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Determination of Relationships between Body Composition, Anaerobic Performance and Balance in Wrestlers

Ali OZAN ERKILIÇ[1], Ömer ŞENEL[2]
[1]Bartın University, Faculty of Sports Sciences, Bartın, TURKEY
[2] Gazi University, Faculty of Sports Sciences, Ankara, TURKEY
Email: aliozan32@gmail.com

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Abstract

The purpose of the present study was to investigate the relationship between body composition, anaerobic performance and balance in wrestlers. 14 wrestlers participated in this study voluntarily. In the study, the Wingate Anaerobic Power Test (WAnT) was used for the determination of anaerobic performance. Tecnobody was used for the determination of balance. Tanita was used for determination of body fat percentage (BF), lean body mass, right-left leg fat, fat mass, muscle, lean mass; right-left arm fat, fat mass, muscle, lean mass; trunk fat, fat mass, muscle and lean mass. According to the results of Pearson Product Moment correlation analysis, absolute peak power values of lower body was significantly correlated with body height ($r=0.552$; $p<0.05$), body weight ($r=0.807$; $p<0.01$), left leg muscle mass ($r=0.823$; $p<0.01$), right leg muscle mass ($r=0.824$; $p<0.01$), left arm muscle mass ($r=0.798$; $p<0.01$) and right arm muscle mass ($r=0.843$; $p<0.01$). On the other hand no significant correlated were obtained for balance and other variables ($p>0.05$). As a conclusion, the findings of the present study indicated that leg-arm muscle mass play a determinant role in lower anaerobic performance.

Keywords: Body Composition, Anaerobic performance and balance

Introduction

Wrestling is the challenge of sportsmen to establish superiority against each other according to FILA rules which is made on the mat by use of their physical and physiological characteristics. (Kılınç and Özen, 2015). Physical characteristics affect performance of physiological capacities for sportsmen. As long as their physical characteristics do not comply with the relevant branch of sports, it is not possible to reach the desired level of performance (Aydos et.al. 2009). Factors such as strength, speed, resistance, balance, coordination, flexibility are defined as performance-determinant factors (Johnson, 1987; Aydos et.al. 2009; Kılınç, 2012). There are studies determining relations between body composition, anaerobic performance, limb strength and back strength in different branches (Aslan et.al., 2011; Aydos et.al., 2009; Cisar et.al.., 1987; Rezasoltani, 2005; Schmidt et.al.., 2005; Vardar et.al., 2007; Uzun et.al., 2017). It was determined in a study where somatotype characteristics of sportsmen in different branches were evaluated, that wrestlers were separated from sportsmen of other branches with their dominant mesomorphic characteristics with a ratio of 95.4% (Hazır et.al. 2004). It is important to bring wrestlers to an appropriate body weight in order for them to battle in their ideal weight categories and for their performance (Karlı, 2006; Lohman, 1988). Anaerobic performance is one of the physiological notions needed for short time muscle activities involving high level of severity (Özkan et.al. 2011). It is determined that mass of sportsmen excluding fat is higher in sports branches where anaerobic energy system is dominant (Broeder, 1997). The branch of wrestling is one of the sports branches with dominant anaerobic function. (Broeder, 1997; Karlı, 2006). It is important to maintain posture and balance in sports activities. Severity and duration of the activity affect the changes in postural swinging as much as the severity of jumping and proprioceptive stimulus (Şimşek, 2011). While it is defended that balance performance in different branches has an important role for protecting the required body composition, it is stated that the same forms a basis for dynamic sports involving immediate changes in the motion pattern (Erkmen, 2007; Altınkök, 2012; Okudur, 2012, Tetik, 2013, Canbolat, 2017; Özkan,2018). Factors such as stature, body weight, gender and characteristics of sports activity could affect balance performance (Davlin, 2004). It is thought that body composition, anaerobic performance and balance are important to succeed in wrestling matches. In this context, the purpose of research is to determine the relation between body composition, anaerobic performance and balance for wrestlers.

Method

Research Group

14 volunteer male wrestlers in between ages 17-20 participated in the study. Body composition, anaerobic performance and balance measurements of test subjects involved in the study were made.

