth the following recommendations for the improvement of the situation;

1. As the results show poor physical fitness of the students, therefore not only the parents but the teachers may also take care of the physical fitness of the students and make it sure that physical fitness is checked on regular bases.
2. The students studying in the schools participated in the study, therefore the researcher recommended that the educational institutions may provide the basic health and sports facilities which are necessary to develop and maintain physical fitness.

In addition, the researcher recommended that for good health of the students the government may arrange programs not only for educational institutions but also the general to give proper awareness regarding the importance of physical fitness and how to achieve and maintain physical fitness.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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Sport Diplomacy as Public Diplomacy Element

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Abstract

The concept of sport diplomacy which is an element of public diplomacy is thought to be a charming structure that surrounds states and nations in a globalized world where borders are eliminated. Although the concepts of sports and diplomacy serve different purposes, these two concepts continue to bring together different nations and cultures under the same roof of peace. It is commonly accepted that sports diplomacy uses sports and its branches as a tool and establishes important links among nations. The purpose of this literature is to evaluate the concepts of diplomacy, public diplomacy, and sports diplomacy and to draw a conceptual framework on sports diplomacy by using descriptive analysis. As a consequence, it can be said that, the sports and diplomacy concept are tried to be filled with various projects, sport as a diplomacy activity is a soft and rational force and nations carry out sports diplomacy activities through international sporting organizations, national brands, media and technology, sports ambassadors and lobbying in order to show each other their superiority in the sports universe to spread their cultures and be better economically.

Keywords: Diplomacy, Sport Diplomacy, International Relations

Introduction

In the international arena, the concept of diplomacy, is used to influence the political systems of other states and the decision-making mechanisms of the countries and public diplomacy which is the work of governments to influence the peoples and to create public opinion in their favor, has recently put forward its effectiveness (Gün, 2014). Other new types of diplomacy that is implemented in conjunction with public diplomacy or in different ways, is sports diplomacy (İnan, 2012). Today, sport has a tremendous contribution to peace as an element of "Public diplomacy" also called "soft power'' (Erandaç, 2011). Sports diplomacy is a one of the most civilized, peaceful and massive diplomatic instrument that many countries take advantages of it (Kurt, 2014). At the same time, sport is used as a tool for both international and intra-national relations as a means of soft power (Nygard and Gates, 2013).

Diplomacy

Diplomacy has been a concept that has led to the continuation of relations between societies since the early days of human history. Considering today's circumstances, it can be defined as a purpose of peaceful official activity between the international community units to carry out the state's external affairs bodies and the aims of foreign objectives policy which are approved with international legal norms (Zharmukhanbetova, 2010). From a wider perspective, diplomacy is the name given to all the countries that have been conducting their foreign relations. When approached from a narrower perspective diplomacy is the execution of foreign policy a part from the policy-building process. According to another point of view, diplomacy tries to preserve the international order while trying to deliver a state to certain objectives (Griffitths et al., 2013).

Public Diplomacy

If public diplomacy is to be defined in an abstract way, it is the whole activities of State's in order to influence other states and public opinion (Jane, 2014). Public diplomacy is defined not only relations with foreign governments but also special talks and interactions in addition to formal negotiations that are frequently made within the framework of non-governmental individuals and organizations (Nye, 2004). The concept of public diplomacy is used first time by A.Gullion who is Dean of the University of Fletcher (1965), defined public diplomacy as a communication activity is carried out in the international arena, as an effort to influence the public's attitudes for the formation and implementation of foreign policy (Köksoy, 2013). However, it would be appropriate to mention the historical dimension of public diplomacy as the fact that public diplomacy is an expression of practices that have been carried out among communities living in the world for centuries. In fact, it would be striking to go one step further at this point and the concept of public diplomacy was used to refer to "expropriation policy" in the foundation years of Ottoman.

The concept of "expropriation policy" which is revealed by historian Halil İnalcık is actually nothing more than public diplomacy practices. Because, during the establishment of the Ottoman Empire, the new lands were easily conquered thanks to "winning to your side" activities which had started to be carried out in the fourteenth century (Karadağ, 2012). Public diplomacy, which takes its essence from "soft power", carries the dimension of international relations from state to state to from state to public from public to public. In this respect, it covers all activities and works carried out in order to establish long-term relations by creating an inter-communal understanding, exchange of ideas, sharing of information, dialogue, negotiation, and cooperation environment to gain mutual minds and hearts. The forms of

public diplomacy that we face in different shapes constitute the basis for the formation of various views. Basically, sports diplomacy is evaluated within the framework of public diplomacy practices (Yıldırım, 2014).

Sport Diplomacy

The relationship between sports and political science has been discussed for a long time. However, the relationship between sports and diplomacy has not been fully explored and explained theoretically. In the current studies, it is observed that in order to clarify relationship between the two concepts are seen as case-specific studies (Murray, 2012).

It can be clearly said that sports have made public diplomacy effort on behalf of the country. (Arpacıoğlu, 2012). Sports diplomacy, as one of the sub-branches of diplomacy, is under the roof of public diplomacy. Sports diplomacy is one of the most civilized, peaceful, and massive diplomatic tools in a country (Kurt, 2014). It is generally accepted that sports can be used to unlock the doors of opportunity in public diplomacy and promote any dialogue (Sombosombo, 2012). Sports diplomacy is used to overcome linguistic and sociocultural differences with the universal passion of sports and to bring people together (Gök, 2016). In the period of the Cold War, sport was actively used as a means of diplomatic propaganda. In this period, two blocks have done various works on sports activities which is an area of interest of each sector with the effort to establish superiority to each other besides military and economic areas.

During the cold war, western and eastern block countries tried to gain superiority against each other in sports as well as in every field. In international sports contest, the message of ‘’we are better than them’’ was attempted to give to the world by the American and Soviet athletes, who are in intense competition each other. From time to time, the shadow of this ideological struggle fell on the sport. Western countries boycotted the 1980 Moscow Olympics and Eastern bloc countries boycotted the 1984 Los Angeles Olympics (Demir, 2012). In that period of time, the leader of the Nazi has considered 1936 Berlin Olympics as an opportunity to show the power of the Nazi regime to the whole world by filming all competitions and announce to everyone that German athletes are superior to others. In 1971, with the invitation of the US Table tennis national team to the People's Republic of China, the relations of US and China that have been dispersed since 1949 have been established for the first time. This table tennis event was followed with the visit of President Richard Nixon to Beijing which is considered a turning point in U.S.-Chinese relations (Erhan, 2010). The two former enemies, Japan, and South Korea, hosted the 2002 World Cup together, sending messages of friendship (Murray, 2012).

A sports-diplomacy relationship that began April 10, 1971, between the US and China today live its golden age because the United States sent the ping pong national team to China (Şafak, 2008). Emerging with the changing diplomatic environment, sports diplomacy is one of the key elements of public diplomacy ‘’meaning soft power’’ contributes to various fields such as sports, the country's athletes, fields of youth, coaches, referees, sports managers, sports scientists, sports clubs , national sports federations, international sport organizations international sport organizations -Public International Sports; Sports Journalists - sports TV or radio channels; international youth exchange, training and youth camp programs in terms of public diplomacy, the activities of these actors or institutions in the field of youth and sports are very important to show the national power resources of the country, such as economic, social, cultural, technology and human and to create a reputation and image in the direction of this power (Gök, 2016). Another example can be given from Turkey-Armenia relations. In

2008, former President of the Republic of Turkey went to the match between the national football teams of the two countries in Yerevan and this circumstance was considered as football diplomacy (Erhan, 2010). Sports diplomacy has four basic functions. These include: building peace, bringing nations together, establishing a dialogue platform, building consensus and confidence, as well as using a variety of tools for sports diplomacy to develop it (Nygard and Gates, 2013).

Sport Diplomacy Tools

Sports diplomacy, which is an element of public diplomacy practices, is a reflection of soft power and also an international tool. International organizations, national brand, media and technology, sports ambassadors, lobbying elements can be listed as sports diplomacy tools.

International Sport Organizations

Sports can be an opportunity for sports diplomacy to achieve various political goals (Brannagan et al., 2018). In most of the time, activities in the field of sports are part of public diplomacy (Kurtuluş, 2014). Sports is one of the unique elements that drives the massive masses from its behind. Large organizations such as world cups and Olympics reach billions of people at the same time. There is nothing else in the world that billions of people's participation can be achieved at the same time. In this respect, sport has very large (soft) power. In a short period of time, the achievements in big competitions can bring those countries into different positions in the eyes of the world (Yıldırım, 2014). According to Grix (2018), there are two ways for sports to be used for public diplomacy. The first one is to host mega sports organizations such as the Olympics or the FIFA World Cup. Hosting major sporting events with global attractiveness is one of the ways in which nations show themselves to increase their international prestige and gain soft power. A second way is to increase their image by using the achievements of sports in elite branches especially for the nations that do not host any sports and mega-activities. Ultimately, states can combine these two methods.

Kurtuluş (2014) stated that the most striking event in the field of sports diplomacy is the Olympics. The Olympics is followed by the entire world, are a very serious publicity tool for host countries. Although the Olympics and large sports games appear to be part of international sports, the countries participating in such events or games are also in the forefront of the diplomatic area. The main argument in the Olympics is that the countries participating in the Olympics represent themselves in a sporting sense and make them feel their existence and power to the world through the Olympics. These organizations are always supported and followed by the world (Doğu, 2010). Events such as Olympics attract many countries in terms of their value and impact on public diplomacy (Grix, 2018). At each period of the year, candidates are selected from the cities of various countries about where the Olympics will be held and here there are significant competitions between these candidate cities (countries). Moreover, the Olympics are among athletes from all over the world with diversified cultures by breaking down the their prejudices where they feel together with the spirit of sportsmanship, fraternity, solidarity alongside to competition, are turns into some kind of practice exchange diplomacy and get ideas about each other's culture (Kurtuluş, 2014). Besides the Olympics, it is commonly agreed that hosting international sports organizations is one of the appropriate ways to use sports as an art of diplomacy.

National Brand

The national brands owned by a country are one of the effective tools in delivering the messages to the target audience through public diplomacy. The reputation and the image of the national brands owned by the country also affect the reputation and image of the country. In brief, national branding contributes to the country's international recognition, reputation, and image (Gök, 2016).

National brands are an instrument of the initiative of non-state actors in the transmission of public diplomacy messages of a state. National brands owned by a country will contribute to its worldwide recognition, reputation, and quality. There is direct emotional and economic interaction between the country's reputation and the country brands that will come out of the country towards to buying (Saydam, 2010 Akt: Sancar, 2012). As a result of this interaction, the perception gained by countries in the global system is a respectable, reliable, strong country image. It is important to bring different cities to the forefront especially with their various features in terms of creating new brand cities. Not only in the sense of tourism, but also in the sense of awareness, should recognition and consciousness such studies be sustained. The combined and balanced use of soft forces will facilitate the functioning of public diplomacy (Yıldırım,2014).

As in science, education, art, technology, and other fields, the achievement succeed in sports is not accidental. On the contrary, thanks to the sports and sports policies of the country, the science, technology and materials used in the field of sports and the other facilities and supports provided to athletes on the name of the country come into prominence in the field of international sport and hereby sport achievements contributes to the country's national brand (Gök, 2016).

Media and Technology

Thanks to rapid using communication and technology tools, a quick interaction period began in the world. With the development of communication technologies, the time and space dimension in communication disappears. Public diplomacy as a strategic communication tool is defined as the sum of the activities of "public understanding, informing and influencing". Communication tools are also very strategic function in terms of public diplomacy. Television, radio, newspapers, and magazines play a major role in promoting the cultural and social values of the countries in the international area (Günek, 2011).

The media is the greatest force to deliver the activities of states or institutions to societies. Diplomacy, which can be defined as the art of managing relations, has gained different dimensions through the development of time, in order to find a common international solution or to convince other countries according to with their own ideas. Although the role of individuals and groups are very important in the formation of the public opinion there is no doubt that the mass media contributing to the process of thinking through technological developments and increasing their number and effectiveness (Yıldırım, 2014). For instance, BBC World which broadcasts in forty-three languages delivers British culture to 150 million people at the same time.

There is no doubt that, today internet especially social media has transformed the international community. Developments in the field of technology have become an indisputable channel for diplomatic communication and changed diplomacy practice. Substantially, this diplomacy model is often conceptualized as a form of public diplomacy and digital technologies such as Twitter, Facebook, and social media platforms is often included ways of communicating with

foreign public opinion in a non-expensive way by States (Adesina, 2017). Sports can affect large masses in different countries of the world and because of its public interest, it draws the attention of both commercial institutions and state institutions and international media organizations. Some countries can be identified with some sports branches they are successful in.

In world public opinion, Basketball is NBA and NBA is the USA. Football has a separate place within the sports branches, especially among the European countries. England's Premier League, Spain's La Liga and Italy's series A-League are carefully monitored by the world public opinion. In addition to this, it can be said that some successful teams such as Real Madrid and Barcelona to be ahead of their country's names. The organizations which are held on a regular basis such as champions league matches; UEFA cup has got great importance for the promotion of countries. Such that, a person who has not supported any team and has not followed any football matches may be more conservative than a fanatic supporter when it comes to the representation of his country in the international area. The great interest shown to such international organization and matches, in fact, it's not just football but also but also related to the reputation of the participating countries, it causes to the International Press to show an intense interest to the related subject (Erzen, 2014). It is also a fact that, the press and media are not interested in the activities mentioned above and the whole organizational dimension will be limited to the spectators coming to the facilities, it is thought that building national unity, national identity and nation will be created through ‘’strategic communication management’ ’in the international arena. However, advertisement activities that can be made by spending a lot of money can be performed more effectively because of the presence of large sports organizations in the media.

Sport Ambassador

Another factor contributing to soft power in public diplomacy activities is sports activities and athletes. Many popular athletes serve as a role model to world youth, at some point they are seen as a representative of their country's public diplomacy (Sancak, 2015). It is very important to have the power to bring together young people or sportsmen and sports staff (coaches, referees, sports managers, etc.), from different or similar cultures for the certain purposes and let them express to the outside world in terms of public diplomacy, communicate and interact with individuals from different cultures. The important thing to remember in terms of sports diplomacy; athletes, coaches, referees and sport managers of a country are important ambassadors although it is an international image of the country (Gök, 2016). According to various indicators, international sporting achievements gained through national teams and national athletes play a convincing role in projecting the cultures and values of countries into their specific goals at the same time making soft power attractive to other nations (Brannagan et al., 2018). On the other hand, athletes play a role in diplomatic functions as being a mediator in the development of mutual understanding through a variety of joint programs among countries (Kurtuluş, 2014). The famous baseball player Ken Griffey is one of the athletes assigned to work in the field of public diplomacy during the era of President George Bush. It is also seen that many sportsmen carry out his duty as Ambassador of the United Nations Children's Fund (UNICEF) and they are also considered as the ambassador of sports.

Sporting achievements succeed by international athletes and teams also have been added among these factors called "soft power" which has been in the International Relations literature for the last 20 years. Moreover, sport has become an important place in the

formation of the images and perceptions of countries in the international area. To give a good example, the FIFA World Cup held in Japan and South Korea in 2002, after Turkey's third degree, the interest of those countries to Turkey has increased significantly (Erhan, 2010). It can be clearly said that coaches and sportsmen representing countries in international organizations are engaged in sports diplomacy activities as a sports ambassador.

Lobbying

The origin of lobbying word originated from the lobby, meaning corridor. Lobbying is based on influencing people who are active in making decisions. The techniques that lobbyists develop to make a significant contribution to the inter-state relations. One of the most important objectives of interstate relations is to achieve a positive international image. One of the most reliable and valid methods of gaining international image is to obtain the positive attitudes and the support of international decision-makers and authorities. Lobbying aims directly at decision-makers in order to achieve the foreign policy behavior desired in public diplomacy. Therefore; targeting decision makers is important in terms of delivering the message to the right recipient (Şporta, 2004; Sancar, 2012; Yıldırım, 2014; Karagöz, 2016).

In terms of public diplomacy of a country, lobbying activities are one of the important soft power sources taking advantages of youth leaders, athletes, coaches, (sportsmen, sports managers, sports press, etc.) and the actors involved in the field of youth and sports as far as in a strategic sense for promoting their own culture, people, language and even religion in a correct way (Gök, 2016).

Lobbying activities in sports are mainly related to changing the locations of countries and cities where sports organizations will be organized and determining the places where such sports organizations will be held by the decision of international sports organizations. Despite the decision-making power of international sports federations, sponsor companies or firms that sponsor them to have financial power. In the event of such a relationship, the firms or companies that are now sponsoring sports event do not hesitate to direct or request from the international sports federations to determine where sports organizations are located in accordance with their commercial interests. During the selection of the host city, which will hold Summer Olympic Games of IOC in 1996, Athens, is the capital of Greece, where the Olympic Games were born was considered as a host city at the 100th anniversary of the modern Summer Olympic Games of 1996, however at the end of the five rounds election organization went to Atlanta where include the many headquarters of big companies such as Coca-Cola, Delta Airlines, within this period it is widely expressed that American sponsoring companies especially Coca-Cola had an impact on the voting members of the IOC (Çetin, 2014 cited, Gök, 2016). In the 2009 FIFA Confederation Cup, the national instrument "vuvuzela'' was banned because the players were disturbed by the loud noise. However, at the 2010 FIFA World Cup in South Africa, as a result of long discussions, it has been released again because of FIFA President and South African authorities' pressure. Lobbying activities are thought to have an effect on the lifting of this ban. It is seen that large and medium-power nations are closely related to sports diplomacy and functions. These functions are Olympics and the international organizations hosting for important organizations (Nygard and Gates, 2013). It is widely thought that the way to being the host city for international organizations which has important functions is through the skillful and successful lobbying activities.

Studies and Practices of European Commission in Sports Diplomacy

The concept of sports diplomacy was first introduced by the European Commission in 2015 to the European Union. The high-level sports diplomacy group within the European Commission was formed by the initiatives of the European Commission's Education, Culture, Youth and Sports Commissioner. In June 2016, a report including various recommendations was sent to all European Union ministries, is responsible for sports. Following this initiative, in November 2016, the European Union Parliament undertook responsibilities to all European Union ministries responsible for sports in order to carry out sports diplomacy activities.

It was decided to implement the European Union sports study plan between 2017-2020. The aim of this plan, establishing a strong dialogue between the third world countries and the countries that want to become the Member States of the European Union and to ensure that these countries integrate with European culture. At the same time, supporting some projects for the development of international sports activities is among the priorities of European Union sports diplomacy (Report to the European Commission, 2018). The European Commission organized a sports diplomacy seminar in 2016. More than 100 members of the European Union including European and national sports federations, Olympic Committees, and politicians attended this seminar. Following the seminar, 13 final declarations were published under 3 main headings. These titles are 1- Relations with the European Union, 2- Introduction of European Union values through International Sports Organizations, 3- Development of Sports Diplomacy Organizational Culture (Seminar on Sport Diplomacy Outcomes, 2016). The European Commission organized a second sports diplomacy seminar in 2017. 13 final declarations were published under 3 main headings. Respectively, these headings: 1- To organize European sports week celebration activities, outside the borders of the European Union. 2- Promotion activities of athletes and coaches who have won medals in international sports competitions. 3-What can be done to increase the international sports position of a country (Seminar on Sport Diplomacy Outcomes, 2017). The European Commission organized a third sports diplomacy seminar in January 2018. According to this seminar, it is the top priority of European Union sports diplomacy to support some projects for the development of international sports (including projects involving disadvantaged young people, disabled individuals, gender discrimination, health problems, refugee problems, etc.) and to ensure that non-member countries and third world countries take part in these projects. In addition to these projects, it was decided that large-scale organizations could be used for the development of international sports diplomacy (Report to the European Commission, 2018). It can be said that the concept of sports and diplomacy are tried to be filled with various projects and studies by looking at the above mentioned.

Conclusion

Sports diplomacy, which is one of the most important tools of influencing and guiding international societies in our time, is used as one of the most effective, smart and magical power tools in the respect of reflecting the sports culture of a country and defending its interests, as well as creating foreign public opinion.

Smart power is neither hard nor soft power; it is a successful composition of both (Demir, 2012). The unification of sport and the benefit for the public diplomacy in the international arena are not controversial. Activities carried out within the scope of public diplomacy include the proper use of potential which cannot be denied for the right purposes (Erzen,

2014). International organizations such as the Olympic and Paralympic Games are used or reflected as a foreign policy strategy to improve the international power position with the concept of sport diplomacy which is called soft power (Almeida et al., 2013).

As a result, it is widely believed that the sports and diplomacy concept is tried to be filled with various projects and sport as a diplomacy activity is a soft and rational force, nations carry out their sports diplomacy activities through international sporting organizations, national brands, media and technology, sports ambassadors and lobbying in order to show each other their superiority in the sports universe to spread their cultures and be better economically.

It can be thought that the rationalist way to have a word in sports diplomacy is, with the logic of following public diplomacy strategy and to empower sports managers who are well trained in sports management and have adequate qualification required by the age. Furthermore, it can be given various training to the athletes, trainers, and sportsman representing his countries for the effective sports diplomacy within the scope of sports diplomacy and to make them a sports ambassador.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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The Effects of Movement Training Applied for 16 Weeks to the Physical Fitness Levels of Children with Intellectual Disability

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Abstract

Intellectual disability can be expressed as the defect that occurs in people's mental development and function. Therefore this handicap should be accepted by the society and it should be known that it is a social problem, instead of an individual one. The aim of this research was to determine the effects of movement training applied for 16 weeks to the physical fitness in children with intellectual disability. 30 volunteer, moderate mentally disabled male children have joined to the study. They have been divided into two random groups as group A (15 children) participating in non-play movement training, and group B (15 children) participating in movement training with games. The measurements included the age, height, weight, right and left-hand grip strength, anaerobic power, throwing the stuffed ball, VO_2max, 30 m sprint and long jump parameters. Because mentally disabled children's attention spans are short, and learning abilities are low, movement training programs, do not just improve physical fitness of these children, but also improve their ability to learn and to be more aware of their surroundings.

Keywords: Intellectual Disability, Training, Physical Fitness

Introduction

Mental disability is defined as a condition that emerges as a backwardness and inadequacy of effective and harmonious behavior, as a result of constant slowdown, stagnation or decline of mental development, for various reasons, before or during birth, or in the developmental stage afterward. This handicap should be accepted by the society, and it should be a social problem instead of an individual one. Thus, participation in social activities of handicapped individuals is very important that it is effective in three main areas of their lives, which are physical, emotional and mental (Eichstaedt and Lavay, 1992).

It is a well-known fact that mentally handicapped children who adopted a sedentary lifestyle, because of their loose and weak muscles and bone structure, are inadequate regarding physical and motor fitness components like strength, endurance, agility, balance, running, flexibility, speed, even when they can successfully participate in activities with their peers with normal intelligence. Besides, health-related issues also adversely affect the development of these children (immune system, hormonal disorders, cardio-respiratory diseases, illnesses). Therefore, improvement of physical fitness components like cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body fat index is very important (Winnick and Short, 1985).

Constantly improving global top-level performance also increases competition. With the increasing competition, many physical properties also improve quickly. Especially with movement training, applied at an early age, not just the individual's physical development but also his/her cognitive abilities and emotional development can be benefited. It is shown that the most important factor that provides these developments is playing games. Because education with games, not just gives the children the opportunity to prepare for the sportive activity that they will practice but also ensures that they enjoy it. The aim of this research is to study the effects to some health and skill related physical fitness parameters of the play and non-play movement training applied to mentally handicapped children for the duration of 16 weeks.

Materials and Methods

Study group: The study is done through cooperation with disability organizations, on 30 volunteer mentally handicapped children. The volunteers were randomly divided into two groups of 15, one of them getting movement training without any play for 16 weeks (group A) and the other getting movement training with gameplay (Group B). The mean age of the group A was measured as (10.50 ± 0.76), and the mean age of the group B was measured as (10.90 □ 0.72). The average height of the group A was measured as (145.45 ± 5.60), and the average height of group B was measured as (141.55 ± 6.61). The average weight group A was (37.00 ± 5.48), and the average weight of group B was measured as (34.22 ± 3.78).

Movement training with or without gameplay: Systematic and scientific play and non-play movement programs were designed, in order to ensure the sufficient physical fitness of these people that we accept as a part of our society, even if they are disabled. With the necessary permits obtained, it was also made sure that they have no health problems preventing them to participate. Movement training programs were designed as individualized programs for these students with moderate mental handicaps, and the effects of these programs were measured on physical fitness factors of health and some skill parameters.

These applications were made under supervision of expert trainers, with the frequency of two days a week, up to 4 days in total, approximately 60 minutes (10 mins. warm-up, 10 mins. basic tempo, 10 mins. cooldown), and allowing the individuals to rest for a day in between. While studying on strength and endurance parameters in the gym two days a week, in the other two days, quickness, speed and flexibility parameters were tried to be improved in either individual and group exercises. The measurements were carried out using appropriate test parameters for subjects (Tamer, 2000).

Height and weight measurement: The subjects were measured with a precision scale of Angel brand down to 20 grams of error. Height measurements were read with a precision of 1 mm error with floating caliper of Holtain brand.

Strength parameter measurements: Grip force measurements were performed with Hand Grip dynamometer of Takkei brand.

30 m Sprint: On a standard 45 m running track, by establishing a photocell in between 0-30 meters, running time for this distance of the subject was measured, and the best of three trials was recorded.

Vertical jump test and calculation of anaerobic power: For the vertical jump test, the device named Takei Physical Fitness Test Jumping was used. By using Vertical jump test results, and with anaerobic strength formula Kg/sec=vertical jump distance (m) was measured.

VO_2max: For the measurement of this, 20 m crunch run test was used. The result was recorded in ml/kg/min.

Standing Long Jump: Is an anaerobic test for explosive force, done while standing without speed gain. The test is repeated two times and the best result was recorded in cm.

Stuffed ball throwing: The subject took strength by putting his/her arms back, with the stuffed ball in both hands, and feet parallel to each other. And then, with the maximum power he/she a can release, threw the ball forward with both hands. Results were recorded in meters.

Flexibility Measurement: The subject sat on the floor and rested firmly his/her bare feet soles on the test stand. Also, the subject tilted his/her body forward and without bending his/her knees, tried to reach as forward as possible with his/her hands in front of his/her body. In this position, he/she waited for 1 or 2 seconds at the furthest possible point. The test was repeated and the best result was recorded.

Findings

Table 1. Preliminary test "t" values of groups A and B

Parameters	N	Group A AO ± SS	Group B AO ± SS	t	p
Age (years)	30	10,50±,76	10,90±,72	-1,710	,095
Height (cm)	30	145,95±5,06	141,55±6,61	2,363	**,024***
Weight (kg)	30	36,99±5,48	34,23±3,78	1,858	,071
Right Grip Force (kg)	30	17,48±3,142	17,55±3,11	-,066	,948
Left Grip Force (kg)	30	18,35±2,10	19,00±2,09	-,988	,330
Long Jump (cm)	30	147,30±9,22	154,50±7,91	-2,651	**,012***
Anaerobic Power (kg/s)	30	41,82±7,68	38,25±9,24	1,329	,192
Stuffed ball Throw (cm)	30	4,19±,17	4,31±,29	-1,458	,153
VO_2max (mN/kg/min)	30	31,51±5,26	30,73±4,69	,496	,623
30 m Sprint (sec.)	30	5,69±,51	5,87±,30	-1,355	,183
Flexibility (cm)	30	13,70±5,83	18,68±6,64	-2,519	**,016***

P<0,05*

After comparing the preliminary test results of both groups, no significant differences have been observed ($p<0.05$) in age, weight, right hand grip, left hand grip strength, anaerobic power, stuffed ball throwing, VO_2max and 30 m sprint parameters, but significant differences ($p> 0,05$) have been observed in height, standing long jump and flexibility parameters.

Table 2. The last test "t" values of groups A and B

Parameters	N	Group A AO ± SS	Group B AO ± SS	t	p
Weight (kg)	30	34,63±3,18	37,77±5,88	-2,103	**,044***
Right Grip Force (kg)	30	18,17±3,502	18,23±3,139	-,057	,955
Left Grip Force (kg)	30	18,93±2,104	19,90±2,056	-1,482	,147
Long Jump (cm)	30	149,75±10,02	156,55±8,46	-2,319	**,026***
Anaerobic Power (k/s)	30	40,45±9,24	45,25±8,24	-1,733	,091
Stuffed ball Throw (cm)	30	4,26±,22	4,33±,28	-,884	,382
VO_2max (mN/kg/min)	30	31,44±4,69	34,49±4,74	-2,041	**,048***
30 m Sprint (sec.)	30	5,83±,30	5,93±,59	-,708	,483
Flexibility (cm)	30	18,50±7,64	17,05±4,98	,711	,481

**P<0,01 *P<0,05

After comparing the results of the last test values for both groups, while no significant difference has been observed ($p>0.05$) in right hand grip, left hand grip strength, anaerobic power, stuffed ball throwing, 30 m sprint and flexibility parameters, rather significant differences ($p<0.05$) have been observed in weight, long jump, and VO_2max parameters.

Table 3. Preliminary test results of group A

Parameters	**N**	**First test AO ± SS**	**Last test AO ± SS**	**t**	**p**
Weight	30	34,23±3,78	34,63±3,18	-,559	,583
Right Grip Force (kg)	30	17,48±3,14	18,17±3,50	-,893	,383
Left Grip Force (kg)	30	18,35±2,10	18,93±2,11	-5,617	,000**
Long Jump (cm)	30	147,30±9,22	149,75±10,02	-3,788	,001**
Stuffed ball Throw (cm)	30	4,20±0,17	4,26±0,22	-1,294	,211
VO_2max (mN/kg/min)	30	30,73±4,70	31,44±4,70	-52,852	,000**
Anaerobic Power (kg/s)	30	38,25±9,24	40,45±9,25	-2900,649	,000**
30 m Sprint (sec.)	30	5,87±0,30	5,82±0,28	44,831	,000**
Flexibility (cm)	30	18,68±6.64	18.50±7.62	,259	,798

**P<0,01 *P<0,05

After comparing the results of the pre- and post-test values of group A, while no significant differences ($p>0.05$) have been found in weight, right-hand grip and stuffed ball throw parameters, rather significant difference have been observed ($p<0.01$) in left hand grip, long jump, VO_2max, anaerobic power, 30 m sprint and flexibility parameters.

Table 4. Preliminary test results of group B

Parameters	**N**	**First test AO ± SS**	**Last test AO ± SS**	**t**	**p**
Weight	30	36.99 ± 5.48	36.55 ± 5.04	1,192	,248
Right Grip Force (kg)	30	17.55 ± 3.11	18.23 ± 3.14	-4,236	,000**
Left Grip Force (kg)	30	19.00 ± 2.10	19.90 ± 2.06	-6,728	,000**
Long Jump (cm)	30	154.50 ± 7.91	156.55 ± 8.46	-4,959	,000**
Vertical jump (cm)	30	18.35 ± 4.08	19.60 ± 4.04	-6,140	,000**
Anaerobic Power (kg/s)	30	41.82 ± 7.68	44.82 ± 7.68	-6646,027	,000**
Stuffed ball Throwing	30	4.31 ± 0.30	4.33 ± 0.28	-,483	,635
VO_2max (mN/kg/min)	30	31.51 ± 5.26	35.75 ± 5.31	-223,847	,000**
30 m Sprint (sec.)	30	5.69 ± 0.51	5.77 ± 0.51	-161,000	,000**
Flexibility (cm)	30	13.80 ± 5.68	16.21 ± 5.82	-34,013	,000**

**P<0,01 *P<0,05

After comparing the results of the pre- and post-test values of group B, while no significant differences ($p>0.05$) have been observed in stuffed ball throwing and weight parameters, rather significant differences could be observed ($p<0.01$) in right-hand grip, left-hand grip strength, long jump, anaerobic power, VO_2max, 30 m sprint and flexibility parameters.

Discussion and Conclusions

In this study, the effects to some health and skill related physical fitness parameters of play and non-play movement training applied to 10-year-old mentally handicapped male children for duration of 16 weeks were studied, by comparing pre and post-test result values. Games are activities done for a specific purpose within a specific time and place, using physical and mental abilities, with their own specific set of rules, which improve social harmony, intelligence and skills and which also are entertaining (Kale and Erşen, 2003). Today, in modern education, games play a huge role in the movement training that will benefit children's physical, spiritual and mental developments (Aslan, 1982).

After comparing the results of the pre- and post-test values of group A, while no significant differences ($p>0.05$) have been found in weight, right-hand grip and stuffed ball throw parameters, rather significant difference have been observed ($p<0.01$) in left hand grip, long jump, VO_2max, anaerobic power, 30 m sprint and flexibility parameters. After comparing the results of the pre- and post-test values of group B, while no significant differences ($p>0.05$) have been observed in stuffed ball throwing and weight parameters, rather significant differences could be observed ($p<0.01$) in right-hand grip, left-hand grip strength, long jump, anaerobic power, VO_2max, 30 m sprint and flexibility parameters.

As the physical and motor requirements of children with a low degree of intellectual levels are similar to other children, their physical education and playing activities are usually in the same pattern with other children. For these children, what usually recommended are individual activities rather than group activities, like individual sports, musical activities, strategy, rules, or memory development-oriented activities, also large muscle activities rather than small muscle activity, and activities that require them to move constantly, rather than keeping them static (Eichstaedt, 1992).

In today's technology age, there is an observable decline in both society's and children's exercising habits. Especially disabled children, with their weak muscles and non-constant joint structures, experience delays in reaching the necessary levels of motor development starting from a very early age. When poor eating habits and lack of exercise also accompany this, significant changes in the body components do occur with an increased fat accumulation. While the significant height and weight increase in children is mostly related to the development of adolescence and childhood, we also see that regular exercises also cause significant effects to the height and weight of children of the same age (Koç and Gökdemir, 1997; Mengütay, 1999). Especially in children with mental handicap, low physical fitness capacity and cardiorespiratory fitness do stand out (Fernhall et al., 2001). Of course; we have lots of opportunities to develop the health capacities of children with intellectual disability. In a research, these children engaged in the recommended 60 min of moderate to vigorous physical activity and measured their activity levels. Results are shown positively (Shields et al, 2009). It is critical that health professionals increase Health Promotion efforts, including physical activity for children and youth with intellectual disabilities (Lloyd, 2012).

The strength level of mentally handicapped individuals is lower than the ones without intellectual disabilities. Muscle strength and endurance is all about improved performance in daily activities gained by carrying and lifting weights, climbing stairs up and down, keeping a good posture and carrying out work-related activities (Feliz et al., 1998). Isokinetic muscle strength and knee flexion and extension of the mentally handicapped were found lower than the normal mental functioning individuals. Lower extremity (leg) muscle strength is associated closely with the VO_2max and running performance and is found to be low. Therefore, for this population, it was described that the factor limiting VO_2max is weak muscle strength (Horvat et al., 2000). Mero et al. (1990), in their study they have done with athletes of 10-11 age groups, have concluded that regular activities increase the capacity of aerobic capacity (Mero et al., 1990).

There is a need to maximize the positive effect of physical activity on people with intellectual disability. First, we need to initiate appropriate techniques used for motivation to participate in physical activity for this population (Jin-Ding Lin, 2010). And then we have to apply any appropriate tests and techniques to them. In literature, there was agreement among studies that children with intellectual disability were significantly less active compared to children without disabilities (Hinckson, 2013; Whitt-Glover, 2006).

After all, boys are more active than girls and this difference is mostly the result of the difference in outside school activities of these children of young age. Even when they have some kind of disability, they are still required to take regular and programmed movement training. Because mentally handicapped children's attention spans are short, and learning abilities are low, movement training programs, do not just improve physical fitness of these children, but also improve their ability to learn and to be more aware of their surroundings.

As a result, activities and exercise programs don't cause much of a change in the mental level of intellectually disabled children, but they do contribute to the development of adaptive behavior, which holds an important place in the social integration of these children.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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Changes of Technical Skills during an Official Futsal Game

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Abstract

Futsal is considered as an intermittent 5-a-side soccer game played worldwide that demands high technical, tactical, and physical capacities of players. Despite the global growth of futsal, there is a lack of research regarding the relationship between physical capacity and technical skills during the game. Thus the aim of the current study was to describe the technical skills of futsal players during a futsal game as well as to indicate any differences from the first to the second half according to their aerobic capacity. Particularly, eleven male futsal players aged 26,6 ± 2,8 participated in the study which conducted during the competitive period of Greek Superleague season 2016-2017. Researchers examined the anthropometric characteristics (age, height, weight, BMI), the aerobic capacity (VO2max) and the technical skills (passing, dribbling, receiving, 1vs1 duels, and stealing) of players. The results highlight the differences in technical skills of futsal players according to their aerobic capacity from the first to the second half of the game.

Keywords: Futsal, aerobic capacity, technical skills, anthropometric characteristics

Introduction

Futsal is an indoor 5-a-side soccer game officially approved by FIFA (Fédération Internationale de Football Association) played worldwide at professional, semi-professional, even at amateur level. It is considered one of the fastest growing sports in recent times (da Costa, Palma, Pedrosa, and Pierucci, 2012). Futsal is characterized as an intermittent sport that demands high technical, tactical, and physical capacities of players (Álvarez, D'ottavio, Vera, and Castagna, 2009). Despite of the global growth of futsal, there is a lack of available scientific research relating to futsal parameters.

Although, futsal is considered as a high-intensity sport that players indicate 85-90% HRmax during game (Álvarez-Medina, Murillo-Lorente, Manonelles-Marqueta, and Giménez-Salillas, 2014; Rodrigues et al., 2011) and 90% during training (Castagna, D'Ottavio, Vera, and Álvarez, 2009), there is a lack of research regarding the relationship between physical capacity and technical skills during the game. Particularly, players spend around 46-52% of the playing time at exercise intensities 80-90% of VO_2max and HRmax, respectively (Castagna et al., 2009). Castagna and colleagues (2007) added that a futsal game elicits about 83,5 and 75,3% of HRmax and VO_2max respectively, while 91% of the playing time spend at HRs higher than 70% of HRmax. In addition, Baroni and Leal (2010) concluded that Brazilian professional futsal players indicate values about $58ml \cdot kg^{-1} \cdot min^{-1}$ during ergospirometric assessment in a motorized treadmill. Duarte and colleagues (2009) measured physiological and technical effects of both duration and number of players during futsal small-sided games. Specifically, they found that by extending these variables players tend to solve the game problems with less recourse to individual solutions, while the successful contacts with the ball, dribbles, and tackles reduced significantly (Duarte, Batalha, Folgado, and Sampaio, 2009).

Regarding cognitive and technical skills, it has been found that youngsters who play futsal develop quicker reflexes, thinking, second thinking, off-ball movements, as well as pinpoint passing, one-touch passing, number and accuracy of the shoot (Mănescu, 2016). Moreover, it has been found that about 24% of scored goals achieved throughout organized attacks, 23% counter attacks, 24% set pieces, and 22% with the participation of the goalkeeper (Fukuda and de Santana, 2012). In support of these findings, Bueno and Alves (2012) added that about 31% of scored goals achieved throughout organized attacks, 28% counter attacks, 23% set pieces, 10% 1vs1 duels, and 10% opponents' faults (Bueno and Alves, 2012). Finally, Chen (2011) concluded that around 43% of attacks come from individual efforts, 30% organized game, 12% counterattacks, 5% rebounds, 4% stealing, 3% wing attacks, and 3% dynamic play. In summary, it is obvious that most of the goals achieved throughout organized-passing game, personal-dynamic game (dribbling or 1vs1 duels), and defending faults.

Thus, the fundamental factors of futsal game are passing, receiving, controlling, and shooting. Furthermore, futsal players have to demonstrate these technical skills as the circuit is limited by space, opponent and time (Marhaendro, 2017). In addition, high skilled futsal players produce significantly faster movement and decision making times than less skilled players (Young and Willey, 2010). Regarding passing ability, it has been found that during a futsal game the most frequently adopted ball passing distance is less than 10m, stop-pass is mostly used in organized game, cross-pass is the most frequent direction of passing, and passing in the midfield area is mainly used for organized-game (Ding-meng, 2013). The significance of passing is heightened by Naser and Ali (2016) who concluded that quick decision-making and passing accuracy are extremely valuable attributes required during a futsal game. They further

added that elite players indicate higher passing scores than both sub-elite and recreational athletes. As far as shooting, which is the most common way of scoring in both soccer and futsal, it is obvious that in futsal more goals are scored per minute of game than in soccer (Castagna et al., 2009). Particularly, it has been found that 47% of shoots were from the area between midfield and second penalty mark, 34% between second penalty mark and the penalty mark, 7% from the penalty area corner, 6% inside the penalty area, and 5% behind the midfield (Chen, 2011). Abdel-Hakim (2014) concluded that goals scored, total shoots, on-target shoots, and effectiveness are the main factors which differentiate winning and losing teams. Past research showed that elite players indicate higher shooting scores than both sub-elite and recreational athletes (Naser and Ali, 2016). On the other hand, defenders use mainly pass blocking and ball stealing to prevent their defending area (Zhao, Fan, and Xin, 2010). Moreover, stealing, passing faults and blocks is the commonest way to gain possession and begin a counter attack (Aburachid, Silva, Soares, Santos, and Greco, 2010). The most important ability that determines to steal and block passing success is the prediction by the defender as a result of direction reading and a fast reaction before the attacker (Menichelli, 2012). Dribbling and 1vs1 duels demand abilities such as determination, space and opponent observation, change of direction and pace and accurate timing (Menichelli, 2012). These technical skills take place closer to the opponent's area, while dribbling for progression and dribbling for shoot consist of the dribbling types that most induce defensive lines (Amaral and Garganta, 2005). The shorter field demands many 1vs1 duels during the game. Researchers, claim that coaches have to encourage 1vs1 duels close to opponents' area because defending teams present more negative reactions and attackers have more chances to shoot the ball (Vaeyens, Lenoir, Williams, and Philippaerts, 2007). A team with a high level of success in dribbling and 1vs1 duels has the potential to create more opportunities for supernumeraries and goals (Menichelli, 2012). Adding that match analysis has shown that the overall intensity of futsal decreases near the end and leads to more scored goals (Barbero-Álvarez and Castagna, 2007; Barbero-Álvarez, Soto, Barbero-Álvarez, and Granda-Vera, 2008), make it obvious that physical condition may be a significant indicator of performance. It has also been found that although defending style is harder during the second half (Zhao et al., 2010), 41% of scored goals achieved in the first half while 58% in the second half (Fukuda and de Santana, 2012).