Data Collection

Informed consent form, including detailed information related to the study and risks and diseases which could be faced, was signed to each test subject before the study. It was asked from test subjects not to do any exercise within 24 hours before tests. Body composition, anaerobic performance and balance measurements of test subjects participated in the study were made.

Body Analysis and Weight Measurement Device

It's a Professional product which could make Total Body Analysis. Working principle of device is Bio Impedance Analysis, 50 kHz electric current is sent to the body through foot electrode and body analysis is made in this way.

Balance Measurements:

It is measured by use of static balance measurements (ProKin, Tecnobody, Dalmine, Italy; 20 Hz sampling rate, sensitivity 0.1°, product type: PK252). After tests are explained to test subjects, data is entered in the computers (length, weight, age) and device is calibrated. Feet of test subjects are placed on the balance platform by taking the lines on x and y axis as reference in naked form. Test is started by pressing the start button on the keyboard of the computer and it is finished automatically by the computer at the end of the testing period (int 1). After each test is completed, device is re-calibrated. Static balance and proprioceptive sense tests are made double leg stance position with open eyes. Static balance test is made by choosing (Static Stability Assessment) module. Double leg static balance tests are determined in a way to stay at an equal distance to the origin point by taking lines on x and y axis as reference for the position of legs and legs open at shoulder width. It is determined as the only leg staying at the midpoint to the origin point in dominant and nondominant static balance test. The leg of participants which is used by them for kicking a ball naturally is determined as the dominant leg in order for those to be consistent with the researches in the literature (Alonso et al., 2011; Knight and Weimar, 2011; Kynsburg et al., 2006 ; Mitchell et al., 2008 ; Yeung et al., 1994). Testing order (Dominant and nondominant leg) is determined randomly. Test subjects were asked to hold their hands laterally in free mode during the test (9). Static Balance Values: Average Center of pressure X - (ACOPX), Average pressure Y (ACOPY) (32), center of forward backward standard deviation (F.B.S.D), medium-lateral standard deviation (MLSD), Average forward-backward velocity (mm/s) (AFBS), Average medium-lateral velocity (mm/s) (AMLS), Perimeter (mm) (P), Ellipse Area (mm2) (E.A.) are noted (Karadenizli et al., 2014 ; Köse, 2014; Wang et al., 2011). Printout showing the results of static balance tests is shown in Figure 1. Static balance score of each individual is acquired from the aforementioned data. As balance score increases, the balance of the individual is assumed as bad and as the score decreases the balance is assumed as good (Güngör, 2010; Karakaş, 2012 ; Köse, 2014).

Anaerobic Measurements

Wingate Anaerobic Power and Capacity Test

WAnT test is made in the ergometer of a scaled bicycle Monark 894 E (Sweeden) which works with a software connected to and compatible with a computer modified for legs (Figure 1). After a detailed information of the tests are given to the test subjects before the tests are started, 4-5 minutes warming up protocol is applied in the bicycle ergometer with 60-70 W work load, 60-70 cycles/min pedal speed, involving 2 or 3 4-8 seconds sprints. After warming up, 3-5 minutes passive rest is given (Inbar et al.,1996). After warming up and resting, seat and handlebar adjustments are made for each test subject, sitting level is adjusted in a way that the test subject will be in a sitting position on the seat and that while pedaling the leg ergometer would be in a way that the knee would stand exactly on the extension when the pedal is at the lowest point and their legs are fixed on the pedals with the help of clips. Test is started after 75 gr load per 1 kg is placed on the scale of the bicycle ergometer as an external resistance during the test for each and every test subject leg. It is asked from test subjects to reach the highest pedal speed as earliest as possible without any resistance. When pedal speed

reaches 150 cycles/min, scale is automatically lowered and test is started. This protocol is programmed from the software of test. Test subjects cycled at the highest speed for 30 seconds against external resistance and test subjects are encouraged verbally during the test. Information related to the power parameters during tests will be recorded with 1000 hz speed and it is transferred to the software of computer by RS 232 connection. All parameters of power are calculated by the software. In addition, test subjects WanT participated every other day and in the afternoons. Test subjects are encouraged verbally during the test. Maximum power and average power of test subjects are acquired as a result of the test. While maximum power (MG) is the highest mechanical power acquired within the course of any five seconds time made during the test, average power (OG) is the average of the power values made during the test. Besides, relative (R) values are acquired by separating the test subjects according to their body weights.