In our knowledge, the literature review showed a lack of research regarding the relation between physical capacity and technical skills during a futsal game. Therefore, the aim of the current study was twofold: (1) to describe the technical characteristics of futsal players during the whole game, and (2) to assess any technical change according to their aerobic capacity.

Methods

Participants

Eleven male futsal players aged 26,6 ± 2,8 participated in the current study which conducted during the competitive period of Greek Superleague season 2016-2017. Players were informed about the procedures, the requirements, the risks, the benefits, and the ethics of the study before signing a consent form approved from the University Ethics Committee. Parental consent was also taken for non-adult players who participated in the study. Moreover, the participants were non-smokers, without any metabolic disease during the study period.

Procedures

Anthropometric characteristics and aerobic capacity assessed indoors on a wooden surface futsal playing field, three days before the official game. Specifically, researchers used a cursor to measure the body height of players and a Seca weighting scale (Seca 880 Weight Scale, Leicester Height Measure, Seca Ltd, Vogel and Halke, Hamburg; Germany) to assess their weight. Then, they examined aerobic capacity by Yo-Yo intermittent endurance test level 2 (Yo-Yo IE2). The test lasts 5-25 minutes and consists of 20-metres repeated shuttle runs at progressively increasing speeds dictated by an audio sound sent out from a CD player. Between each shuttle, the players had a 5-seconds period of jogging around a marker placed 2.5-metres behind the finishing line. Two failures to achieve the shuttle run in time resulted in termination of the trial. The covered distance in the last complete successful shuttle recorded as the player performance. Before the test, all players carried out a standard warming-up consisting of the first three running bouts of Yo-Yo test before a period of dynamic stretching. All players familiarized with the Yo-Yo IE2 test and experimental procedures one week before the assessment (Bradley, Di Mascio, Bangsbo, and Krustrup, 2012). VO_2max was estimated by the following mathematic type 'IR2 distance (m) × 0.0136 + 45.3'. Moreover, a 25Hz video camera set-up in upper plane recorded the actual time of a two-half 40-minute game. The video later replayed by the researcher to evaluate passing without and under press (the opponents were ± 3m away or close to the ball), one-touch passing, passing faults (passes that did not reach the teammate), receives (the receiver kept the possession of the ball), fault receives (the receiver did not keep the possession of the ball), on-target and off-target shoots (shoots inside/outside the goalpost), dribbling and dribbling faults (individual trials to the defending half), won and lost 1vs1 duels (individual trials to the attacking half with one opponent), steals (defenders went to the ball before the receivers).

Statistical analysis

SPSS package (v.17) at a significance level $p <$, 05 used for the statistical analyses of the current data. All the anthropometrical and technical characteristics expressed as means and standard deviations. The players discriminated into two groups according to their aerobic capacity medians (±64). Finally, t-tests for dependent samples used to examine the differences between the two halves.

Results

The following table shows the anthropometric characteristics of players who participated in the current study (Table 1). Specifically, the players' age, height, weight and BMI were 26,56 ± 2,83yrs, 174,67 ± 6,48cm, 74,00 ± 2,29kg, and 24,34 ± 2,45kg/m^2 respectively. They further revealed aerobic capacity of 64,88 ± 4,07ml·kg^{-1}·min^{-1}.

Table 1. Anthropometric characteristics of futsal players.

	N	M	SD
Age	11	26,56	2,83
Height		174,67	6,48
Weight		74,00	2,29
BMI		24,34	2,45
Aerobic capacity		64,88	4,07

The following table shows the technical skills of futsal players for the first and the second half of a game (table 2). Specifically, during the 1st half futsal players indicated 108 passes without press from the opponent (*M*= 9,82 ± 6,35), 11 one-touch passes (*M*= 1,00 ± 1,27), 26 passes under press from the opponent (*M*= 2,36 ± 1,86), and 14 fault passes (*M*= 1,27 ± 1,19). During the 2nd half they achieved 93 passes without press from the opponent (*M*= 8,46 ± 6,96), 7 one-touch passes (*M*= ,64 ± ,92), 32 passes under press from the opponent (*M*= 2,91 ± 2,12), and 23 fault passes (*M*= 2,09 ± 1,97). T-test analysis showed a significant difference only for passing without press variable (t= 2,1; *p*< ,05). Regarding receiving, during the 1st half players carried out 119 receives in total (*M*= 11,90 ± 7,91) and 4 receiving faults (*M*= ,40 ± ,52). On the other hand, during the 2nd half they achieved 133 receives in total (*M*= 12,09 ± 8,50) and 2 receiving faults (*M*= ,18 ± ,41). Furthermore, during the 1st half they performed 9 on-target (*M*=,82 ± 1,33) and 6 off-target shoots (*M*=55 ± ,82). Moreover, during the 2nd half they performed 9 on-target (*M*= ,82 ± 1,33) and 8 off-target shoots (*M*= ,73 ± ,79). As far as dribbling, during the 1st half players carried out 10 dribbles in total (*M*=,91 ± 1,51) and 6 fault dribbles (*M*=,55 ± ,82). On the other hand, during the 2nd half they carried out 14 dribbles in total (*M*= 1,27 ± 1,74) and 4 fault dribbles (*M*= ,36 ± ,51). Concerning 1vs1 duels, during the 1st half they performed 19 won-duels (*M*= 1,73 ± 1,56) and 11 lost-duels (*M*= 1,00 ± 1,00). During the 2nd half they achieved 25 won-duels (*M*= 2,27 ± 1,74) and 12 lost-duels (*M*= 1,09 ± 1,51). Finally, during the 1st half players carried out 28 steals (*M*= 2,55 ± 1,64) while in the 2nd half they carried out 27 steals (*M*= 2,46 ± 1,29).

Table 2. Technical skills during the 1st and the 2nd half.

Technical skills	1st half						2nd half					
	N	Sum	M	SD	Sk	Ku	N	Sum	M	SD	Sk	Ku
Pass without press	11	108,00	9,82	6,35	,24	-,54	11	93,00	8,46	6,96	,48	-1,10
One-touch pass	11	11,00	1,00	1,27	1,45	2,13	11	7,00	,64	,92	,91	-1,27
Pass under press	11	26,00	2,36	1,86	,15	-1,45	11	32,00	2,90	2,11	,76	,13
Fault pass	11	14,00	1,27	1,19	,23	-1,51	11	23,00	2,09	1,97	,33	-1,33
Receives	10	119,00	11,90	7,91	,43	-,04	11	133,00	12,09	8,50	,84	,56
Fault receives	10	4,00	,40	,52	,48	-2,28	11	2,00	,18	,40	1,92	2,03
On target shoots	11	9,00	,82	1,33	1,65	2,29	11	9,00	,82	1,33	1,65	2,29
Off target shoots	11	6,00	,55	,82	1,15	-,25	11	8,00	,73	,79	,57	-,97
Dribbling	11	10,00	,91	1,51	2,30	5,81	11	14,00	1,27	1,74	1,45	1,10
Fault dribbles	11	6,00	,55	,82	1,15	-,25	11	4,00	,36	,505	,66	-1,96
Won duels	11	19,00	1,73	1,56	,36	-1,47	11	25,00	2,27	1,74	,05	-1,45
Lost duels	11	11,00	1,00	1,00	,73	-,13	11	12,00	1,09	1,51	1,93	4,29
Steals	11	28,00	2,55	1,64	,24	-,81	11	27,00	2,46	1,29	-,05	1,29

The following table shows the technical skills of futsal players during the first and the second half of a friendly game according to the level of their aerobic capacity (Table 3). Although there were not any significant differences among players with high (>64) and low (<64) aerobic capacity the results showed some differences among them from the first to the second half. Specifically, total passes without press reduced during the 2nd half from 47 (*M*= 9,40 ± 7,16) to 44 (*M*= 8,80 ± 8,26) for players with low aerobic capacity and from 51 (*M*= 12,75 ± 5,74) to 44 (*M*= 11,00 ± 6,16) for players with high aerobic capacity. One-touch passes slightly increased during the 2nd half from 5 (*M*= 1,00 ± 1,00) to 6 (*M*= 1,20 ± 1,10) for players with low capacity but they reduced during the 2nd half from 6 (*M*= 1,50 ± 1,73) to 1 (*M*= ,25 ± ,50) for players with high aerobic capacity. Regarding under press passes they were increased during the 2nd half from 11 (*M*= 2,20 ± 2,17) to 15 (*M*= 3,00 ± 2,55) and from 13 (*M*= 3,25 ± 1,71) to 14 (*M*= 3,50 ± 2,08) for both groups of low and high aerobic capacity. Finally, fault passes also increased during the 2nd half from 4 (*M*= ,80 ± ,84) to 10 (*M*= 2,00 ± 2,12) and from 8 (*M*= 2,00 ± 1,41) to 11 (*M*= 2,75 ± 2,22) for both groups of low and high aerobic capacity. Although receives slightly reduced from 63 (*M*= 12,60 ± 10,64) of the 1st to 62 (*M*= 12,40 ± 8,14) of the 2nd half for players with low aerobic capacity, they increased from 42 (*M*= 14,00 ± 2,65) of the 1st half to 63 (*M*= 15,75 ± 9,54) of the 2nd half. On the other hand, fault receives remained the same from 1 (*M*= ,20 ± ,45) of the 1st half to 1 (*M*= ,20 ± ,45) of the 2nd half for group with low aerobic capacity and from 1 (*M*= ,33 ± ,58) of the 1st

half to 1 (*M*= ,25 ± ,50) of the 2nd half for group with high aerobic capacity. On-target shoots increased from 4 (*M*= ,80 ± 1,10) of the 1st half to 7 (*M*= 1,40 ± 1,67) of the 2nd half for low aerobic capacity group, while they reduced from 4 (*M*= 1,00 ± 2,00) of the 1st half to 2 (*M*= 1,00 ± ,82) of the 2nd half for high aerobic capacity group. Regarding off-target shoots, they remained similar from 3 (*M*= ,60 ± ,89) of the 1st half to 3 (*M*= ,60 ± ,89) of the 2nd half for the low aerobic capacity group, but they increased from 3 (*M*= ,75 ± ,96) of the 1st half to 4 (*M*= 1,00 ± ,82) of the 2nd half for high aerobic capacity group. Concerning dribbling, they increased from 7 (*M*= 1,40 ± 2.07) of the 1st half to 10 (*M*= 2,00 ± 2,35) of the 2nd half for the low capacity group, and from 3 (*M*= ,75 ± ,96) of the 1st half to 4 (*M*= 1,00 ± ,82) of the 2nd half for the high capacity group. On the other hand, fault dribbles reduced from 4 (*M*= ,80 ± ,84) of the 1st half to 3 (*M*= ,60 ± ,55) of the 2nd half for low aerobic capacity group, and from 2 (*M*= ,50 ± 1,00) of the 1st half to 1 (*M*= ,25 ± ,50) of the 2nd half for high aerobic capacity group. Regarding won-duels, they were increased from 9 (*M*= 1,80 ± 1,64) of the 1st half to 12 (*M*= 2,40 ± 1,34) of the 2nd half for low aerobic capacity group, and from 9 (*M*= 2,25 ± 1,71) of the 1st half to 13 (*M*= 3,25 ± 1,71) of the 2nd half for high aerobic capacity group. Lost-duels they were reduced from 5 (*M*= 1,00 ± 1,00) of the 1st half to 3 (*M*= ,60 ± ,89) of the 2nd half for low aerobic capacity group, but they increased from 5 (*M*= 1,25 ± 1,26) of the 1st half to 7 (*M*= 1,75 ± 2,36) of the 2nd half for high aerobic capacity group. Finally, steals reduced from 12 (*M*= 2,40 ± 1,52) of the 1st half to 10 (*M*= 2,00 ± 1,22) of the 2nd half for low aerobic capacity group, but remained similar from 13 (*M*= 3,25 ± 1,71) of the 1st half to 13 (*M*= 3,25 ± 1,26) of the 2nd half for high aerobic capacity group.

Table 3. Technical skills during the 1st and the 2nd half.

	Aerobic capacity <64						Aerobic capacity >64					
Technical skills	**N**	**Sum**	**M**	**SD**	**Sk**	**Ku**	**N**	**Sum**	**M**	**SD**	**Sk**	**Ku**
Aerobic Capacity	5	310,26	62,05	1,41	,36	-2,42	4	273,67	68,42	3,40	,00	,39
Total Time 1st half	5	33,50	6,70	2,78	-,01	-,40	4	36,71	9,18	2,55	-1,06	2,13
Total Time 2nd half	5	35,35	7,07	2,99	-1,75	2,85	4	34,35	8,59	1,90	1,02	-,15
	1st half											
Pass without press	5	47,00	9,40	7,16	-,18	-2,14	4	51,00	12,75	5,74	1,53	2,50
One-touch pass	5	5,00	1,00	1,00	,00	-3,00	4	6,00	1,50	1,73	1,54	2,89
Pass under press	5	11,00	2,20	2,17	,07	-1,82	4	13,00	3,25	1,71	-,75	,34
Fault pass	5	4,00	,80	,84	,51	-,61	4	8,00	2,00	1,41	-1,41	1,50
Receives	5	63,00	12,60	10,64	,41	-1,59	3	42,00	14,00	2,65	-1,46	.
Fault receives	5	1,00	,20	,45	2,24	5,00	3	1,00	,33	,577	1,73	.

On-target shoots	5	4,00	,80	1,10	,61	-3,33	4	4,00	1,00	2,00	2,00	4,00
Off-target shoots	5	3,00	,60	,89	1,26	,31	4	3,00	,75	,96	,86	-1,29
Dribbling	5	7,00	1,40	2,07	1,92	3,88	4	3,00	,75	,96	,86	-1,29
Fault dribbles	5	4,00	,80	,84	,51	-,61	4	2,00	,50	1,00	2,00	4,00
Won duels	5	9,00	1,80	1,64	,52	-1,69	4	9,00	2,25	1,71	-,75	,34
Lost duels	5	5,00	1,00	1,00	,00	-3,00	4	5,00	1,25	1,26	1,13	2,23
Steals	5	12,00	2,40	1,52	1,75	3,72	4	13,00	3,25	1,71	-,75	,34
	2nd half											
Pass without press	5	44,00	8,80	8,26	-,04	-2,96	4	44,00	11,00	6,16	1,71	2,83
One-touch pass	5	6,00	1,20	1,10	-,61	-3,33	4	1,00	,25	,50	2,00	4,00
Pass under press	5	15,00	3,00	2,55	,91	2,00	4	14,00	3,50	2,08	,00	,39
Fault pass	5	10,00	2,00	2,12	,52	-,96	4	11,00	2,75	2,22	-,48	-1,70
Receives	5	62,00	12,40	8,14	-,53	-1,19	4	63,00	15,75	9,54	1,96	3,85
Fault receives	5	1,00	,20	,45	2,24	5,00	4	1,00	,25	,50	2,00	4,00
On-target shoots	5	7,00	1,40	1,67	1,09	,54	4	2,00	,50	1,00	2,00	4,00
Off-target shoots	5	3,00	,60	,89	1,26	,31	4	4,00	1,00	,82	,00	1,50
Dribbling	5	10,00	2,00	2,35	,58	-2,63	4	4,00	1,00	,82	,00	1,50
Fault dribbles	5	3,00	,60	,55	-,61	-3,33	4	1,00	,25	,50	2,00	4,00
Won duels	5	12,00	2,40	1,34	-,17	-2,41	4	13,00	3,25	1,71	-,75	,34
Lost duels	5	3,00	,60	,89	1,26	,31	4	7,00	1,75	2,36	1,19	,44
Steals	5	10,00	2,00	1,22	-1,36	2,0	4	13,00	3,25	1,26	1,13	2,23

Discussion

The current study aimed to describe the technical skills of players during a futsal game as well as to indicate any differences from the first to the second half because of physical capacity. Similarly to past research Greek futsal players revealed mesomorphic somatotype with mean values of height, weight, and BMI about 175cm, 74kg, and 24kg/m^2 respectively (i.e. Avelar et al., 2008; Trabelsi, Aouichaoui, Richalet, and Tabka, 2014). Their mean aerobic capacity (VO_2max) was 64,88ml·kg^{-1}·min^{-1} finding higher than previous studies which showed values

around 55-65ml·kg^{-1}·min^{-1} (Álvarez et al., 2009; Castagna et al., 2009; Milanez et al., 2011; Pedro, Milanez, Boullosa, and Nakamura, 2013). Furthermore, it is suggested that the limits to play for a top-level team are about 50-55ml·kg^{-1}·min^{-1} (Castagna et al., 2009) while other studies heightened the significance of VO_2max concluding that physical performance discriminates players of different competitive level (Krustrup et al., 2003; Krustrup, Mohr, Ellingsgaard, and Bangsbo, 2005; Pedro et al., 2013). However, Berdejo-del-Fresno and colleagues (2015) suggested that futsal coaches may increase aerobic capacity of their players throughout an adequate periodization of small sided games by modifying the field dimension and the number of players involved into each task and exercise (Berdejo-del-Fresno, Moore, and Laupheimer, 2015).

Regarding specific technical skills, the results showed that during the second half apart from passing faults which were increased all the other passing situations (passing without press, passing under press, one-touch passing) reduced. The discrimination of players into two groups according to their aerobic capacity showed that although there was not a significant difference between them players with higher VO2max indicated better results in passing skills. The current findings are in accordance with past research which showed that longer period of game reduces the technical abilities of players and increases their faults (Duarte et al., 2009). Adding that organized-game which demands high passing frequency is the most common way to achieve a goal (Bueno and Alves, 2012; Fukuda and de Santana, 2012), as well as that elite players, indicate higher passing scores than sub-elite and recreational athletes (Naser and Ali, 2016), passing is considered a fundamental ability related to physical capacity that coaches have to take into account.

In contrast to findings of passing, during the second half players increased their receiving scores but they reduced their receiving faults. When the descriptive differences between high and low aerobic capacity players were examined, it was found that although players with low aerobic capacity reduced their receiving scores, players with high aerobic capacity increased their scores. In contrast, receiving faults of players with low aerobic capacity remained similar, they were reduced for players with high aerobic capacity. Although there is a gap of knowledge regarding receiving skill, we suggest that because of fatigue players with higher aerobic capacity reduced their one-touch passing and they increased two-touches game that demands a receive. Adding that also dribbling and 1vs1 duels increased during the second half as well as the significance of decision making (Naser and Ali, 2016; Young and Willey, 2010), players might need more time to make a decision so their game demands an increase of receives. Furthermore, their teammates might reduce their off-ball movements because of fatigue so as to get into a position to receive the ball, oblige players with the ball to increase their receivings.

As far as shooting ability the results showed that on-target shoots remained similar from the first to the second half while off-target shoots increased. Particularly, players with low aerobic capacity increased their on-target shoots during the second half, while their off-target shoots remained similar. In contrast, high aerobic capacity players reduced their scores of on-target shoots and increased their scores of off-target shoots. These findings were in contrast to past research which suggests that during the second half teams achieve more goals (Barbero-Álvarez and Castagna, 2007; Barbero-Álvarez et al., 2008; Fukuda and de Santana, 2012). A possible explanation of these contradictory findings might be the effectiveness of shooting performance as well as the different aerobic capacity of players with different playing position (Arins and Silva, 2007; Burns, 2003; Gioldasis, 2016). Furthermore, a finding that might explain the current results is that teams play harder defense during the second half (Zhao et

al., 2010) so there is reduced area for on-target shoots. Moreover, because of the harder defense players of other playing positions than attack might try more shoots.