Data Analysis

Pearson Products Moment Correlation analysis is used to determine the relation between body composition, anaerobic performance and balance of wrestlers involved in the study.

Findings

Average and standard deviation values of physical variables of wrestlers involved in the study are shown in table 1.

Table 1. Average and standard deviation values of physical variables of wrestlers

N	Age	Length	VA	%Fat
	21.28 ± 2.38	175.57 ± 6.23	77.48 ± 10.86	10.92 ± 4.04
	Right Leg Fat (%)	**Right Leg Muscle Mass (kg)**	**Left Leg Fat (%)**	**Left Leg Muscle Mass (kg)**
Wrestlers 14	12.33 ± 3.88	11.25 ± 1.22	12.9 ± 3.85	10.9 ± 1.18
	Right Arm Fat (%)	**Right Arm Muscle Mass (kg)**	**Left Arm Fat (%)**	**Left Arm Muscle Mass (kg)**
	12.17 ± 2.81	3.83 ± 0.56	12.90 ± 3.30	3.87 ± 0.61

As can be seen from Table 1, right legs of wrestlers have more muscle mass and less fat value compared to their left legs. It is thought that this difference is originated from the dominant leg.

Average and standard deviation values of WanT variables of wrestlers involved in the study are given in table 2.

Table 2. Average and standard deviation values of WanT variables of wrestlers

Lower extremity			
MG (watt)	**RMG (watt/kg)**	**OG (watt)**	**ROG (watt/kg)**
916.64 ± 133.191	12.60 ± 2.23	594.80 ± 167.54	8.56 ± 0.58

MG: Maximum Power, RMG: Relative Maximum Power, OG: Average Power, ROG: Relative Average Power

As can be seen from Table 2, maximum power and capacities of wrestlers are above normative values when compared to maximum and average power normative values. That's to say, it is observed that players have a good anaerobic performance.

Average and standard deviation values of left and right leg variables of wrestlers involved in the study, which are acquired from balance, are given in table 3

Table 3. Average and standard deviation values of left and right leg variables of wrestlers acquired from balance

"	LEFT Ellipse area	Perimeter	Standard F-B	Standard M-B	C.o.p Y	C.o.p X
	1081.8 ± 573.59	671.79 ± 221.43	6.84 ± 3.23	8.40 ± 2.60	-20.97 ± 31.27	-10.20 ± 27.69
	RIGHT Ellipse area	Perimeter	Standard F-B	Standard M-B	C.o.p Y	C.o.p X
	817.49 ± 359.94	617.93 ± 190.02	6.25 ± 2.88	7.15 ± 1.96	18.61 ± 26.99	-8.84 ± 19.85

Average and standard deviation values of eyes open and eyes closed variables of wrestlers, involved in the study, with both legs acquired from the balance are given in table 3

Table 4. Average and standard deviation values of eyes open and eyes closed variables of wrestlers with both legs acquired from the balance

	Open Ellipse Area	Perimeter	Standard F-B	Standard M-B	C.o.p Y	C.o.p X
WRESTLERS	263.01 ± 195.57	239.08 ± 172.21	3.35 ± 2.83	5.52 ± 2.43	5.18 ± -0.83	3.44 ± 11.8
	Close Ellipse Area	Perimeter	Standard F-B	Standard M-B	C.o.p Y	C.o.p X
	354.24 ± 259.02	222.54 ± 98.88	3.44 ± 1.82	5.53 ± 2.43	-5.54 ± 13.21	-0.86 ± 26.13

The relation between body composition, anaerobic performance and balance of wrestlers involved in the study are given in table 5.

Table 5. The relation between body composition, anaerobic performance and balance of wrestlers

	MG	RMG	OG	ROG
Length	**.552***	-.066	.321	-.502
Body Weight	**.807****	-.398	.048	-.455
Right Leg Muscle Mass	**.824****	-.269	.104	-.357
Left Leg Muscle Mass	**.823****	-.312	.082	-.299
Right Arm Muscle Mass	**.798****	-.305	-.238	-.261
Left Arm Muscle Mass	**.843****	-.238	-.022	-.251

As can be seen from Table 5, when the relation between body composition, anaerobic performance and balance of wrestlers involved in the study is analyzed, there is a relation only in between body composition variables and maximum power and no relation could be found in between the other variables. Shortly, body composition is an important variable for anaerobic power variable.