Regarding dribbling ability, players performed higher scores during the second half but less dribbling faults. Specifically, both high and low aerobic groups indicated an increase in total dribbles during the second half but a reduction in dribbling faults. These findings come in contrast to past research which suggests that players solve game problems with less resource to individual solutions (Duarte et al., 2009). However, the increase of dribbling activities might be related with the reduction of passing scores. In addition, Chen (2011) suggests that most of the scored goals achieved after individual-dynamic game which demands dribbling and 1vs1 situations. Probably, during the second half because of fatigue and harder defensive style players are not able to find solutions through team-game and they use more their individual techniques which most induce defensive lines (Amaral and Garganta, 2005).

As far as 1vs1 duels the results showed that both won and lost 1vs1 duels increased during the second half. Particularly, players with low aerobic capacity indicated higher scores of won 1vs1 duels but lower of lost duels during the second half. On the other hand, players with high aerobic capacity increased both won and lost 1vs1 duels. Similarly, with dribbling activities, players performed more 1vs1 duels, finding that is probably explained by the need for more individual techniques so as to induce the defensive line (Amaral and Garganta, 2005). Furthermore, coaching choices probably increase the 1vs1 situations because it has been found that a team with high level of success in dribbling and 1vs1 duels has the potential to create more opportunities for supernumeraries and goals (Menichelli, 2012).

Finally, players slightly reduced their scores of stealing during the second half. Specifically, only players with low aerobic capacity revealed lower scores during the second half. Although the reduction of stealing a ball was very low and only for low aerobic players, it is probably explained by the fact that stealing demands a high level of game reading and reaction by the defender (Menichelli, 2012) which consist of privilege for players with high aerobic capacity. Furthermore, the high scores of steals also during the second half might be explained by the fact that defensive style was harder (Zhao et al., 2010).

Conclusion

The findings of the current study highlight the differences of technical skills of futsal players between the first and second half. It is suggested that futsal coaches have to develop aerobic capacity of their players so as to achieve higher scores in technical skills during the whole game. Specifically, total shoots, shoots on-target, 1vs1 duels close to opponent's half differentiate winning and losing teams. There is a need for sport scientists and training staffs to improve their knowledge and contribute to the development of futsal in their respective countries. Further studies examining physical, technical and tactical aspects of performance and across a wider range of participants are warranted.

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Conflict of Interest

The author has not declared any conflicts of interest.

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An Examination of the Physical Parameters and Respiratory Function of Child Gymnasts

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Abstract

This study examines the physical parameters of child gymnasts. A total of 39 children, 24 females and 15 males, with a mean age of 5.75±1.08, participated in the study voluntarily. Their heights and weights were measured. A 10-meter sprint test to measure acceleration and speed, a flexibility test, and a hand reaction test was done. Respiratory function forced vital capacity (FVC), the first second forced expiration volume (FEV1), peak expiratory flow (PEF), skin calibration off body fat composition (BFC) tests were also conducted. SPSS 22.0 software was used for the statistical analysis. Descriptive statistics and frequency analysis were used to determine the distribution of the variables. The t-test was conducted in independent groups to determine the differences in physical parameters and respiratory functions by gender. The difference between the groups was significant for BFC, but not significant for other physical parameters, and there was no significant difference in respiratory function by gender.

Keywords: Respiratory Functions, Child Gymnasts, Physical Parameters

Introduction

Gymnastics is a sport that goes back to ancient Greek, Egypt, Indian civilizations. The first types of gymnastics were in the early ages of mankind when they started to live as a community in ancient rituals where they offered sacrifices to get along with the gods (Morpa Sports Ency. 1997). Gymnastics attracts the attention of many people in international competitions. Challenging gymnastic moves, dynamic jumps, and rhythmic swings are shows where art and sports merge together (Cihaner, 1998). Gymnasts must have proportional bodies, thin, but with developed muscles and a highly developed neuromuscular coordination in order to execute the extreme movements typical of gymnastics (Bağcı, 2003). This study examines the effects of gymnastics on young boys' and girls' physical parameters. It has become an evident fact that there are differences and ordinary developments in small children's reaction times, flexibility, body fat composition, and respiratory function. One factor is the lung functionality test, which is used for measuring the expanding volume and capacity of lungs and determining the expanding capacity of the respiratory tract, muscles and lungs (Kayatekin et. al., 1993; Yıldırım et al., 1996). Another test might be described as the creation of an impulse and a reaction to that impulse (Guyton, 1972; Taşkıran, 2007; Sevim, 2010) or the time difference between the start of an impulse and the start of a reaction (Tamer, 2000). It has also been reported that there is a genetic component to the reaction time between stimulations and first muscular reaction (Bompa, 1998). The flexibility factor, also called the range of motion, is the ability of a single joint or a joint group to move at the widest possible angle (Tamer, 2000). It is known that your flexibility depends on structural limitations such as bones, muscles, ligaments, joint capsules, tendons and skin (Baltacı, 2003). The body fat percentage parameter is affected by the tightness or looseness of the skin and subcutaneous fat tissue. When measuring skinfold thickness, it should be considered that there may be a difference between the values obtained from loose tissues and the values obtained from tight tissues (Lukaski, 1987) since two layers, skin and subcutaneous fat tissue, are measured.

This study examines some physical parameters and the respiratory function of child gymnasts by gender.

Materials and Methods

A total of 39 children, 24 girls, and 15 boys, with a mean age of 5.75±1.08, from the gymnastics branch of the Erzincan Youth Services and Sports Provincial Directorate, participated in the study voluntarily. In order to ensure voluntary participation, family approval was obtained because the age range was 4-8 years.

Official ID age records were taken as the age of the participants. Their heights were measured with a tape measure, and their weights were measured with a digital scale. In order to determine acceleration and speed, a 10-meter running test was conducted where the initial and endpoints were clearly marked and with the help of chronometer and audible sign (speed=distance traveled/time, acceleration=speed/time). The flexibility test was a sit & reach test bench. BFP was determined using a skinfold caliper. In order to measure respiratory function, a portable spirometer was used (MIR-Medical International Research Minispir-Italy). The participants performed the test with maximum exhalation. The test was repeated 3 times and the best result was selected and recorded by assessing forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak flow rate (PEF) (Marangoz et al., 2016). The Nelson reaction scale was used in determining dominant hand reaction, and

reaction times were determined by calculating the value on the ruler using these formulas (Tamer, 2000):

Reaction Time=√2 x Distance to where the ruler fell/Speed-Related to Gravity

Reaction Time=√2 x Distance(cm)/980 ms

SPSS 22.0 software was used for statistical analysis of the data. Descriptive statistics and frequency analysis were applied to determine the distributions of the variables. The t-test was used to determine the difference in physical parameters and respiratory function by gender. The results are presented as means, percentages and standard deviations. The threshold for statistical significance was $p<0.05$.

Results

Table 1. The Distribution of Participants by Gender

Gender	Frequency (f)	Percentage (%)
Girl	24	61.5
Boy	15	38.5
Total	39	100.0

Table 2 shows that the mean age of the participants was 5.75±1.08 years, their mean height mean was 114.08±7.59 cm, and their mean weight was 21.10±3.85 kg.

Table 2. Physical Parameter Distributions

Variables	n	Minimum	Maximum	X	*SD*
Age (years)	38	4	8	5.75	1.08
Height (cm)	39	101	129	114.08	7.59
Weight (kg)	39	13.20	28.50	21.10	3.85

Table 3. The Mean Values of the Physical Parameters

Variables	Sex	n	X± *SD*
10 Meters (s)	Girl	24	2.56±0.46
	Boy	15	2.28±0.48

Speed (s)	Girl	24	4.03±0.73
Acceleration (s)	Girl	24	1.67±0.60
Flexibility (cm)	Girl	24	29.00±5.12
	Boy	15	28.26±4.49
Reaction Time (s)	Girl	24	0.04±0.01
	Boy	15	0.04±0.01
BFP (%)	Girl	24	21.94±3.83
	Boy	15	18.45±3.92

Table 3 shows that the boys had better 10-meter speed and acceleration values. Reaction times were in the same range for both genders, and the girls had better flexibility and BFP.

Table 4. The Mean Values for Respiratory Function

Variables	**Sex**	**n**	**X± *SD***
FVC (l)	Girl	24	1.43±0.83
	Boy	15	1.28±0.77
FEV1 (l)	Girl	24	0.81±0.28
	Boy	15	0.90±0.33
PEF (l)	Girl	24	1.64±0.80
	Boy	15	1.76±0.82

Table 4 shows that the girls had higher FVC values, and the boys had higher FEV1 and PEF values.

Table 5. The Differences in Respiratory Function by Gender

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper

FVC	E.v.a.	.084	.773	.576	37	.568	.15367	.26689	-.38711	.69444
	E.v.n.a			.585	31.450	.563	.15367	.26255	-.38150	.68883
FEV1	E.v.a.	.425	.518	-.806	37	.425	-.08083	.10027	-.28399	.12233
	E.v.n.a			-.779	26.644	.443	-.08083	.10372	-.29378	.13211
PEF	E.v.a.	.296	.590	-.471	37	.640	-.12592	.26722	-.66736	.41553
	E.v.n.a			-.467	29.060	.644	-.12592	.26946	-.67697	.42513

Table 5 shows that there was no significant difference in the girls' and boys' respiratory function.

Table 6. Comparison of Some Physical Parameters by Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
10 meters	E.v.a.	1.530	.224	1.768	37	.085	.27375	.15482	-.03995	.58745
	E.v.n.a			1.745	28.572	.092	.27375	.15691	-.04737	.59487
Flexibility	E.v.a.	.428	.517	.455	37	.652	.7333	1.6110	-2.5309	3.9976
	E.v.n.a			.469	32.795	.642	.7333	1.5622	-2.4458	3.9125
BFP	E.v.a.	.249	.621	2.737	37	.009	3.48543	1.27358	.90492	6.06594
	E.v.n.a			2.721	29.321	.011	3.48543	1.28076	.86722	6.10364
Reaction Time	E.v.a.	.019	.891	-.285	37	.777	-.00108	.00380	-.00879	.00662
	E.v.n.a			-.265	23.423	.793	-.00108	.00408	-.00952	.00735

Speed	E.v.a.	2.105	.155	-2.017	37	.051	-.47453	.23531	-.95132	.00226
	E.v.n.a			-2.055	31.671	.048	-.47453	.23095	-.94515	-.00390
Acceleration	E.v.a.	2.147	.151	-2.084	37	.044	-.39641	.19017	-.78174	-.01108
	E.v.n.a			-2.144	32.555	.040	-.39641	.18490	-.77278	-.02004

The table 6 shows that the differences by gender were statistically significant in the BFP, speed and acceleration parameters, but the differences in the remaining parameters were not significant.

Discussion and Condusion

The physical factors examined in the present study have been the subject of many studies in the literature. These factors include information that can be given as an example and would support the results of this study. Bağcı (2003) compared the physical characteristics of a 9-11 age group of rhythmic gymnastics and artistic gymnastics athletes and determined that the mean height of the artistic gymnasts was 133.00 cm and that the mean height of the rhythmic gymnasts was 136.72 cm. Bulca and Ersöz (2004) found that the body fat ratio was 14.2±0.9% in rhythmic gymnasts and 20.5±3.2% in sedentary girls. Özer (2001) showed that, unlike other physical fitness parameters, elasticity decreases with age. The elasticity of children is constant from 5 to 8 years old, reaches its maximum at 12-13 years, and then decreases with age. He also noted that girls are more flexible than males at all ages and that the biggest gender differences are seen during puberty and maturity. Kılıç (2007) found that the mean sit & reach elasticity test value of 7-year old students was 12.86±6.95 cm, the mean sit & reach elasticity test value of 8-year old students was 13.43±7.36 cm. The mean sit & reach elasticity test value of 10-year-old students was 12.35±7.66 cm, and the mean sit & reach elasticity test value of 11-year-old students was 10.59±7.50 cm.

The mean age of this study's participants was 5.75±1.08, the mean height was 114.08±7.59, and the weight mean was 21.10±3.85. The mean of the 10-meter test was 2.56±0.46 for the girls and 2.28±0.48 for the boys. The mean of speed was 4.03±0.73 for the girls and 4.50±0.67 for the boys. The mean acceleration was 1.67±0.60 for the girls and 2.07±0.53 for the boys. The mean of flexibility was 29.00±5.12 for the girls and 28.26±4.49 for the boys. The mean reaction time was 0.04±0.01 for the girls and 0.04±0.01 for the boys. The mean BFP was 21.94±3.83 for the females and 18.45±3.92 for the males. The mean FVC was 1.43±0.83 for the girls and 1.28±0.77 for the boys. FEV1 was 0.81±0.28 for the girls and 0.90±0.33 for the boys. The PEF value was 1.64±0.80 for the females and 1.76±0.82 for the males. This study found that males had better speed and acceleration values at 10 meters, that their reaction times were the same, and that the females had better flexibility rate and higher BFP and FVC values. The males had higher FEV1 and PEF values. There was no significant difference in respiratory function between the males and females. This study found that the differences between the groups were significant in the parameters of BFP, speed, and acceleration, but no significant differences were the other parameters. These results cannot be linked to hormone levels since the mean age was 4-8. When considering the effects of gender

differences on physical abilities, genetic development, personal development and the fact that all parameters peak at different ages due to gender differences should also be taken into consideration. The differences determined by this study may be related to this.

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Conflict of Interest

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Analysis of Friendship Activity and Adjective Measurement Implementation for Children with Intellectual Disability in Unified Sports

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Abstract

The purpose of this study is to analyze the needs of trainers about the measurement instruments of friendship activity and adjective in the child intellectual disability in unified sports based on the implementation and condition of instrument availability. The analysis of the measurement conditions of friendship and activity in the children's learning process is designed in depth. The total of 18 subjects consisted of 15 trainers, 1 head of psychology laboratory, 1 head of the special education laboratory or Pendidikan Luar Bbias (PLB) laboratory, and 1 representative of SOIna Development and Sports section. Data collection was obtained through interviews of trainers related to the measurement of related laboratory and PLB related to instrument availability. The Data analysis was conducted qualitatively by collecting various of the data related to the measurement of friendship activity and adjective, then reducing it so that the conclusion about the result of the trainer's need related to the measurement instrument of friendship activity and an adjective to the child's mental retardation in unified sports. The result of the interview shows that the measurement of friendship and activity of the trainer through observation without a valid and reliable instrument. On the other hand, the trainer realizes the importance of an instrument in measurement. The result of confirmation to Head of the Laboratory of Psychology, Head of Laboratory of Psychology, Head of Laboratory of Psychology, Head of Laboratory of Psychology, Head of Laboratory of Psychology. Based on these results it can be the instrument of friendship activity and adjective in the child intellectual disability in unified sports.

Keywords: friendship activity, intellectual disability, unified sports

Introduction

Sports is a series of physical and psychological activities that can maintain or improve the quality of one's health. The development of sports activities in Indonesia today has led to adaptive sports is a sport that is destined for children with special needs one of the intellectual disability. intellectual disability children is a state of children with intelligence (IQ) below 70 who also has limitations on mental development, adjustment, and social (Kauffman & Hallahan, 2011: 176). The purpose of sport covers all aspects including one of them is a psychosocial aspect. The development of the psychosocial aspect of the child in intellectual disability can be seen in the activity of friendship or known as friendship activity. Friendship activities child intellectual disability basically has a good value (positive) and less good (negative) as a child in general. The statement is in line with the results of Martin & Smith's (2002: 478) and Weiss & Smith (2002: 427) research that friendship activity in children with disabilities generally includes both positive and negative aspects. One activity that can have a positive effect on friendship activity in children with intellectual disability is unified sports.

The development of the world's lightest sports intellectual disability category is accommodated by SOI (Special Olympic International) based in America, then enter Indonesia with the formation of SOIna (organization special Olympic Indonesia). Unified sports is a mild non-intellectual disability inclusion of the sport's inclusion of children with mild to non-intellectual disability inclusions, with two goals including changes in friendship and childhood trait in the mild category of the intellectual disability (Rector, 2013: 7). One of the objectives of skills to be developed in unified sports is friendship activity and adjective. In connection with this objective, an instrument is used to measure the friendship activity and adjective in the unified sports of the child with the intellectual disability.

According to Colton and Covert (2007: 5), Instrument is a mechanism for measuring phenomena, which is used to gather and record information for assessment, decision making, and ultimately understanding. While Matondang (2009: 96) concluded in his research that an instrument is a tool that because it meets academic requirements it can be used as a tool to measure a measuring object or collect data about a variable. Assessment instruments are important in sports because as a tool used to gather information about the abilities, interests, and motivations of students or athletes to be measured, an understanding of the athlete's abilities so there needs to be validity and reliability. Kaplan and Saccuzo (2013: 10) explain that the principle of psychological measurement contains two important things, namely reliability, and validity. Test reliability refers to the accuracy, reliability, consistency, or repetition of test results, then validity refers to the meaning of the usefulness of the test results in order to be interpreted. Valid and reliable measurements provide accurate results to the measured goal (Sugiyono, 2013: 103). Measurement of something phenomena is needed in various fields, including in the field of sports. Instrument preparation begins by listing the specific objectives of the instrument that determine the objectives of the instrument and indicate the area of content to be assessed (Benson & Clark 1982: 791). Therefore a preliminary study is needed to determine the area to be developed.

The preliminary study was conducted through interviews with several coaches unified sports. Interview result found that so far to measure friendship activity and adjective in child intellectual disability, the trainer still apply observation directly at the time of activity without using special instrument valid and reliable. A valid and reliable measurement instrument is urgently needed by the trainer to measure the effectiveness of a unified sports program and plan for the program unified sports next. This condition is expected to give positive changes to the friendship activity and adjective child intellectual disability.

The literature study was carried out by researchers and obtained information that the instrument of friendship and adjectives of children with intellectual disability in the world was first developed by Siperstein (1980) in Boston USA in the form of friendship activity scale (FAS) and adjective checklist (ACL). The FAS and ACL instruments of Siperstein (1980) were re-validated by Nalbant, et.al. (2011: 523) in the Turkish version for the sport of child intellectual disability. Instrument version in Turkey by Nalbant et al. (2011) was done because to get a valid and reliable result, of course, measuring tool adapted to the characteristics of the subject in the field refers to differences in the characteristics of regional differences conditions for example in the United States is different from in Turkey. This is in accordance with the opinion of Snyder & Mitchell (2006: 3) the culture of the location affects the condition of children with disability due to 1) Culture where determining the characteristic condition of the child's special needs; 2) Each region represents the state's disability condition; 3) Everyone believes that each region has a different culture; and 4) Differences in place also found differences in general view of disability.

Based on these findings, researchers are encouraged to explore more about the conditions of measurement and availability of instruments of friendship activity and adjectives for child intellectual disability. The results of this study are expected to be input for the relevant institutions to immediately develop the instrument of friendship activity and adjective for children intellectual disability valid and reliable.

Methods

The method used in this research is qualitative and devoted to the realm of psychology. Krahn, et al. (1995) and Kidd (2002) explain that qualitative research in psychology began to be used frequently to communicate individual or group experiences, which might create resistance from the dominant group. The analysis of the measurement condition of friendship activity and adjective in the children's intellectual disability was done in depth to some informants, therefore the research design used as a case study. Jailani (2013: 48) discloses that case studies are a type of approach in research whose study of one case is intensive, profound, detailed, and comprehensive. The case study approach is essentially focused on the case. These cases can be derived from unique cases, specific contexts, emerging issues, cultural, natural, holistic, phenomena and so on. The case referred to in this study is related to the implementation of the measurement of friendship activity and adjective for the child in the intellectual disability unified sports and the availability of measurement instruments.

Informants have as many as 18 people with the criteria as a coach unified sports as much as 15 coaches unified in Yogyakarta, 1 head of the psychology laboratory at the University of Gadjah Mada (UGM), 1 head of the laboratory PLB Yogyakarta State University or *Universitas Negeri Yogyakarta* (UNY), and 1 representative of Development Section and Sport Special Olympic Indonesia (SOIna). The place of study was conducted in the Yogyakarta Special Region or *Daerah Istimewa Yogyakarta* (DIY). The selection of research sites was conducted with the consideration that DIY is still actively implementing unified sports and several times winning events both nationally and internationally.

Data collection techniques used are interviews and documentation. Interviews were conducted on informants to explore in-depth information about the condition of measuring the friendship activity and adjective on the child's intellectual disability and the availability of the instrument. While the documentation is done to review the evidence about the conditions of implementation as well as the availability of measuring instruments of friendship activity and

adjective. The data analysis was conducted qualitatively by collecting various data related to the measurement of friendship activity and adjective, then reducing it by selecting the important data needed for subsequently presented so that obtained a conclusion (Miles and Huberman, 1994: 10).