Conclusion

Although there are different studies with body composition and other basic motoric characteristics when the literature is searched, there are so many studies where body composition, anaerobic performance and balance are approached. In this study, the relation between body composition, anaerobic performance and balance of wrestlers is analyzed. While the relation in between body composition and anaerobic performance of test subjects is found, no relation could be found in between balance scores and other variables.

When table found in Table 5 is reviewed; while there is a statistical positive relation ($p<0.05$) in between length, weight, right-left leg muscle mass and right-left arm muscle mass and maximum power of wrestlers involved in the study according the statistical results of Pearson Products Moment Correlation, no relation is found in other variables ($p<0.05$).

In addition to a good power, hand eye coordination, anaerobic performance, resistance, flexibility; a high level of balance skill is needed to show high performance in wrestling matches. Generally, maintaining the balance after repetitive pushes, draws during the match, constitutes an important role for wrestling in order for them to keep the continuity of the match and to win the match. Muscle power is very important to maintain the said balance (Liman, 2008, İbiş et al., 2015).

In studies made for the literature in order to design the study herein, strength-power of the muscle is higher depending on the width of femoral perimeter, amount of muscles, muscle mass and muscle fibers forming the femoral region, and this shows that that will also affect maximum power. (Astrand and Rodal, 2001). Besides, muscle fibril length, muscle cross sectional area, leg volume and muscle mass are characteristics which have determinant role on the power produced by the muscle in anaerobic conditions. It is expressed frequently in researches that anaerobic performances of test subjects with higher leg volume, muscle mass and muscle cross sectional area are better (Dore et al., 2001, 478; Zorba et al., 2010, 93).

While a meaningful relation is found by Zorba et al. (2010, 94) in between fat-free body mass and average power and in between fat ratio, fat-free body mass and maximum power, findings of the study have shown that leg volume and leg mass of wrestlers have a determinant role for

their anaerobic performances (Zorba et al, 2010, 93). Some studies of the literature also support the data acquired from this study (Dore et al., 2001, 477; Esbjörnson et al., 1993, 263; Martin et al., 2004, 498).

Anaerobic power is important for all kinds of sportive activity, the importance of anaerobic power increases more for some sports branches it is used predominantly (high jump, shot, javelin throw, discus throw, sprinting (100 m, 200 m), swimming (25 m, 50 m), basketball, football, volleyball, handball, tennis, baseball). While anaerobic power is defined as the capability of the individual to use phosphagen system system in short term high severity muscle activities, anaerobic capacity is defined as the amount of energy acquired from the combination of glycolysis and phosphagen system. AP, age, gender, muscle type, muscle mass, muscle cross sectional area, heredity, practice and body composition affect very much (Özkan, 2011, 10-15; Akyüz et al., 2013, 40; Taş et al., 2013, 16).

In the studies made for the literature, it is expressed that anaerobic values increase depending on the increase in femoral perimeter, leg volume, leg muscle volume and fat free leg volume. The reason of that is shown to be higher amount of muscles forming the leg, muscle mass and muscle fibers being high and higher level of strength-power formed by the muscle (Akyüz et al., 2013, 44-45). In other words, different ratios and intensities of muscles, fats and bony tissues of individuals affect physiological capacities of individuals. When studies of the literature are taken into consideration, it is actually observed that changes in anaerobic performance are related to body type, arm-leg volume, body weight, fat free body mass, muscle mass and muscle type which supports the aforesaid expressions (Taş et al., 2013, 21).

In some studies of the literature, it is expressed that regular practices made especially for lower extremity increases the strength of lower extremity muscles and, accordingly, that there appears a development in the balance capability (Siriphon and Chamonchant, 2015; Muehlbauer et al, 2015; İbiş et al., 2015). Depending on these studies, the said improvement of the balance is thought to be related to the increase in the strength formed depending on the types of warming up and practice applied on muscles of lower extremity in addition to balance practices (Köse and Tülin, 2015). When results of the research made by İbiş et al. (2015) and literature search are taken into consideration, it is stated that increase in fat free leg mass affects strength positively and that the increase in strength increases the balance performance. In the light of these results, while a relation is found in between body composition of wrestlers and anaerobic performance variables in this study, no relation could be found in between their balance scores and other variables. As a result, findings of the study have shown that some variables such as length, body weight, leg-arm muscle mass play a determining role in anaerobic performance values acquired from lower extremity.