Results and Discussion

The implementation of measurement friendship activity and adjective in children with intellectual challenges in a unified sports

This section will discuss the results of interviews with coaches and Development Section and Sports SOIna related to the implementation of unified sports in Indonesia as well as the implementation of the measurement activity friendship and the adjective in children with intellectual challenges in unified sports. Here are the results of the interviews obtained from the trainer and the Development and Sports Section SOIna:

Trainer

Based on interviews conducted with the trainer obtained some information, namely:

a. Unified sports began to be introduced in Yogyakarta in 2013 with the coaching clinic as well as socialization about unified sports against the coach. The event is organized by SOIna center. In these activities in addition to socialization, also conducted atrial unified through a game of basketball and football. In the activities coaching clinic, elected representatives of intellectual disability students from special school or *Sekolah Luar Biasa* (SLB) city with regular students high school from SMA N 3 Yogyakarta to become a test team unified sports. Then, in 2014 SOIna follow up the activity by re-organizing coaching clinic to all trainers in the Yogyakarta region. This activity is carried out simultaneously by holding a national invitation, so it is different from the previous year that only tested, in 2014implementation is unified sports done through the game that is football unified.

b. All coaches selected as informants in this research have followed a coaching clinic related to unified sports organized by SOIna in Yogyakarta.

c. Implementation of unified sports implemented either through competition and non-competition. Competitive implementation has been done by the coach especially in basketball unified. Implementation is represented by students from SLB Negeri 2 Yogyakarta with students from SMP 11 Yogyakarta. In the joint team, SLB Negeri 2 Yogyakarta as the representative of Yogyakarta city team joined the SLB team Dharma Rena Ring Putra II Yogyakarta. Apart from the competition side, the implementation of unified sports is also conducted non-competition such as unified sports conducted directly in schools when there are visits from both students and from regular schools. In general, students visit the SLB to observe the characteristics of children with intellectual disability at the time of sports activities, that is when the trainer usually asks students to go directly into the activities of children, especially in exercising so that they directly understand the characteristics of children when exercising. The same thing is done when the trainer invites the children intellectual disability for sports activities outside the school, usually trainers bring children to the public field there are students from regular schools. On the occasion, the SLB trainers work with regular school coaches to combine the students of both schools in activity unified sports. The goal is to increase the motivation and social sense and self-confidence of the children's intellectual disability.

d. Inactivities unified sports, the trainer tries to equalize the child's goal so that the child's intellectual disability is not considered negative by the community, increasing the motivation of the child's intellectual disability when he feels his opponent is better. In addition, with the unified coach hopes to improve the friendship activity and adjective in the child's intellectual disability. From the aspect of children's skills, intellectual disability will be able to imitate the normal children do, otherwise, normal children can also recognize the children's intellectual disability. The existence of reciprocity between the child with the normal child intellectual disability of psychological aspects, association, and nature can show a positive influence on the friendship activity and adjective in the child's intellectual disability.

e. Measurements of friendship activity and adjective are carried out by the trainer through direct observation of the child's intellectual disability in the process of sports activities.

f. The trainer discloses the importance of an instrument in sports activities especially the unified sports in order to serve as a guide for trainers to measure the success of a program and subsequent program planning.

Trainers are in dire need of instruments for measuring friendship activity and adjectives for child intellectual disability in unified sports.

Section of Development and Sports SOIna

Interview conducted on the SOIna especially the development and sports with the aim of confirming the truth of information obtained from the trainers unified sports in Yogyakarta. The results of interviews on the development and sports section of SOIna are as follows:

a. Unified sports is a development of traditional sports that combine the athletes Special Olympic with non-Special Olympic. Unified principally strives to develop the potential of physical, mental and social persons with physical, physical, and mental health through sports activities combined with normal children.

b. Talking about unified should be seen not the competition but the training process. The process of training becomes a turning point in the development of skills in the child's intellectual disability. Seeing such conditions, of course, the training process needs to be considered such as arranging to whom the coach will cooperate, the form of cooperation, the purpose of cooperation and cooperation process. In addition to the rules, in Special Olympic there should be a provision that when the child's training process has seen an improvement in his ability then no longer be included in the same team but try to be included in a team with a higher level with the aim to improve the ability of athletes intellectual disability.

c. Related to the psychosocial aspect, Special Olympic so far has never done the measurement using the instrument. Measurements are made using direct observation in the training process and the match. Based on the information, Special Olympic is trying to develop a psychological approach in sports activities intellectual disability one of them to determine the level of athlete's stress before the game, analyze the factors causing it to further find the right solution to overcome them. How to measure the level of athlete stress is done through observation of the habits they do before the game like listening to music, playing games, or playing with the things he likes.

d. SOIna asserted that they do not yet have a valid and reliable instrument for measuring the friendship activity and adjectives for children with intellectual disability in unified sports.

e. SOIna reveals the importance of an instrument in measurement so that they strongly support the development of measuring instruments of friendship activity and adjectives for

child intellectual disability in unified sports that are expected to be used by all trainers unified.

Based on the results of interviews conducted on trainers and representatives SOIna can be concluded that the implementation of unified sports in Yogyakarta is done by combining between children who have intellectual barriers with normal children in the training process both competition and non-competition. The statement is in accordance with the Rector's opinion (2013); Townsend (2007); Valkova (1998), which explains that the unified sports an inclusion program which combines individual disabilities (athletes) with individual non-disability (partners) on sports are good teams for training and competition that positively affect social acceptance between children with and without disabilities intellectual so as to increase social behavior.

The goals expressed by the trainer are consistent with the seven goals unified sports expressed by Siperstein, et al (2001: 3) as follows:

a. Provide Athlete challenge (with and without intellectual disability) to improve their ability together.

b. Provide valuable opportunities through sports for individuals with intellectual disabilities who have not been involved with the Special Olympic; especially those with mild category intellectual disabilities and people in certain communities who do not have enough athletes to do group work.

c. Prepare athletes with high-level skills to participate in school or sports communities.

d. Increase public awareness of the spirit and skills of individuals with intellectual disabilities.

e. Enables the Special Olympic athlete to participate as a team member or as a coach of a team unified sports.

f. Enable athletes to develop friendships and understanding their individual abilities through the spirit of team equality and unity.

g. Increase the self-esteem of each athlete.

Based on the results of interviews with trainers, so far the coach has realized that friendship activity and adjective are aspects that have changed in the process of activities unified sports. The opinion is in line with the results of research Ozer et al. (2012: 229), which explains that the program unified sports soccer provides a positive influence on the psychosocial whom behavior, activity, friendship, and nature in children with and without intellectual disabilities. Also supported by the results of Sullivan and Glidden (2014: 375) which concluded in his research that unified sports change certain attitudes as a result of interventions with cognitive, effective, and component behavior.

Description of the condition of measurement instrument availability

In order to measure the extent to which activities unified sports can have a positive effect on changes in friendship activity and adjectives in the child's intellectual disability, an instrument is required. This statement is in line with the opinion of Firdaos (2016: 377) who said that the instrument plays a very important role in determining the quality of a measurement. An instrument is said to be good if valid and reliable. This statement is in accordance with the opinion of Kothari (2004); Kimberlin & Winterstein (2008) who explained that the main indicator of the quality of measuring instruments is the validity, reliability. Validity refers to the degree to which a test measures what we really want to measure. Reliability/reliability

with respect to the accuracy and accuracy of measurement procedures. Practicality related to various economic factors, comfort, and interpretation of

Search related to the availability of the instrument is done to the psychology lab that is deemed competent and has a correlation with the psychosocial and laboratory aspects of PLB who are competent in the field of child intellectual disability. The results of interviews to the head of a psychology laboratory obtained information that during this time development of measurement instruments for children with special needs has never been done so that they do not have a special instrument about friendship activity and adjective in children intellectual disability. While the results of interviews to the head of the lab PLB obtained information that In the world of the most frequently used instruments such as WISC, Raven (SPM and CPM) tests used to measure intelligence or intelligence of children. There are two subtests in Weschler that are performance and verbal. He revealed that so far there has been no instrument developed to measure psychosocial skills, especially friendship activity and adjective in children with intellectual disability.

Based on these conditions can be seen the gap between the needs of the field with the availability of measurement instruments. Thus it can be concluded the importance of the development of measuring instruments of friendship activity and adjective in order to facilitate the trainer in measuring program effectiveness and follow-up plan.

Conclusions

Based on the results obtained can be concluded that Unified Sports gives a positive influence on changes in friendship activity and an adjective but appropriate measurement is necessary. A measurement is said to be good if it has a valid and reliable instrument. So far the form of measurement of friendship activity and adjective for child intellectual disability in unified sports is done through direct observation without any valid and reliable guidelines. The trainer feels the importance of a measurement instrument to measure the success of a program so that the trainer desperately needs the availability of the instrument of friendship activity and the adjective. The results of interviews with the head of the psychology laboratory and the head of the PLB laboratory revealed a fact about the unavailability of measuring instruments of friendship activity and adjective for the child's intellectual disability. It can be concluded that there is a gap between the needs of the trainer and the availability of instruments in the field so that an instrument required friendship activity and adjective for intellectual disability children in unified sports.

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Growth in Public Interest and Scientific Research on Kinesiology Taping

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Abstract

Kinesiology taping has grown in popularity, though there are a number of unsubstantiated claims made by some kinesiology taping advocates. An investigation was conducted into trends in general and scientific interest in kinesiology taping. Data in the public domain (Google Trends and Google Scholar data) indicated significant growth of interest both in terms of public search queries and scientific publications relevant to kinesiology taping. Cyclical trends in interest relevant to kinesiology taping were identified. Segmented regression indicated some of the growth in interest in kinesiology taping may be attributed to exposure of spectators of the Olympic Games to kinesiology taping in athletes. Despite substantial growth in research on kinesiology taping there remain unsubstantiated claims.

Keywords: Kinesiology Tape, Google Trends, Google Scholar Data, Segmented Regression, Olympic Games

Introduction

Kinesiology tape is a thin, stretchy, elastic cotton strip with an acrylic adhesive. Originally developed by Japanese Chiropractor Dr Kenso Kase in the 1970's as a natural, alternative healing method, its alleged benefits have been met with controversy. Studies have shown benefits of kinesiology tape in assisting recovery of sport injuries and other non-sport injuries (Thelen et al., 2008) as well as increasing sport performance (Hsu et al., 2009; Yoshida et al., 2007). This study investigates the growth in interest in kinesiology taping as well as the growth in research on this topic.

Clinical benefits

Studies on kinesiology tape for joint and muscle injuries demonstrate kinesiology tape can improve pain free active range of movement (ROM) immediately after tape application for patients with shoulder pain (Thelen et al., 2008). There is also evidence that kinesiology tape can lead to pain relief and lumbar muscle function normalization in those suffering from chronic lower back pain (Paoloni et al., 2011) however there does not appear to be any additional benefits to patients suffering from lower back pain that are already undergoing manual therapy (Added et al., 2016). Kinesiology tape has also shown to benefit post-operative swelling (Ristow et al., 2013). On the other hand, there is conflicting evidence on whether kinesiology tape decreases pain intensity and overall disability in patients or only has a non-significant effect (Shakeri, Keshavarz, Arab & Ebrahimi, 2013). Studies have shown short term pain relief for patients with shoulder impingements (Hsu, et al., 2009) whilst some studies show no benefit in terms of a decrease in pain (Thelen et al., 2008). Kinesiology tape may also benefit patients with postural imbalances. This implies a beneficial assistive treatment approach when combined with physiotherapy (Simsek et al., 2011). In a systematic review of randomized controlled studies (Parreira, Costa, Junior, Lopes & Costa, 2014), itself building on five other systematic reviews, it was concluded that kinesiology taping was no better than a placebo. It was thus recommended that kinesiology taping had no place in clinical practice (Parreira et al., 2014). Though there were some studies identifying marginal benefits these were hypothesized as being due to random fluctuations becoming significant due to small sample sizes involved (Parreira et al., 2014).

Sport benefits

In terms of sports performance, kinesiology tape has been shown to increase the range of trunk flexion (Yoshida et al., 2007). Additional studies have shown kinesiology tape to increase muscle activation (Hsu et al., 2009) and knee flexion ROM in athletes with an acute hamstring strains (Gunur & Alsancek 2014). The viability of kinesiology taping for proprioception is a particularly contentious field (Bischoff et al., 2018). Kinesiology tape has been demonstrated to increase proprioceptive post-anterior cruciate ligament rupture knee stability (Bischoff et al., 2018), proprioceptive ankle stability (Simon et al., 2014) and enhance absolute force sense error for both healthy athletes and athletes suffering from medial epicondylitis (Simon et al., 2014). A contrasting result from Halseth et al. (2004), demonstrated that kinesiology taping likely did not enhance proprioception. Other studies have shown kinesiology tape to enhance either relative or absolute force sense in healthy college athletes, improve range of motion in certain injured cohorts and force sense error compared with other tapes (Mostafavifar et al., 2012). However, no benefits were seen in maximal grip strength (Chang et al., 2010), or peak power across a range of interventions (Harmanci et al., 2016). Csapo and Alegre (2015), conducted a meta-analysis on 19 studies and concluded that kinesiology taping effects were not dependent upon the muscle groups taped and that any strength gain from kinesiology taping would be negligible.

Evidence shows kinesiology tape holding potential in increasing sport performance and as a beneficial method of treatment combined with traditional physiotherapy. However, due to many conflicting studies, additional clinical studies need to be undertaken to further validate the efficacy of kinesiology tape.

Growth of general and scientific interest in kinesiology taping

The aim of this study was to investigate the growth of interest in kinesiology tape since its creation. It was interesting to evaluate patterns in interest in kinesiology taping in the context of the many unsubstantiated claims for this methodology. It was first necessary to design a method to measure this growth over time. Internet activity was selected as a suitable proxy for worldwide interest in a particular topic at a given point in time. It was considered to be a very reasonable hypothesis that growth in kinesiology taping would increase yearly (from zero) since its creation and it would be of interest to investigate any substantial changes in its popularity using statistical analysis on this data. Given the wide ranging and yet unproven claims associated with kinesiology taping it was hypothesized that as general interest and number of subsequent claims increased that this trend would also be represented by increase in the number of scientific publications and citations within the scientific literature.

Methods

An algorithm was written utilizing the programming language R (R version 3.3.2 "Sincere Pumpkin Patch") to access publicly available data on Google trends data for specific topics. Data was gathered from January 2004 (the limit of reliable historical data) to March 2018 on the use of three key search phrases selected as relevant to kinesiology taping ("kinesiology tape", "kinesio tape" and "kt tape"). A number of details were gathered including geolocation and time data for the searches. Data was analyzed using Davies's test (Davies, 1987) to test for breakpoints via a non-zero difference-in-slope parameter of a segmented relationship. Segmented regression was also used to identify the position of these breakpoints using the R package segmented version 0.5.3.0 (Muggeo, 2008). An overview of worldwide trends was created using the R package googleVis version 0.6.2 (Gesmann, & de Castillo, 2011).

The programming language python (Python 3.6.4) was utilized to access publicly available Google scholar data in order to measure scholarly activity on the topic of kinesiology taping, using the same phrases as for Google trends searches. This code was complemented with substantial manual searching to comply with Google Scholar's access criteria.

All investigation was conducted on publicly available data in accordance with Google API's terms of service (https://developers.google.com/terms/).

Results

Table 1 shows the top 25 countries ranked in terms of the popularity of the search phrases relative to the total search volumes for each country. The score is scaled from 0-100 where 100 is allocated to Singapore, the country with the highest number of searches relative to the size of the country's search traffic. The other countries are scaled according to their proportion of national volume of search queries relative to this score (such that for example the second highest scoring USA has 79.5% of the volume of Singapore relative to the USA population size). Figure 1 demonstrates the interest by region for the world.

Table 1. Summary of the top 25 countries by relative search prevalence

Country	Relative Search Prevalence	Country	Relative Search Prevalence	Country	Relative Search Prevalence
Singapore	100.0	South Africa	37.3	Portugal	22.4
United States	79.5	Australia	35.4	United Arab Emirates	19.9
Canada	60.2	Hong Kong	34.8	Norway	19.9
Germany	59.6	Switzerland	31.7	Greece	19.9
Hungary	58.4	Malaysia	26.7	Israel	19.3
Ireland	49.1	Denmark	24.8	Croatia	18.6
Austria	46.6	Slovenia	22.3	Brazil	18.01
United Kingdom	43.5	Philippines	22.4		
New Zealand	41.0	Czech Republic	22.4		

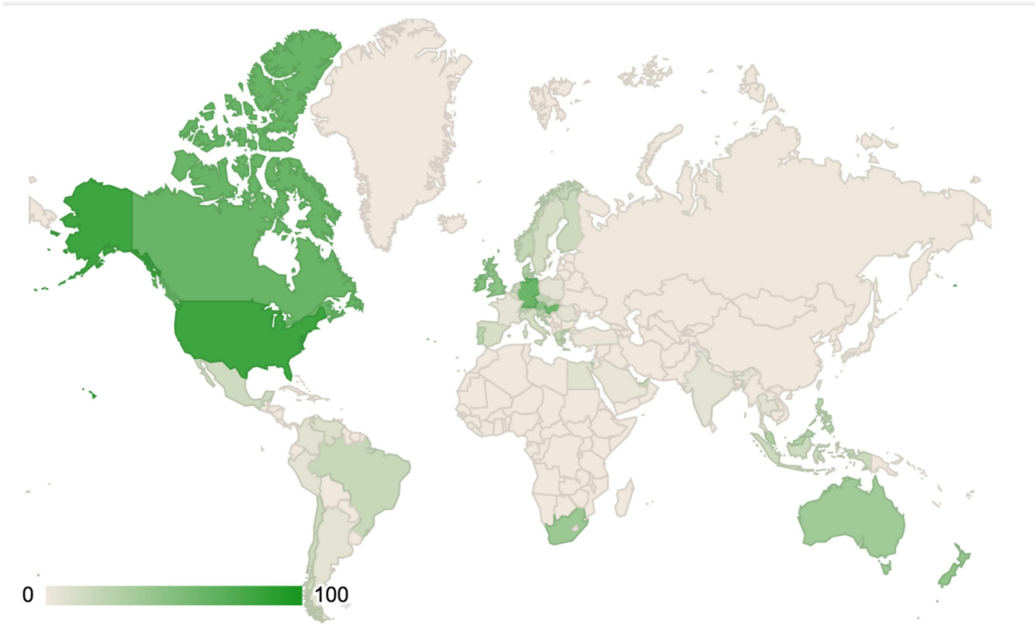

Figure 1. Distribution of relative volume of search traffic by nationality

Due to the search query terms being English language terms, the majority of users were in countries where the primary written language was English such as North America, Australia, New Zealand and the United Kingdom. However other countries also demonstrated a high prevalence of Google searches for kinesiology tape, such as Germany.

The use of the three search phrases between January 2004 and March 2018 (data up to 20th March 2018) is demonstrated in Figure 2.

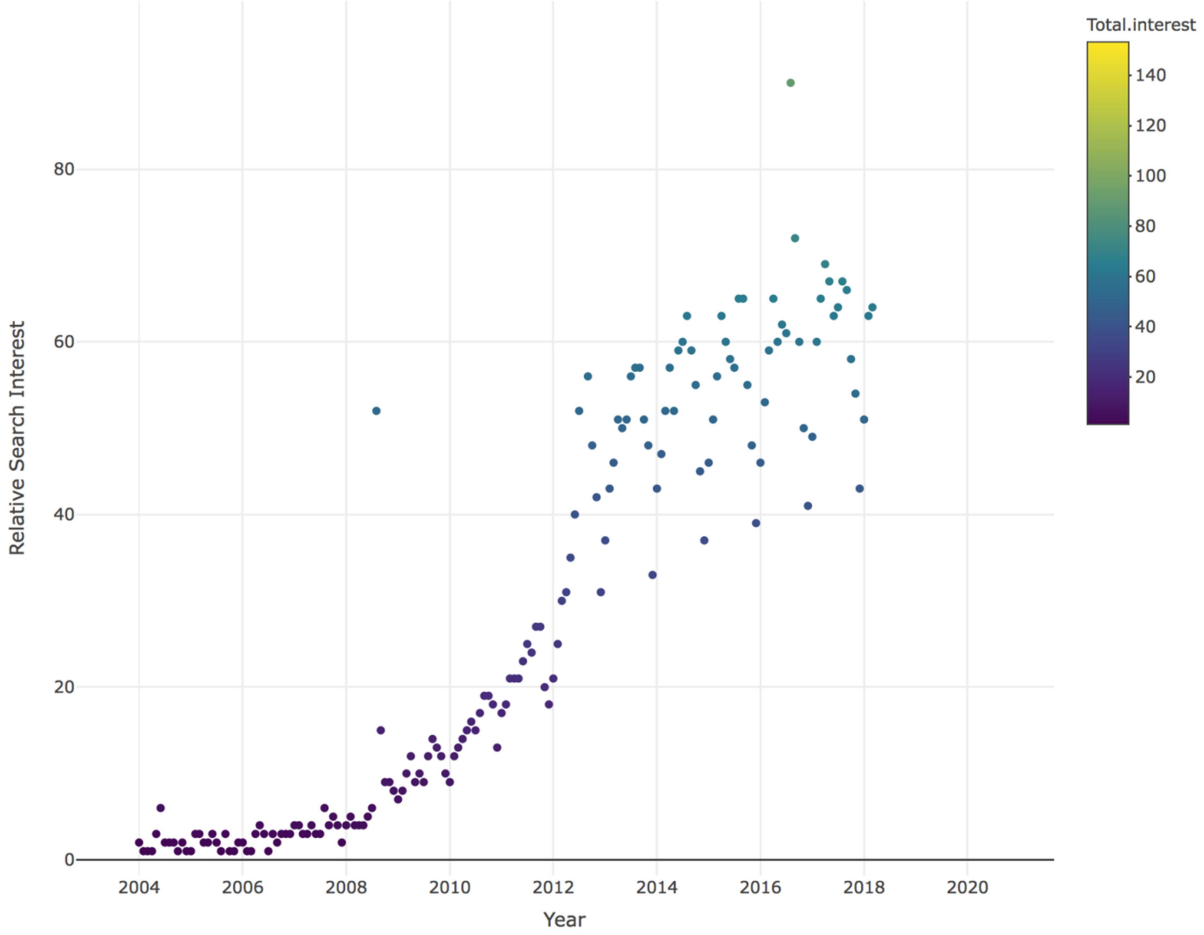

Figure 2. Relative search volume over time for public Google searches since 2004

A distinct peak with a relative search interest value of 52 is seen in August 2008. This peak appears to initiate a dramatic increase in the use of the three search phrases. A similar peak is seen in August 2016 and represents the highest value on the chart (90). The initial peak of 52 is not exceeded until August 2012, after which point the chart appears to enter a cyclical pattern with peaks each year between August and October. This pattern is better demonstrated in Figure 3. In fact examining the Figure 3 it appears in most years since 2004 there are relative peaks between August and October. Davies's test indicated ($p<0.0001$) the presence of breakpoint(s) in the chart. Segmented regression identified breakpoints at 1st December 2006, 1st February 2012 and 1st August 2012.

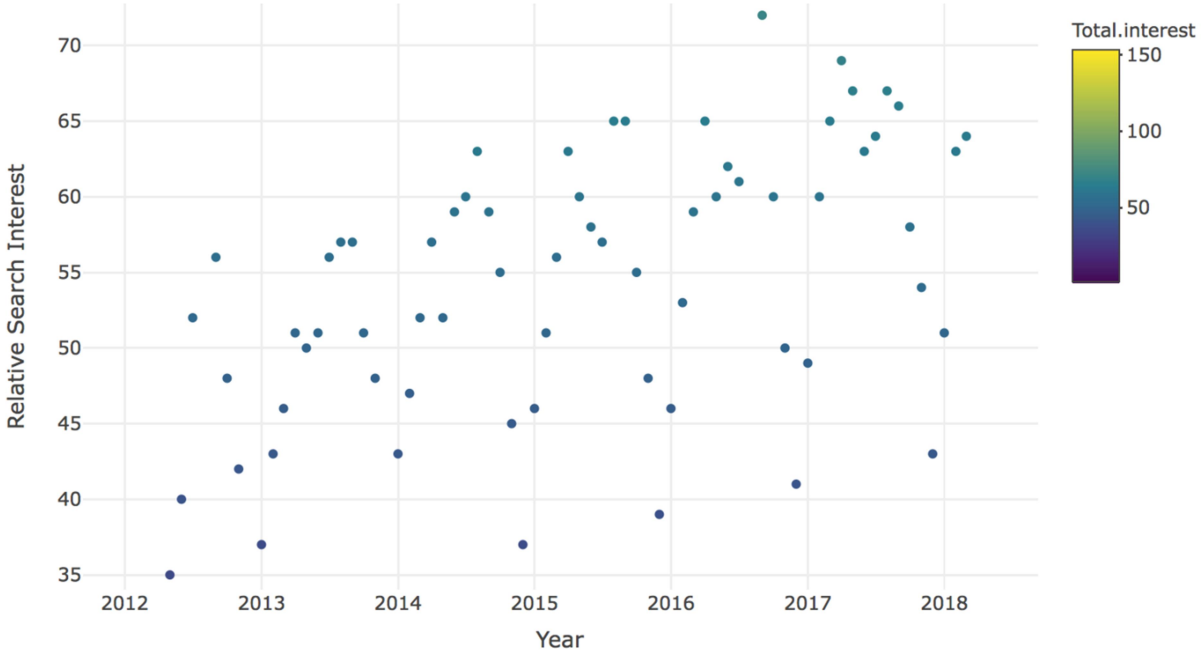

Figure 3. Relative search volume over time for public google searches since 2004 with range reduction. A cyclical oscillation with relative lows in search traffic towards the end of the year and a larger relative volume in the middle of the year

The number of citations and papers identified by Google Scholar using the phrases relating to kinesiology taping are shown in Figure 4. It can be seen that the number of articles referring to kinesiology tape has grown substantially in the past 10 years. It is notable that there has not been similar growth in the number of citations.

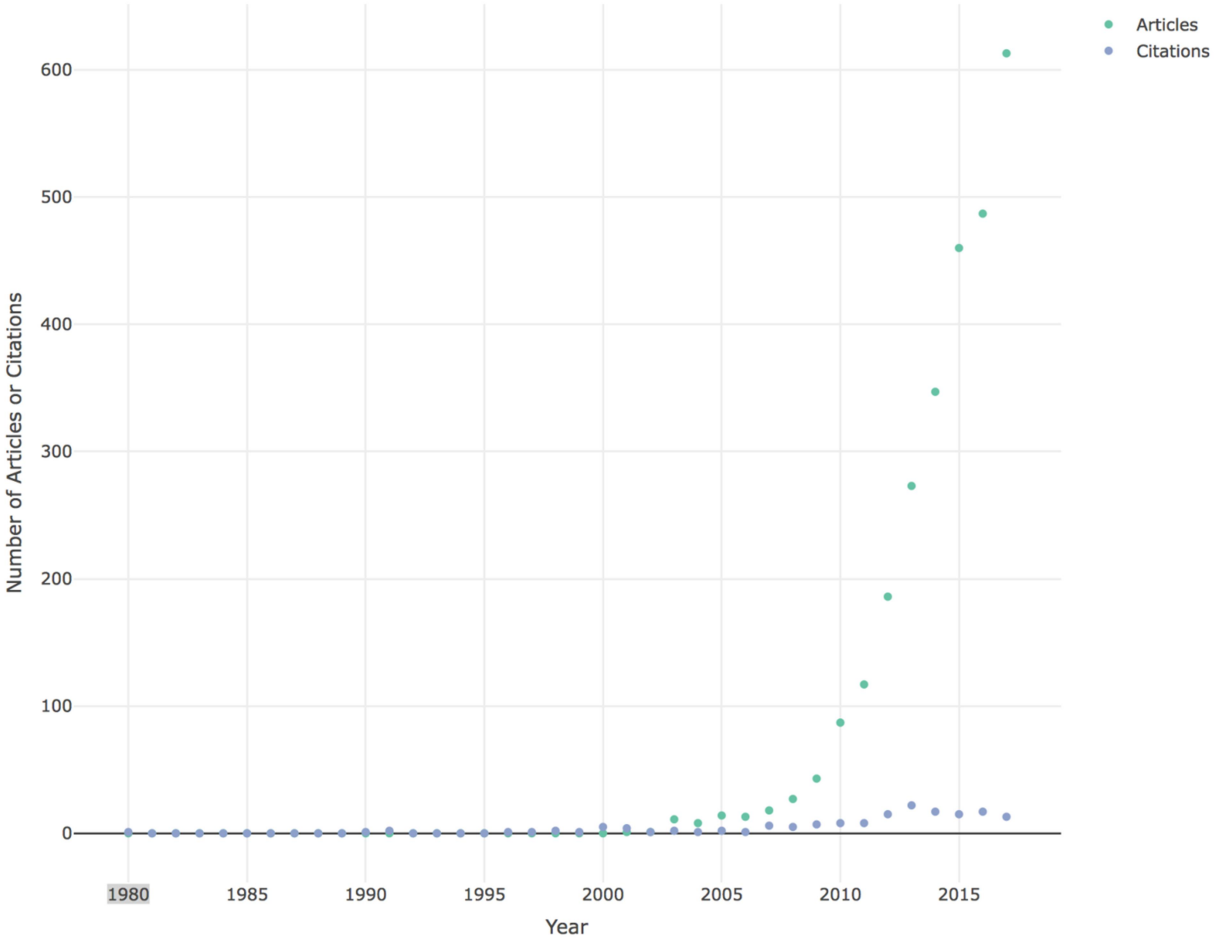

Figure 4. Number of articles containing the identified phrases relating to kinesiology tape published and accessible via Google Scholar since 1980 (teal). The number of citations of articles containing the identified phrases (as per identification via Google Scholar) are shown in grey.

The Davies' test revealed the presence of changes in slope ($p<0.0001$) for both the number of articles and number of citations. Although Davies' test indicates the presence of significant changes in slope, it was not considered as the appropriate option for estimating their position (breakpoints). Segmented regression estimated slope breakpoints for number of articles (2001, 2008, 2011) and citations (2005, 2011, 2013).

Discussion

The distribution of searches (Figure 1) is in general higher for English speaking countries and there is minimal search volume relative to total volume of searches for many countries such as China, Russia and most of Africa (with the exception of South Africa). This is unlikely to be related to other search engines being used and more likely due to a large volume of searches not being conducted in English. Whilst this lack of interest may be related to other terms being used for kinesiology tape based queries, it may also be due to kinesiology tape not yet developing in these markets. It is an interesting finding, though no underlying

mechanism is proposed for the high level of interest in kinesiology taping showed by Singapore as the country with the highest relative prevalence of the relevant search terms.

The August 2008, August 2012 and August 2016 peaks in Figure 2 interest coincided with the quadrennial Summer Olympics. It is likely that people watching athletes compete at the Olympics saw their use of kinesiology tape or were exposed to its use by the media covering the games and searched the phrases relative to find out more about kinesiology tape (or purchase it). The August 2016 peak coincided with the Rio Summer Olympics and Brazil was one of the countries with the highest traffic in South America. It was noted that the August 2012 peak coincided with the breakpoint identified via segmented regression. Although the other two Olympic peaks were not identified with segmented regression, they were clearly outliers via observation from the graph. The 2012 London Olympics breakpoint would imply that the London Olympics has influenced the ongoing popularity of kinesiology tape. Based on the increase in search trends during the Olympics, the cyclical pattern in Figure 3 with peaks each year between August and October may be due to other sporting events. As there is a clear pattern, it would be expected that there is an underlying construct causing this cyclical oscillation. Peaks in interest in kinesiology taping in the countries in Table 1 during Olympic and a yearly cycle (Figure 3), may be of interest to those selling or marketing kinesiology tape.

As can be expected the growth in the number of citations on kinesiology taping has dramatically grown in association with general interest in this topic. It is possible that some of this growth in research activity may be related to investigating unsubstantiated claims made relative to this product. It should be highlighted that the growth in citations has not matched the growth in publications on this topic. This may well be due to different capabilities of Google Scholar in terms of identifying publications as opposed to identifying citations. However, it should be noted that it could represent a deficit in research papers referencing other works on this topic. In this case this could contribute to the number of unsubstantiated claims and unanswered questions with regard to kinesiology taping. It should be considered that if each new paper making reference to kinesiology taping referenced at least one other paper on the topic of kinesiology taping, the number of citations should exceed the number of new publications in this field. It is unlikely that papers would not have at least one other associated reference on this topic, therefore it is most likely that this lack of citations is a limitation in the Google Scholar platform that most likely will improve over time. This analysis of citations can be revisited if changes to the process of identifying citations are made by Google Scholar.

The segmented regression indicated a breakpoint at 2013 for the graph of the number of citations. This breakpoint is also visually apparent from observation of the graph (Figure 4). This breakpoint would indicate that the number of citations is in a downtrend as opposed to the uptrend in articles. Some explanation for this could be that papers are currently in press or will be written over the next few years citing these papers and thus the citation counts for these earlier works will increase. This however does not seem sufficient to accommodate this downtrend whilst article count is in a strong uptrend.

Conclusion

This analysis demonstrated considerable growth in public interest and scientific research on kinesiology taping. A portion of this growth may be attributed to exposure of kinesiology taping to spectators of the Olympic Games. With the growth of interest in kinesiology taping,

there has also been a growth in claims pertaining to the benefits of such taping. Whilst research has also developed in this field, many of these unsubstantiated claims still persist. The growth of scholarly citations relevant to kinesiology taping has not kept pace with the growth of publication of articles, however this difference may be an artifact of the methods used.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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Religious Belief vs. Religious Practice. What is More Beneficial to Elite Athletes? An Investigation of Religious/Spiritual Belief, and its Relationship to Challenge & Threat Appraisal

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Abstract

Religiosity/spirituality has been linked with reduced anxiety in athlete populations. This study set out to assess the impact of religious/spiritual belief, opposed to practice, to see whether it too would predict anxiety, as well as feelings of control and cognitive appraisal in elite athletes (N = 115). Self-reported self-efficacy, control, achievement goals, life satisfaction, trait anxiety and strength of belief in a higher power (SBHP) were measured and analysed with simple linear regressions and multiple regressions (with challenge and threat appraisals as the dependent variables). The models predicting both challenge and threat appraisal were found to be significant, although SBHP was not a significant predictor, nor was it significantly predicative of any of the variables, or significantly correlated with them. The contribution of religious/spiritual belief to psychological benefits is compared to religious/spiritual practice and discussed alongside implications for future research and applied practice.

Keywords: sport, psychology, religion, spirituality, belief, anxiety, challenge, threat, appraisal

Introduction

Religion and Sport

There is very little international agreement on how to define the terms 'religiosity', 'spirituality' and 'supernatural belief' (Snider & McPhedran, 2014) and where the boundaries lie between them. The focus of this paper is on the concepts of religiosity and spirituality, and if one is to fully study these it is essential to ascertain working definitions. Schofield, Baker, Staples, and Sheffield (2016) for example, recently proposed that paranormal belief, spirituality and religiosity are three distinct typologies, whereas Snider and McPhedran (2014) use the operational term 'religiosity/spirituality' to encompass the institutional beliefs and practices of the traditionally religious, combined with spirituality, which the authors class as a "less structured, personal and self-defined branch" of religiosity (p. 570). Schofield et al. (2016) also cite that spirituality has been defined as a more personal notion (Zinnbauer et al., 1997) that revolves around individual values, rather than the institutional ideas characterised by formal religiosity (Hood, Hill, & Spilka, 2009). Others see religiosity and spirituality as being two branches of the all-encompassing category of paranormal belief (Benson, Roehlkepartain, & Rude, 2003), whilst some use the terms religiosity and spirituality interchangeably (Williams & Sternthal, 2007, cited in Snider & McPhedran, 2014). Given that the forthcoming literature generally splits out religiosity and spirituality, the present study will refer to religiosity and spirituality as separate entities but referred to as one all-encompassing category, 'religiosity/spirituality', in line with Snider and McPhedran (2014). Whilst this conciseness in definition will be used for the present paper, it is worth caveating that there is little universal agreement in defining these terms in the literature on supernatural belief, with Schofield et al. (2016) citing that "when concepts such as religion are defined, the only person likely to agree with a given definition is its author" (p. 419).

The link between religiosity/spirituality and sport has been researched from many different angles. Some have contended that sport itself is a religion (e.g., Reid, 2016; Chidester, 1996; Prebish, 1992), whereas others have argued that sport fills a spiritual void for athletes (e.g., Lawrence, 2005), and some opine that fans that follow sport also have a religious or spiritual relationship with it (Wann, Melznick, Russell, & Pease, 2001; Wann, 2001; Serazio, 2013). There has also been research into the conflicting role identities of religion and athlete (Stevenson, 1991), a growing body of literature that has investigated the best ways coaches can deal with or consult with religious athletes (Mosley, Frierson, Cheng, & Aoyagi, 2015; Watson & Czech, 2005; Watson & Nesti, 2005) studies purporting religiosity as a protective factor against substance abuse (Rodek, Sekulic, & Pasalic, 2009; Storch, Storch, Kovacs, Okun, & Welsh, 2003), as well studies assessing the prevalence of religiosity or spirituality in athletic populations (Storch, Kolsky, Silvestri, & Storch, 2001; Bell, Johnson, & Petersen, 2009). Given the array of literature on the subject, one might think there would be a healthy body of research on the potential sport psychology benefits derived from religiosity/spirituality. This supposition would be strengthened even more so by the wealth of literature in the clinical domain. For example, in a recent meta-analysis of 23 random control trials, Gonçalves, Lucchetti, Menezes, and Vallada (2015) found significant effects of religious or spiritual interventions on anxiety general symptoms ($p < .001$). In another meta-analysis, Hackney and Sanders (2003) went further and argued that the type of religiosity definition produces different effect sizes. They grouped definitions into three types: institutional religiosity (attendance, participation, and prayer), ideological religiosity (attitudes, belief and belief salience) and personal devotion (emotional attachment to God). In their analysis of 34 studies, they found significant increases in mean effect size (for

psychological health) as one proceeds from institutional religiosity (.06) to ideology (.08), to personal devotion (.15).

However, despite the wealth of literature on the link between religion or spirituality and sport, as well as the weight of research in the clinical domain looking at psychological benefits derived from religiosity/spirituality, there are a limited number of studies that have researched the potential psychological benefits that might be derived from religious/spiritual practice or belief, in the context of competitive sport. Sarkar, Hill, and Parker (2015) have remarked that "given religion and spirituality are important for the welfare of numerous individuals, it is somewhat surprising that relatively few studies within the sport psychology literature have directly examined the association between religion, spirituality, and well-being in sport performers" (p. 49). Some authors have attempted to relate religiosity/spiritually to the experience of flow or being in the zone. Athletes and performers who describe the experience of being in the zone has been conceptualised as 'flow' and coined in the psychological literature by Csíkszentmihályi (2008). The author describes it as an optimal experience whereby the subject feels complete, undistracted concentration with the task at hand. Csíkszentmihályi (2008) lists eight characteristics of flow, including 'clarity of goals', 'intrinsically rewarding experience', 'effortlessness' and 'feelings of complete control'. Dillon and Tait (2000) found a correlation between those who scored high on their Spirituality in Sports Test (SIST) with the Zone Test, which they used as a proxy for measuring flow. Criticisms of this study include the non-elite level of the sample population, given they completed at National Collegiate Athletic Association (NCAA) Division III level, and the small sample size (62). In fact, a closer look at the study design reveals that only 42 of the participants were collegiate athletes, with the remaining 32% of the participants self-reporting that they had been on teams in high school. With such a low sample of athletes, the correlational nature of the data may be considered low in reliability, give the very small sample size (e.g., Button et al., 2013). Spittle and Dillon (2014) aimed to repeat their findings with 92 competitive golfers, but this time found no correlation between scores on the SIST and the Zone Test, however, they did find significant correlation between spirituality and 'sense of control', a subscale of another measure of flow, the Dispositional Flow Scale (DFS). Whilst this study has a larger sample size than the pioneering Dillon and Tait (2000) paper, the label of the golfers as 'competitive' could be argued to be somewhat generous. A closer look at the participants reveals that 67% of them had not played higher than club level standard, with professional golfers making up 2.2% of the sample. Both of these studies intended to study relationships with spirituality and being in the zone and used quantitative scales to attempt to capture the concept of flow. However, in a systematic review of literature on flow states in elite sport, Swann, Keegan, Piggott, and Crust (2012) argue that quantitative measures are not as effective at investigating flow as qualitative means, "especially as they attempt to explore an intensely subjective experience by using objective measures" (p. 810).

The focus of this review will now switch to a body of research, which has repeatedly inferred a relationship between religiosity/spirituality and lowered anxiety, in both clinical populations and athlete populations. The reason why this particular area of the literature is of such interest is because researchers have found that high-anxiety conditions inhibit sports performance, including anticipation judgments and visual search behaviors (Alder, Ford, Causer, & Williams, 2016). As such, any insight into lowering athletes' anxiety is of great value to the domain of sport psychology.