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Looking but Not Seeing: Effect of On-Site Ads in Sports Broadcasts on Television

Ümit Can BÜYÜKAKGÜL[1], Arif YÜCE[2], Hakan KATIRCI[3]
Faculty of Sports Sciences, Department of Sports Management, Eskisehir Technichal University, Eskisehir, Turkey
E-mail: uc_buyukakgul@eskisehir.edu.tr

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Abstract

In this study, brand recall differences related to TV broadcasts of basketball matches were examined. 194 participants who were students of Faculty of Sport Sciences at Anadolu University took part in this study. An experimental design was created using a video including basketball TV broadcasts of Tahincioğlu Turkish Basketball League to evaluate recall performance of participants. Data analysed using by SPSS v.20. As a result, it was determined that at least one and up to 14 of 84 different brands in the video were recalled correctly as unaided. Minimum 1 and maximum 33 number of brand were recalled as aided by participants. Four of five mostly recalled brands as both unaided and aided were same and interestingly, Tahincioğlu, which is the name sponsor brand of Turkish Basketball League was not among these four brands. Briefly, for a greater brand recall, it may be considered a more effective approach for businesses to advertise or sponsor in different content and format but not through a single communication channel.

Keywords: brand recall, on-site ads, sports broadcasts, sponsorship

Introduction

TV broadcasts of sports events are amongst useful channels for advertisers. Sports audience is heavily exposed to advertisers' on-site ads during the broadcast of sports events (Bennett, 1999). In 2018, the total media advertising expenditure in the world increased by 7.4% compared to the previous year and reached to 628.63 billion dollars. By the end of 2020, it is estimated that the total advertising share of the digital world will get closer to 50% (McNair, 2018). Although the technological developments that have emerged since the beginning of the 2000s have turned new media tools into an important advertising medium, advertisements on television are still known to have considerable intensity (Li & Lo, 2015). It is amongst the main objectives of on-site advertisers in sports events that sports audience gains awareness about the brand and remembers this brand in the future (Bennett, 1999). Research studies show that the frequency and duration of messages have an influence on the rate of recall. In other words, it is stated that the audience may have a higher recall rate when the message of the advertiser is transmitted more frequently or for longer (Bennett, 1999; Breuer & Rumpf, 2011; Cornwell & Humphreys, 2013).

In addition to these factors, the awareness of the brand being advertised is another variable that affects the brand recall (Breuer & Rump, 2012; Moore, Pickett & Groves, 1999). The advertised brand can be more easily recognized by the audience when it is a well-known brand. As a result, the recall rates of well-known brands are higher (Leng, 2017). Awareness is primarily a concept related to the colours and dimensions of the brand. From this point of view, the area covered by the brand and the brightness of its colours have an influence on recall (Breuer & Rumpf, 2015; Moore, Pickett & Groves, 1999). Awareness, in addition to colour and dimension variables, is also related to strategic physical positioning. Brands located near the match clock or the scoreboard (Statlar & Johnson, 1989) and above the jerseys of the athletes (Biscaia, Correia, Ross & Rosado, 2014) have a high level of recall since they attract more attention. Solomon (2004) defines five variables related to the consumers' process of recall. These variables are related to both brand and consumer. These variables, which can be evaluated separately in the process of recall as well as within the framework of their relationships with each other, can be expressed as the mood of the consumers, familiarity with the brand, the remarkable features of the brand, the nostalgic effects of the brand on the consumer and the age of consumers.

The method of evaluating brand recall is one of the measures used to make advertising more effective (Till & Baack, 2005). When the studies on the evaluation of brand recall in the field of sports are examined, it is found out that these studies are generally related to sponsorship. These studies generally measure the effects of different variables associated with sponsor brands in video or computer games (Nelson, 2002; Nelson, Keum & Yaros, 2004; Donavon, Anwar-McHenry, Hernandez Aguilera, Nicholas & Kerrigan, 2016; Vashisht & Royne, 2016; Vashisht & Pillai, 2017). When the studies on the television broadcasts of sports events (Breuer &Rumpf, 2012; Breuer &Rumpf, 2015; Leng, 2017) are examined, it is seen that aided and unaided recall methods were used. With these methods, it is evaluated whether or not the brand is recalled directly or indirectly by the sports audience (Law & Braun-LaTour, 2004).