Stress and Anxiety

The majority of studies attempting to ascertain a competitive benefit from being religious or spiritual have focused on coping skills and reducing anxiety. One of the most cited papers is Czech, Wrisberg, Fisher, Thomson, and Hayes (2004) and their investigation of Christian athletes' prayer experiences. In a semi-structured interview with nine former NCAA Division I collegiate athletes, they uncovered four key themes following inductive and deductive analysis. Two themes were most prominent. The first was using prayer for performance purposes such as reducing anxiety, whilst the second theme was about prayer routine, and the control that athletes derive from a regular pre-competition routine. Whilst hard to extrapolate these results to a general population, the results of this study suggest that prayer could be used by athletes to reduce anxiety and increase the perception of control. One might note that reductions in anxiety often came from prayers that utilised secondary tools such as breathing exercises, for example, "I would use a kind of praying/relaxation breathing technique" (Czech et al., 2004, p.7). This suggests that it may not be just prayer that is leading to reduced anxiety, but the accompanying breathing exercise as well. In the second theme, the authors note that it might not be prayer routine that gives athletes competitive advantage, but the control that they derive from a ritualistic routine. The authors note Womack's (1992) characteristics of rituals that give athletes a feeling of control over their environment, namely 'stylized', 'repetitive', 'sequential', and 'potent', all of which the authors argue are reflective of the prayer routines described by their participants. There are a number of potential critiques of this study. First of all, the use of former athletes is questionable, given that the heated experience of competition might have dissipated since retiring from competitive sport. It arguably creates a methodology closer to biographical accounts of competitive sport, as opposed to a study of current athletes. The lead author also admits a personal bias given that he himself is a Christian and a former athlete. Whilst they have mitigated for this by employing an interpretive group to give unbiased perspectives on coding and categories, the lead author ultimately pulls together the analysis, and hence this may still cast doubt over the impartiality of the findings. Furthermore, one might question how homogenous this population is. A sample size of nine athletes is difficult to generalise from, plus anxiety in athlete populations has been related to multiple predictive factors including, but not exclusive to, serotonin transporter promoter polymorphism and personality traits (Petito et al., 2016), the anxiety of coaches (Mottaghi, Atarodi, and Rohani, 2013) and parental pressure (O'Rourke, Smith, Smoll, & Cumming, 2011), yet it is not clear whether the authors have attempted to reveal, nor control for such additional factors within the study design.

In a very recent paper, Najah, Farooq, and Rejeb (2017) used a quantitative approach to studying the effects of religiosity/spirituality practice on psychological outcomes. They assessed 50 professional athletes that had suffered anterior cruciate ligament (ACL) injuries prior to their surgery. They classified them as either high or low in religiosity or spirituality (RSH or RSL) and either high or low in the extent to which they prayed or meditated (PMH or PML) before distributing the Brief Cope Inventory (BCI) and Depression and Anxiety Stress Scale (DASS 21). Their results showed that belief scores were negatively correlated with depression (r = -.41, p < .01) and anxiety (r = -.42, p < .01). They also found that praying and mediation were negatively correlated to depression (r = -.31, p < .05) and anxiety (r = -.30, p < .05) but to a less significant degree. Furthermore, when they compared the groups they had created, they found that those with higher religious and spiritual belief displayed higher coping, whilst those with less belief had higher depression and anxiety scores. Similarly, those who were found to pray or meditate more were also higher on coping scores, however, no significant differences were found for depression and anxiety. These results

suggest that religiosity/spirituality does have a relationship with anxiety, however, it must be noted that the context of the study is restricted to dealing with injury, and findings might not be generalisable to athletes in competition scenarios. The authors also concede that the way they defined high and low religious/spiritual groups was based on only two questions in the BCI, admitting, "…it is not possible to distinguish or quantify the levels of religious belief and practice based on these items" (p. 188). Similarly to the Czech et al. (2014) study, it is also not clear whether other personal factors that may predispose anxiety have been measured or controlled for. Added to the low sample size, they stress that the findings should be regarded as promising insight for future research, rather than robust findings.

Elsewhere, a number of researchers have found a relationship between religiosity/spirituality and anxiety in elite athlete populations. A much-referenced study by Vernacchia, McGuire, Reardon, and Templin (2000) for example found that 6 Olympic athletes in their sample of 15 Olympians identified the importance of religion/spirituality in coping with injuries as well as personal and athletic set backs. Whilst this study might be heralded for its high quality sample of elite athletes, the self-reported qualitative findings from six athletes is hard to generalise to all religious athletes. Kim and Duda (2003) also found that religion is used as a coping strategy. In their cross-cultural study of 318 NCAA Division I collegiate athletes and 404 Korean athletes playing at equivalent level in South Korea, they found that subjects used religion as a coping strategy when undergoing psychological stress. Finally, Park (2000) also found that Korean athletes utilised prayer as a coping mechanism for stress, with 22% of the study's 148 international athletes identifying with this strategy of coping. This study may point to evidence of a relationship between religious/spiritual practice and anxiety that applies across countries and cultures. Despite its large sample of elite, international athletes, the finding is a descriptive statistic. One might equally point out that 78% of the sample did not utilise religion as a coping strategy. When inspecting the findings further, one also discovers that there were five other coping strategies that were more popular than utilising religion (mental training, training strategies, somatic relaxation, hobbies, and social support). The Park (2000) study is widely cited in the literature, which is perhaps slightly reflective of the paucity of the literature on religiosity/spirituality and sport psychology benefits. None of these five studies meet the highest standard of reliability in terms of randomly controlled trials, and are all single measures in time without the benefit of longitudinal evidence. However, the cumulative weight of these findings, in addition to meta-analyses in clinical populations might suggest that religiosity/spirituality is related to anxiety within athlete populations.

Models of Stress and Emotion

Whilst there has been a modest amount of research looking at the relationship between religiosity/spirituality and anxiety in athlete populations, so far this has been assessed in absence of an overarching model of how stress and emotion affects athletic performance. One might look to the Multidimensional Anxiety Theory (MAT), which was developed by Martens, Burton, Vealey, Bump, and Smith (1990). It is a theory that broadens the construct, as it regards anxiety as comprised of two distinct components: cognitive anxiety and somatic anxiety. Whilst the theory looks to dig deeper in to the concept of anxiety, some researchers have criticised it, noting evidence that suggests somatic and cognitive anxiety are not mutually exclusive phenomena (e.g., Krane, 1992). But the critical reason why this theory has not been used within the present study is its lack of consistency in predicting how these two types of anxiety predict performance (McNally, 2002). Another prominent theory of anxiety is the Catastrophe Model (Hardy & Fazey, 1987, cited in Hardy & Parfitt, 1991), which also utilises a dichotomous view of anxiety, but unlike MAT uses the construct of physiological arousal instead of somatic anxiety. Catastrophe Model predicts that performance will only

become severely impaired when an individual exhibits high cognitive anxiety, whereby accompanying physiological arousal is tolerated up until a crucial threshold after which a rapid deterioration in performance (i.e. a catastrophe) is predicted. Whilst this theory makes strong claims about when anxiety will determine a drop in performance, researchers have noted that evidence hasn't consistently mirrored the theory's predictions (e.g., Hardy, Parfitt, & Pates, 1992, cited in McNally, 2002), and it also fails to explain exactly how the effects of cognitive anxiety and physiological arousal on performance occur (McNally, 2002). The Theory of Challenge and Threat States in Athletes (TCTSA) proposed by Jones, Meijen, McCarthy, and Sheffield (2009) is the most recent theoretical addition to the anxiety and arousal literature within athlete populations. It aims to further the position of Lazarus (1999) who argued that factors such as anxiety and control affect athletic performance, via their impact on whether an athlete appraises his or her arousal as a challenging or threatening experience (see the full model in Figure 1).

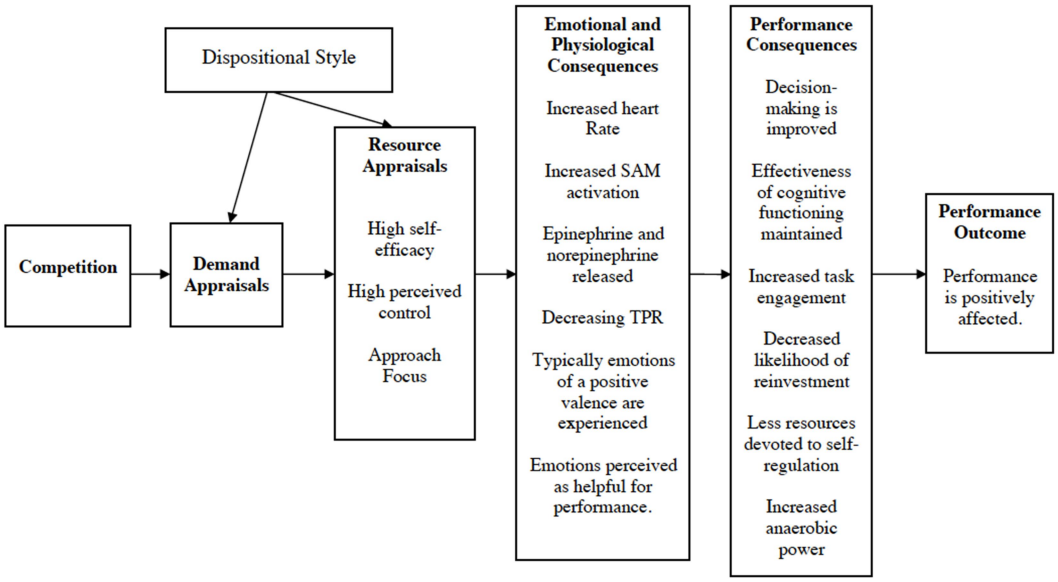

Figure 1a. Theory of Challenge and Threat States in Athletes (TCTSA) – The Challenge State

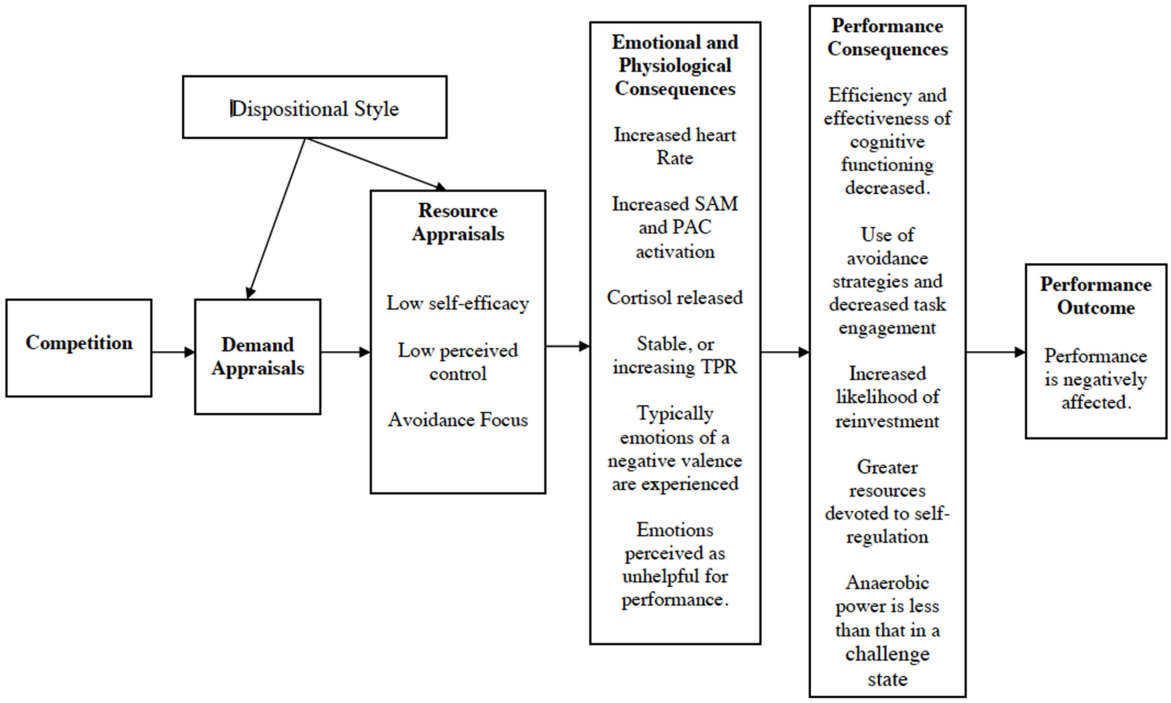

Figure 1b. Theory of Challenge and Threat States in Athletes (TCTSA) – The Threat State

It also aims to integrate biopsychosocial (BPS) models of challenge and threat (Blascovich & Tomaka, 1996; Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004), by making predictions about challenge or threat states through demand appraisals (e.g., perception of danger, uncertainty and required effort) as well as resource appraisals (e.g., skills, knowledge and ability). A key aspect of BPS theories that the TCTSA has integrated, concerns athletes' physiological responses to arousal and posits that specific patterns of neuroendocrine and cardiovascular response are indicative of a challenge or threat state. The TCTSA is a sport-specific model and integrates other commonly proposed factors that influence athletic performance, namely, self-efficacy, perceived control and motivational goals. The TCTSA's assertion that challenge and threat states are the result of how athletes perceive and process stress, anxiety and arousal has been supported by a number of studies (e.g., Turner et al., 2013; Meijen, Jones, McCarthy, Sheffield, & Allen, 2013; Moore, Vine, Wilson, & Freeman, 2012; Turner, Jones, Sheffield, & Cross, 2012; Vine, Freeman, Moore, Chandra-Ramanan, & Wilson, 2013). Given the growing body of research supporting it, and given it has been developed specifically for athletes and aims to predict athletic performance, the TCTSA has been chosen as the model to underpin the present investigation of SBHP, and its potential psychological benefits for elite athletes.

Aims and Hypotheses

In order to add value to this research area, one might look at three key elements: strength of belief, the definition of elite athlete, and a framework for anxiety in competition environments. Firstly, the majority of the studies in the literature only concern religious/spiritual *practice*. Just one paper (Najah et al., 2017) addresses the *belief* aspect of religiosity/spirituality as a potential determinant. Secondly, aside from Vernacchia et al. (2000) and their study of Olympic athletes, the majority of the literature base is derived from findings with student-athletes, despite the fact that many practicing sport psychologists are

looking for research that they can utilise for elite populations. Finally, all the studies tend to look at the relationship between religiosity/spirituality and psychological benefits in isolation, despite the fact, there are existing frameworks that consider anxiety and control as part of an interlinking chain of factors that impact on performance through challenge and threat appraisal. As such, the present study has three aims: i) to investigate whether SBHP is related to psychological benefits, ii) to study this relationship with a large sample of elite athletes, and iii) to assess whether SBHP impacts on cognitive appraisal and all the factors that comprise the TCTSA (self-efficacy, motivational focus, control, and anxiety). Given the wealth of research in the clinical domain, the primary hypothesis was that SBHP would predict anxiety in the elite athlete sample. The secondary hypothesis was that SBHP would contribute to the TCTSA model, helping to predict control, and both challenge and threat appraisals by acting as a protective factor against anxiety.

Method

Participants

The sample comprised 115 elite athlete participants (male = 85; female = 20; M_{age} = 22.16; *SD* = 5.83) who were recruited from a variety of sports (Athletics, *n* = 10; Basketball, *n* = 2; Cricket, *n* = 2; Football, *n* = 10; Lacrosse, *n* = 2; Motor Racing, *n* = 4; Rugby, *n* = 36; Tennis, *n* = 42). The 'elite' parameter was classified following recommendations by Swann, Moran, & Piggott (2015), who carried out a systematic analysis of 91 empirical studies that used the term 'elite athlete'. As such, athletes were deemed elite if they i) were above the age of 15, and ii) played their sport at county, national, or international level, or were part of an elite academy pathway (county, *n* = 9; national, *n* = 56; international, *n* = 41; youth academy, *n* = 9). Athletes were recruited from professional rugby and cricket clubs, elite tennis academy programs, a premier league football under 18 academy team, as well as professional footballers playing at Championship level, National League 1 and National League 2. Participants came from 13 countries (Austria, Australia, Belgium, Denmark, India, Ireland, Mexico, New Zealand, Romania, South Africa, Spain, UK, USA) and all participants were fluent in English. Finally, athletes came from a variety of religious and spiritual backgrounds (organised religion, *n* = 19; spiritual but not religious, *n* = 32; agnostic, *n* = 31; atheist, *n* = 29; undefined, *n* = 4).

Design

Considering the brevity of research that has studied SBHP in relation to sport psychology, a cross-sectional design was deemed appropriate. Cross-sectional research is deemed appropriate for making initial enquiries into an area of interest (Thomas, 2011), and the results that emerge from such studies may enlighten the hypotheses for future, more complex investigations (Sedgwick, 2014).

Measures

The Cognitive Appraisal Scale (CAS). The CAS (Skinner & Brewer, 2002) is an 18-item measure used to assess participants' trait style of cognitive appraisal. It is an evaluative scale that investigates whether athletes appraise situations as a challenge (e.g., *I believe that most stressful situations contain the potential for positive benefits*) or threat (e.g., *I worry that I will say or do the wrong things*). Participants reported the extent to which they agreed or disagreed with each statement along a six-point Likert-type scale that ranged from 1 (*strongly disagree*) to 6 (*strongly agree*). Following its application in a recent study of cognitive appraisal with athlete populations, participants were asked to answer the questions specific to their sport

(Williams & Cumming, 2012). This same study also found reliability of the scale with both the challenge (CR = 0.89, AVE = 0.50) and threat (CR = 0.94, AVE = 0.60) subscales. In the present study, Cronbach's alpha coefficient for threat appraisal was found to exceed Nunnally's (1967) minimum level of .7 (α = .92) however the challenge appraisal subscale was just below this threshold (α = .66). This latter result was deemed acceptable given that Hair et al. (2006) have suggested the acceptable limit can decrease to .6, particularly for exploratory research and in studies in the social sciences.

The Character Strength Inventory-Spirit scale (CSI-Spirit). The CSI-Spirit (Isaacowitz, Seligman, & Valiant, 2003) is a seven-item measure used to assess SBHP. It is an evaluative scale that investigates the extent to which athletes believe in the existence of extraordinary, supernatural or unseen entities (e.g., *I believe in a universal power, a god* and *I have had dreams that foretold what was going to happen*). Each statement was responded to along a five-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Following two studies of validity by Schuurmans-Stekhoven (2014) a modified six-item version of the scale was used. The authors found the scale to be internally reliable, with a Cronbach alpha coefficient of .77, and noted that this six-item scale is useful for isolating supernatural/spiritual beliefs from related constructs (such as pure religiosity and prosociality). This is an important characteristic given the afore-mentioned surge in people who identify with being spiritual but not religious (Pew Research Centre, 2012). The coefficient for the present study was found to be above Nunally's (1967) minimum limit (α = .84).

The Academic Control Scale (ACS). A one-item measure was used to assess control, adapted from the Academic Control Scale (Perry, Hladkyj, Pekrun, & Pelletier, 2001) following its use in a recent study with athletes, which used this item as a measure for control (Turner et al., 2013). Participants responded to the statement 'The more effort I put in, the better I will do' on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

The Achievement Goals Questionnaire (AGQ). The AGQ (Conroy, Elliott, & Hofer, 2003) is a 12-item scale used to measure whether one's approach to mastery and performance is characterised by 'approach' (e.g., *It is important for me to master all aspects of my performance*) or 'avoidance' (e.g., *I just want to avoid performing worse than others*) whereby respondents are asked to rate each statement along a seven-point Likert scale ranging from 1 (*not at all true*) to 7 (*very true*). Participants were asked to complete the scale with reference to their sport, following a recent study of elite athletes by Turner et al. (2013). Stoeber and Stoeber (2009) found good reliability for each of the subscales in an adult sports population (mastery approach, α = .73; mastery avoidance, α = .82; performance approach, α = .81; performance avoidance α = .85) whilst Stoeber, Stoll, Salmi, and Tiikkaja (2009) found acceptable validity for the subscales with under-18 athletes (mastery approach, α = .51; mastery avoidance, α = .71; performance approach, α = .79; performance avoidance α = .67). The Cronbach's alpha coefficient for the present study was found to be above Nunally's (1967) minimum limit for all sub-scales (mastery approach, α = .73; mastery avoidance, α = .93; performance approach, α = .87; performance avoidance, α = .90).