In light of this information, the aim of this study is to detect the recall rate of on-site brands, which appear in television broadcasts of the games between teams that play in Turkey's Tahincioğlu Basketball League during 2017-2018 season, by using aided and unaided recall methods.

Materials and Methods

Researchers created a 27 minutes and 54 second length video. This video comprised of match highlights of 18th match day on the official YouTube channel of the Turkish Basketball Federation. This video was created by researchers in the computing environment. No external sound (e.g., announcer, TV commentator, etc.) took part in the video. In this way, it was aimed to create a real stadium atmosphere (e.g., sirens, referee whistles, ball sound, shoe sound etc.) for the respondents. Respondents were not informed of the aim of the before playing video. In this way, it was aimed to prevent biases, such as focusing on the brands shown on screen and going out of a real game watching behaviour. In addition, respondents were allowed to have small discussions among themselves throughout the video. Again, it was aimed to create a game-watching atmosphere close to reality as in a stadium. After the video viewing session was completed, a questionnaire consisting of eight questions was distributed to the respondents. The survey included questions related to demographic variables and unaided and aided recall. In order to determine demographic variables, the respondents were asked questions about their gender, age, how often and how they watched basketball games (e.g., via TV, internet or in stadium) and which sport games they watched. Respondents were asked to write down the brands (unaided recall) they saw in the video. The respondents were then given a list of 84 brands that appeared clearly in the video and approved by all researchers, and they were asked to assess their aided recall of each brand by marking the logos next to them. Brand logos were presented to the participants in the exact same colour and shape they appeared in the video. This was done to help with the recall.

Participants recruited from students attending formal education at the Anadolu University Faculty of Sport Sciences. 194 students (71 women, 123 men, M_{age}=21.06, age range: 18-27 years) participated in this study. Participants did not take any money or presents for their participation.

Results

When demographic variables of respondents (see Table 1) was examined, it can be seen that 63.4% of participants were male and 36.6% were female. 69.1% of the respondents were aged between 18-21 and 30.9% of them were aged 22 or above. When frequency of the respondents' watching basketball games on media (e.g., TV, Radio, Internet, etc.) was examined, it was clear that 33% of them did not watch any basketball games on media, while the remaining 67% watched basketball games at least once a week on media. Furthermore, 51% of the respondents preferred watching basketball games in the stadium while 49% did not prefer doing so.

Table 1. Demographic Characteristics

Gender	**Frequency**	**%**
Male	123	63.4%
Female	71	36.6%
Age		
18-21	134	69.1%

22 and above	60	30.9%
Frequency of Watching Basketball Games on Media		
1-2 times a week	89	45.9%
3-4 times a week	24	12.4%
5 times a week or more	17	8.8%
Never	64	33%
Watching Basketball Games in the Stadium		
Yes	99	51%
No	95	49%

Table 2 shows preference rankings of the respondents in the branch of sports watched on media. First is the football with a rate of 71.4%, second is basketball with a rate of 47.1% and third is volleyball with a rate of 30.5%. In other words, out of 194 respondents, 137 reported that they watched football on media as their first preference, 89 watched basketball on media as their second preference and 57 watched volleyball on media as their third preference.

Table 2. Rankings of Sport Branches Watched on Media

Preference	Sports Branch	Number of People
1. Preference	Football	137 (71,4%)
2. Preference	Basketball	89 (47,1%)
3. Preference	Volleyball	57 (30,5%)

Table 3 presents data on the sports branches that respondents prefer watching in the halls or stadiums. Football takes first place with 45.3%, basketball is the second with 36% and volleyball is the third with 25%.

Table 3. Rankings of Sports Games Watched in Hall / Stadium

Preference	Sports Branch	Number of People
1. Preference	Football	86 (45.3%)
2. Preference	Basketball	67 (36%)
3. Preference	Volleyball	45 (25%)

Data regarding respondents' unaided recall of brands in the video included in the study is given in Table 4. It was determined that at least one and up to 14 of 84 different brands in the

video were recalled correctly as unaided. It was seen that the majority of respondents (80.4% - 156 people) recalled one, two, three, four, five, six or seven brands unaided. The highest number of recalled brands was 14 and only one person could reach this number. It was also determined that six people could not recall any of brands.

Table 4. Findings on Unaided Recall

Number of Recalled Brands (Unaided)	Number of People Who Can Recall	Percentage (%)
None	6	3.1
1	10	5.2
2	28	14.4
3	35	18.0
4	34	17.5
5	23	11.9
6	16	8.2
7	10	5.2
8	7	3.6
9	6	3.1
10	8	4.1
11	5	2.6
12	1	0.5
13	4	2.0
14	1	0.5
TOTAL	**194**	**100**

The first five brands that were recalled unaided by respondents are presented in Table 5. Banvit is the first brand; Odeabank is the second brand; Pınar is the third brand, Murat Bey is the fourth brand and Bilyoner.com is the fifth brand.

Table 5. Findings on Brands Recalled Unaided

Brand Name	Number of People Who Can Recall
Banvit	125
Odeabank	75

Pınar	62
Murat Bey	60
Bilyoner.com	59

Table 6 shows results of aided recall by the respondents. When Table 6 is examined, number of brands that respondents could recall aided was minimum one and maximum 33. Participants were able to recall mostly four, five, six, seven, eight, nine, ten, eleven or fifteen brands as aided. Twenty one people, through aided recall, could remember seven brands. That was the highest number of recalled brands.

Table 6. Findings on Aided Recall

Number of Brands That Can Be Recalled (Aided)	Number of People Who Can Recall	Percentage (%)
1	3	1.5
2	5	2.6
3	6	3.1
4	15	7.7
5	12	6.2
6	13	6.7
7	21	10.8
8	12	6.2
9	12	6.2
10	11	5.7
11	10	5.2
12	9	4.6
13	6	3.1
14	7	3.6
15	10	5.2
16	5	2.6
17	8	4.1
18	4	2.1
19	8	4.1
20	4	2.1

21	2	1.0
22	1	0.5
24	2	1.0
25	1	0.5
26	1	0.5
29	2	1.0
30	1	0.5
31	2	1.0
33	1	0.5
TOTAL	194	100

When brands which are recalled unaided by respondents were examined (see Table 7), Banvit takes the first place, Pınar is the second, Bilyoner.com is the third, Murat Bey is the fourth and Fiat is the fifth brand.

Table 7. Findings on Brands Recalled Aided by Respondents

Brand Name	**Number of Recall (Person)**
Banvit	170
Pınar	110
Bilyoner.com	98
Murat Bey	91
Fiat	89

Discussion

Interest in basketball in Turkey has gained momentum with Garanti Bank's advertising project called "*12 Dev Adam (12 Giant Men)*" and today, this interest has climbed up to the top level with the achievements of Fenerbahçe Beko team in Turkish Airlines EuroLeague. The success of the Turkish national team and the Turkish athletes who played in the NBA were also influential in this process. In this study, an experiment was designed to measure brand recall in order to make an evaluation of brands seen during TV broadcasts of matches of Tahincioğlu Turkish Basketball League 2017-2018 season in Turkey. After all analyses, results that are expected to contribute to relevant literature were obtained. On the basis of weekly basketball watching status of respondents and how they watch games (e.g., in stadiums or on media), it is seen that the results obtained from the sample of this study can be easily evaluated as a proper sample for basketball. Because 67% of participants stated that they watched basketball games at least once a week and they watched these games both in the stadium and on media.

The experimental design of this study was created based on Pieters and Wedel (2007)'s previous study. In the study of Pieters and Wedel mentioned that the respondents only paid attention to the manipulated part of the stimuli when they directed about what to follow during video. In this study, there was no manipulation on brands to eliminate such bias. Therefore, the results of the analysis can be considered sufficient for related literature.