Self-efficacy. As recommended by Bandura (2006), a self-efficacy measure will ideally be bespoke to the specific domain of expertise in question. As such, a generalisable sports related measure of self-efficacy was used, taken from Coffee & Rees (2008) and utilised in a recent study of challenge and threat states in elite athletes (Meijen, Jones, Sheffield, McCarthy, & Allen, 2013). This six-item scale was adapted using the prefix 'With reference to your next

performance…', where subjects responded to statements such as *"I am confident I can perform well, even if things get tough*" along a five-point Likert scale ranging from 1 (*not at all*) to 5 (*completely*). Meijen et al. (2013) found good reliability for this scale with their elite athletes (α = .75). The Cronbach's alpha coefficient for the present study was found to be above Nunally's (1967) minimum limit (α = .71).

The Satisfaction with Life Scale (SWLS). The SWLS (Diener, Emmons, Larsen, & Griffin, 1985) is a five-item scale whereby participants indicate their agreement with statements pertaining to life satisfaction (e.g., *If I could live my life over, I would change almost nothing*) along a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). This scale has been validated with athlete samples in a recent study by Cronin and Allen (2015). This scale has previously displayed adequate reliability with adults and under-18s. For example, Stoeber and Stoeber (2008) found reliability with adults, reporting a Cronbach's alpha coefficient of .85, whilst Cronin and Allen (2015) also found reliability with 10-19 year old adolescents, reporting a Cronbach's alpha coefficient of .88. The Cronbach's alpha coefficient for the present study was found to be above Nunally's (1967) minimum limit (α = .79).

The State Trait Anxiety Inventory-Trait (STAI-T). The STAI-T (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) is a 20-item trait scale of anxiety. Participants responded to statements such as *"I make decisions easily"* and *"I take disappointments so keenly that I can't put them out of my mind"* along a four-point Likert scale ranging from 1 (*almost never*) to 4 (*almost always*). Covassin et al. (2014) found reliability for this scale with collegiate athletes, finding a Cronbach's alpha coefficient of .86, whilst Fernandez-Berrocal, Alcaide, Extremera, and Pizarro (2006) found reliability in an under 18 population, with a Cronbach's alpha coefficient of .75. The Cronbach's alpha coefficient for the present study was found to be above Nunally's (1967) minimum limit (α = .90).

Pilot study for under-18 athletes. As three of the scales had not previously been validated with youth athletes (CSI-Spirit; Self-Efficacy Scale; CAS), a separate pilot study with ten athletes under the age of 18 was carried out to ensure comprehension and understanding of the scales. These participants received the same questionnaire as the other athletes but were also asked to rate three statements (e.g., *"I found the questions easy to comprehend and understand"*) along a five-point Likert scale ranging from 1 (*definitely true*) to 5 (*definitely false*). The results generally indicated comprehension of the measures for the under-18 subjects, with 11 out of 13 subjects (85%) agreeing that they understood the wording for the measures across the three scales, and two subjects (15%) agreeing that they found the wording difficult.

Procedure

After the study received institutional ethics approval, participants were recruited via contacts at various elite sports institutions. Under-18 athletes were recruited via their parents who received the information sheet and a parental consent form. Athletes were sent the survey by email and asked to visit a secure web link to complete the survey online using Qualtrics online survey software (Qualtrics, Provo, UT), whereby full information about the study was conveyed and informed consent was given as part of the webpage. If they chose to consent and continue, participants were asked to provide demographic information before completing the battery of questionnaires. The user experience took between five and ten minutes depending on reading speed. To ensure anonymity and honest answers, subjects were not asked for their name and were reassured at the outset that all responses would be anonymised.

Data analysis

After collecting the responses, the dataset was cleaned and screened, and missing data was identified and removed from the study. The data was then assessed against parametric assumptions for multiple linear regression before the main analysis. The main analysis consisted of a correlation matrix, two hierarchical multiple regressions and simple linear regressions using SBHP as the independent variable. The two hierarchical multiple linear regressions were conducted with threat appraisal and challenge appraisal as the dependent variables. Following the theoretical links established in previous research (Jones et al., 2009; Meijen et al., 2013; Turner et al., 2013; Turner et al., 2012), self-efficacy, control and the four subscales of the GAQ were entered at step 1, with trait anxiety, life satisfaction and SBHP entered at step 2. This was replicated for both hierarchical regressions.

Results

Preliminary Analyses

Multiple regression assumptions were checked. Firstly, outliers were identified via inspection of box plots and z-scores. Eight outliers were found outside of +/-3 standard deviations and were addressed using the winsorizing technique (Shorack, 1996). Following winsorizing, normality of the residuals was found, judging by the histograms and P-P plots for both regressions (see Appendix 1.0.) The sample size of 115 satisfies Field's (2013) directive that one "should have ten cases per predictor in the model" (p.313) and also a G-Power analysis (Faul, Erdfelder, Buchner, & Lang, 2009) at the outset which found that a F-test (two-tailed) for a medium effect, with $\alpha = .5$ and $\beta\text{-}1 = .8$ and nine predictor variables, gives a minimum sample size of 114 (see G-Power analysis in Appendix 2.0.) The next assumption was that of homoscedasticity. The scatterplots (Appendix 3.0) of standardised residuals showed that the data meets the assumption of homoscedasticity and linearity for both multiple regressions (each of the partial plots also showed a linear relationship between the individual predictors and both dependent variables, and can be viewed in Appendix 5.0.) Next, multicollinearity was checked by running collinearity diagnostics tests. These tests indicated that multicollinearity was not a concern given that none of the independent variables correlated above .8, no single item scored more than VIF > 10 (see Appendix 5.0) and the average VIF score was more than one (Field, 2013). Finally, the data met the assumption of independent errors for both regressions (Threat, Durbin-Watson value = 1.98; Challenge, Durbin-Watson value = 1.64).

Main Analyses

Primary hypothesis. Descriptive statistics and correlation coefficients for the two dependent variables and nine independent variables can be seen in Table 2. The data shows that threat appraisal was positively correlated with trait anxiety, mastery avoidance, performance avoidance, and performance approach, and negatively correlated with self-efficacy. Challenge appraisal was positively correlated with self-efficacy, control and mastery approach, and negatively correlated with trait anxiety. SBHP was not significantly correlated with any of the variables under investigation.

SBHP was analysed as a predictor variable in ten simple linear regressions with the other variables in the study used as dependent variables. None of these regressions provided a significant result, nor approached significance, and can be viewed in Table 1 below.

Table 1. *Summary of simple linear regression analyses with SBHP as the predictor variable (N = 115)*

	F	*p*	R^2
Self-efficacy	(1,112) = 1.50	.22	.01
Control	(1,113) = .21	.65	.002
MAp	(1,113) = .03	.86	.0003
MAv	(1,113) = .03	.86	.0003
PAp	(1,113) = 2.57	.11	.02
PAv	(1,113) = 1.67	.20	.02
Trait anxiety	(1,113) = .88	.35	.008
Life Satisfaction	(1,113) = .80	.37	.007
Challenge Appraisal	(1,113) = .76	.39	.007
Threat Appraisal	(1,113) = .67	.42	.006

MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals, SBHP = strength of belief in a higher power.

Table 2. Summary of means, standard deviations, and correlations for scores on mastery approach, mastery avoidance, performance approach, performance avoidance, anxiety, life satisfaction, control, self-efficacy, SBHP, and challenge and threat appraisals.

	M & SD	1	2	3	4	5	6	7	8	9	10	11
1 Threat appraisal	3.18 / 1.00	–										
2 Challenge Appraisal	4.75 / .50	-.16	–									
3 Trait anxiety	1.96 / .44	.65***	-.22*	–								
4 Self-efficacy	3.86 / .46	-.30**	.35***	-.15	–							
5 Control	5.36 / .80	-.05	.26**	.08	.30**	–						
6 MAp	6.44 / .60	.001	.25**	.01	.31**	.45***	–					
7 MAv	4.83 / 1.49	.69***	-.18	.57***	-.28**	.08	.07	–				
8 PAp	5.12 / 1.45	.28**	.14	.16	.16	.06	.40***	.17	–			
9 PAv	3.31 / 1.74	.39***	.03	.21*	-.002	.13	.13	.29**	.47***	–		
10 Life satisfaction	5.02 / 1.01	-.08	.11	-.31**	.05	-.18	-.06	-.09	-.03	-.01	–	
11 SBHP	2.71 / .90	.08	.08	.09	-.12	-.04	.02	.02	.15	.12	.08	–

Note: *$P < .05$, **$P < .01$, ***$P < .001$. MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals, SBHP = strength of belief in a higher power.

Secondary hypothesis. With threat appraisal as the dependent variable, multiple regression results showed a significant effect at Step 1 (R^2 = .56, P < .001) with mastery avoidance (β = .60, P < .001) and performance avoidance (β = .17, P < .05) as significant predictor variables. The entry of trait anxiety, life satisfaction and SBHP at Step 2 improved the model fit, ΔR = .65, P < .001 with trait anxiety (β = .40, P < .001) the only additional significant predictor variable. The contribution of SBHP to the model was non-significant (β = .-.04, P = .52). Both steps of the model are shown in Table 3.

Table 3. Summary of hierarchical regression analysis for variables predicting threat appraisal (N = 115)

	Model 1			Model 2		
	B	*SE B*	*β*	*b*	*SE B*	*β*
Self-efficacy	-.23	.16	-.11	-.26	.15	-.12
Control	-.10	.10	-.08	-.12	.09	-.09
MAp	-.09	.14	-.05	-.03	.12	-.02
MAv	.41	.05	.60**	.27	.05	.39**
PAp	.11	.06	.15	.09	.05	.12
PAv	.10	.04	.17*	.10	.04	.16*
Trait anxiety				.92	.17	.40**
Life Satisfaction				.08	.06	.08
SBHP				-.04	.07	-.04
R		.75			.81	
R^2		.56			.65	
R^2 Adjusted		.53			.62	
R^2 change		.56			.10	
F for change in R^2		22.56			9.51	
Sig. F Change		4.89×10^{-17}			.000013	

*p < .05 **p < .01. . MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals, SBHP = strength of belief in a higher power.

With challenge appraisal as the dependent variable, multiple regression results showed a significant effect at Step 1 (R^2 = .18, P < .01) with self-efficacy (β = .22, P < .05) the only significant predictor variable. The entry of trait anxiety, life satisfaction and SBHP at Step 2 marginally improved the model fit but not significantly, ΔR = .22, P = .17 with no additional significant predictor variables. The contribution of SBHP to the model was non-significant (β = .-.08, P = .37). Both steps in the model are shown in Table 4.

Table 4. Summary of hierarchical regression analysis for variables predicting challenge appraisal (N = 115)

	Model 1			Model 2		
	B	*SE B*	*β*	*b*	*SE B*	*β*
Self-efficacy	.24	.11	.22*	.24	.11	.23*
Control	.09	.07	.15	.11	.07	.18
MAp	.07	.09	.08	.05	.09	.06
MAv	-.05	.03	-.14	-.01	.04	-.04
PAp	.04	.04	.12	.04	.04	.12
PAv	.000492	.03	.002	-.002	.03	-.007
Trait anxiety				-.19	.13	-.17
Life Satisfaction				.04	.05	.09
SBHP				.05	.05	.08
R		.42			.47	
R^2		.18			.22	
R^2 Adjusted		.13			.15	
R^2 change		.18			.04	
F for change in R^2		3.88			1.73	
Sig. F Change		.002			.17	

*$p < .05$ **$p < .01$. . MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals, SBHP = strength of belief in a higher power.

Discussion

Results Summary

Despite research in both the sport psychology and clinical domains suggesting a potential relationship between religiosity/spirituality and anxiety, the results of this study do not strengthen this literature base. The findings of this study did not support the primary hypothesis that SBHP would predict anxiety. It also did not support the secondary hypothesis that is would predict control, and play a significant role in predicting cognitive appraisal. As such, these outcomes are at odds with Najah et al., (2017) and their argument that "belief in an omnipotent God…can be mentally beneficial" (p.187). It also challenges the findings of Czech et al. (2004) and their assertion that religion/spirituality allows athletes to "feel as if

they have some control over what happens to them on the playing field" (p.9). These results are particularly in opposition to the suggestion by Bell et al. (2009) that religion provides a framework that "allows relief from fear and anxiety on the basis of the athletes understanding (i.e., belief) that a supreme being is in complete control of the situation" (p.1). The implications of these results for both hypotheses will now be discussed, as well as a reflection on methodological issues.

Primary Hypothesis

SBHP did not predict anxiety, and neither was it correlated to these variables. One of the implications is it that religious/spiritual belief and religious/spiritual practice may result in different outcomes. With the exception of Najah et al. (2017) who made initial steps toward measuring supernatural belief, all the studies in the literature have primarily investigated the practice of religiosity/spirituality, such as prayer or mediation. Given the consistency of findings within both the sport psychology and clinical domains regarding a relationship with anxiety, these results may point toward the possibility that strength of belief in itself is unrelated to psychological benefits, and it is, in fact, other elements of religiosity/spirituality (such as religious practice, or the religious community) that determine psychological benefits. Czech et al's (2004) study, for example, suggests that prayer is accompanied by potential mechanisms (such as breathing exercises, ritualistic adherence to routine) that might help to explain any potential determinant of reduced anxiety or increased control, whilst Czech and Bullet (2007) have also found in their study of NCAA collegiate athletes, that prayer intensity and frequency increases with the importance of performance. Finally, Coakley (2003) suggests six possible reasons athletes utilize religious prayer, with reason number one being using it as a coping mechanism for stressful situations. The community aspect of religion has also been identified as a factor in reduced stress and anxiety in non-athlete populations, through increased acceptance and social support (Ellison, Boardman, William, & Jackson, 2001).

Another implication of this finding is that religiosity/spirituality does not result in beneficial psychological outcomes for athletes, regardless of whether it is derived through belief, practice or community. With the exception of Najah et al. (2017), every study in the literature base has been a qualitative exploration of religion. In an epistemological critique of the spirituality in sport literature, Crust (2006) points out that there is a danger that an overreliance on qualitative enquiry undermines a quantitative attempt at exploring whether these recurring themes are generalisable. There is a danger that the recurrent themes mined in qualitative research produces an availability bias (Kahneman, 1982), which shines a light on successful athletes that have derived a benefit from religiosity/spirituality, whilst an unstudied majority that has not derived these same benefits, are not equally represented in the literature. It could be argued that this second implication is less convincing, given the wealth of research in the clinical domain that has found a relationship between religiosity/spirituality and reduced anxiety, in meta-analyses (Gonçalves et al., 2015; Hackney & Sanders, 2003), Christian populations (e.g., Leondari & Gialamas, 2009), Muslim populations (e.g., Vasegh & Mohammadi, 2007), Jewish populations (e.g., Rosmarin, Pargament, & Mahoney, 2009) and in multiple countries (e.g., Lavrič & Flere, 2010).

Secondary Hypothesis

SBHP did not predict either challenge or threat appraisal, and nor did it predict the other variables in the TCTSA (self-efficacy, control, and achievement goals). As mentioned previously, this challenges previous research such as Czech et al. (2004) who found that athletes reported a greater sense of control over their performance as a result of

religiosity/spirituality. The relationship between religiosity/spirituality and control, cognitive appraisal, self-efficacy, and achievement goals has not been studied to the same degree as anxiety, given its central role in clinical research. As such, it is difficult to conceive any further conclusions. However, as with anxiety, it also a possibility that these factors do have a relationship with religiosity/spirituality but it is not with religious/spiritual belief, but rather with religious/spiritual practice and community. Future research is needed in order to reveal any potential relationships.

Methodological Issues

Self-report measures. In a very recent review of self-report measures with elite athletes, Saw, Kellmann, Main, and Gastin (2017) note that whilst many athletes habitually report within a narrow range of values, many others will fluctuate wildly. As such, because data was only collected at a single point in time, the results of this study may have been likely to change if more data points had been taken over a competitive season. Furthermore, given that the season had ended for many athletes (data was taken between April and June), the intensity of emotions being measured may have dissipated as they started to switch into 'holiday mode'. It must also be noted that many of the subjects were in elite academy programs where researchers have previously found a competitive environment for professional contracts can sometimes affect the accuracy of self-reported data (Turner et al., 2013).

Measurement of challenge, threat, and anxiety. Because of constraints in getting access to the athletes in this study, it was not possible to measure anxiety or arousal using physiological data, as is now common in contemporary challenge and threat studies (e.g., Turner et al., 2013; Moore et al., 2012; Vine et al., 2013) where measuring cortisol levels, cardiac output and stroke volume is now common practice. This added level of detail would have been optimal for assessing not only anxiety but also whether self-reported arousal was characteristic of challenge or threat states. In a very recent study, Cumming, Turner, and Jones (2017) have broken new ground by measuring self-reported challenge and threat appraisal with elite rowers over an entire season, and have called on researchers to measure longitudinally but with the physiological measures as well. Taking state anxiety measurements over multiple time periods would have built a more accurate picture of the athletes in this study, compared to the single measure of trait anxiety.

Measurement of SBHP. This is the first study to act on recommendations from Schuurmans-Stekhoven (2014) regarding the use of the CSI-Spirit (Isaacowitz et al., 2003) as a measure for religious/spiritual belief. Whilst the scale was found to have good internal reliability, it is also possible that new or bespoke measures of SBHP may produce a different set of results. This is also the first study in the area that has attempted to study the belief salience of both overtly religious, and non-religious but spiritual athletes, given the huge rise in non-religious but spiritual individuals reported in government censuses in recent years (Pew Research Centre, 2012; Pew Research Centre, 2014; Pew Research Centre, 2015). It is again possible that results may have differed if only overtly religious *or* spiritual athletes were studied.

Measurement of performance. The TCTSA was selected as the model of anxiety and arousal to underpin this study, and yet one of the key elements of the theory is its ambition to predict performance. However, due to the aforementioned constraints with access to the athletes, performance data was not obtained.

The participant sample. Differences in participant samples may have played a role in arriving at different results. This is the first study in the literature to restrict its targeting of athletes based on recommendations by Swann et al. (2015) and their category definitions of

elite athletes. It must be noted that the majority of studies in the literature have used collegiate athletes, whilst 84% of the sample in the present study played at a national standard or above, and 36% played at international level, with many of the subjects being professional athletes participating at the highest echelons of their sport, or in elite training academies. It could be argued that this sample, the majority of whom dedicate every waking hour to being an athlete, may differ somewhat from athletes recruited from student populations where participation is non-professional and balanced with full-time academic study.

After considering these methodological issues, it might be reasonable to argue that tweaks to the study design might result in findings that support the extant literature, as opposed to challenging it. As such, more research is needed to clarify the reasons behind the discrepancy.

Summary

In summary, the present study has found no correlations or predictive relationships between the strength of religious/spiritual belief, and a range of psychological factors including trait anxiety, control, and cognitive appraisal. Given the results are inconsistent with previous research, and the myriad of potential methodological issues, this study may contribute more questions than answers to the literature base. The foremost question might be whether the multitude of previous studies linking religiosity/spirituality to decreased anxiety, might highlight the benefits of religious/spiritual prayer, meditation or community support, opposed to religious/spiritual belief.

This area of sport psychology is in need of new research to add to the literature. In the last available review of the area, Maranise (2013) points out "little academic attention has been given to this rapidly-increasing popular culture phenomenon [sport and spirituality]" (p.83). Within this context, it must also be noted that following on from Crust's (2006) critique of the abundance of qualitative study in the area, the present research does contribute valuable initial quantitative evidence with a larger sample size. It is also the first study to contribute to the literature with a large-scale sample of elite athletes using recommendations by Swann et al. (2015) to define 'elite'. Another distinctive feature of the present study was its attempt to underpin the investigation of anxiety and control within the context of a contemporary model of stress and arousal, in the TCTSA. Furthermore, it is the first study in the literature to follow recommendations by Schuurmans-Stekhoven (2014) in using the CSI-Spirit (Isaacowitz et al., 2003) to isolate the measurement of SBHP. The literature is now in need of longitudinal studies and random control trials to push the reliability and credibility of the evidence further. Future studies might look to study religious/spiritual belief *and* practice, utilise physiological measurements to augment self-report data and measure multiple data points over the course of a competitive season. There might also be variation across different sports, religions, cultures, ages, and genders. Studies that isolate or investigate the contribution of these variables may also be valuable to the literature. Finally, as athletic performance is often an important interest to practitioners in sport psychology, future studies might want to replicate the present study in underpinning research with the TCTSA, and go a step further by measuring performance as well.

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Conflict of Interest

The author has not declared any conflicts of interest.

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Correction note

Our article entitled, "Football Cheerings on the Content of Music and Movement (In Turkish: Müzik ve Hareket Bağlamında Futbol Tezahüratları)" which was published on the 3rd Special Issue (July 2015; 845-857, Doi: 10.14486/IntJSCS/353) missed some of the references. The complete list of the references should be updated as following;

Veli Ozan ÇAKIR, Sevda KORKMAZ

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