Companies that sponsor sports such as basketball, which can reach large audiences by placing their own logos or symbols in some part of the teams, athletes and activities to increase the visibility of their brands and to increase their brand value accordingly (Cornwell, 2008; Meenaghan & O'Sullivan, 2013). Their place on the screen, harmony with the sports field and context of brands are important factors for recall (Breur & Rumpf, 2015). When the results of this study are examined, it can be said that the images belonging to the brands are recalled regardless of where and how long they stay on the screen and whether they are moving or not. The Tahincioğlu brand, which is the name sponsor of the Turkish Basketball League and that appears almost all of the video (27 minutes), is recalled at a lower rate when compared to the Pınar brand, which only appears 18 seconds in the same video. However, the brand Bilyoner.com which has a sponsorship deal with the Turkish Basketball Federation was recalled at a higher rate compared to the Tahincioğlu brand. This may be because the brand awareness of the Tahincioğlu brand is less than the Pınar and Bilyoner.com brands. Furthermore, the fact that Tahincioğlu brand cannot emphasize basketball related components in the brand personality or does not carry out necessary marketing communication activities for these elements can be considered among the possible reasons for not creating brand recall. Figure 1 created considering this information will help to gain a better understanding of the results of the research.

Figure 1 shows that most recalled brands have similar colours. It was observed that these colours were mostly red, green and white. It would be a misguided idea to imagine that the visuals with a random combination of these colours will be recalled directly. It should be remembered that these brands do not only focus on basketball, but basketball constitutes only a small part of the budget allocated by these brands for advertising. Furthermore, two of the five brands (Pınar and Banvit) took place on the list of the 100 most valuable brands in Turkey in 2018 (Brand Finance, 2018). On the other hand, in 2018, the Murat Bey brand has been listed amongst the top five export companies in Turkey. In addition, the brand also holds many innovation, entrepreneurship and customer management awards both nationally and internationally. In this respect, it is a fact that these brands are "well-known" brands on both national and international platforms. Additionaly, it is seen that these brands are related to sports based on brand personalities. Brand personality is created by the filter of how the product related features, brand name, symbol or logo, advertisements, price, distribution channels, employees or managers, describe this brand in the mind-sets of the consumer (Aaker, 1997). Pınar, Banvit and Murat Bey brands have been investing in basketball for a considerable time and they are all identified with a basketball team. Bilyoner.com is already related to sports because it is a betting brand. Sponsor's brand awareness is directly proportional to its accessibility and visibility. The brand, which sponsors a sports team, can reach a wide audience ranging from those who come to watch the event on-site to those who read the news about the relevant event on media. This gives the sponsor the opportunity to increase its accessibility and visibility (Reiser, 2012). In the light of all this information, very low levels of aided and unaided recall of the Tahincioğlu brand despite its name sponsorship can be evaluated with the reasons explained above.

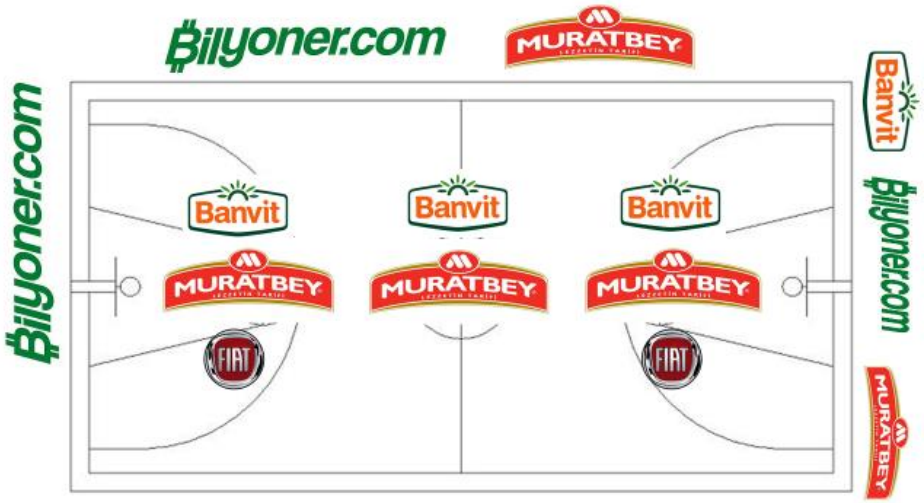

Figure 1. Unaided and Aided Recalled Brands' Positions on the Screen

As a result, it can be said that the most recalled brands appear on the screen in different places and formats. In addition, it was also determined that the brand's recall was not directly proportional to the format, number and duration of appearance on screen during the game. It will be an incomplete evaluation to associate the recall of the most frequently recalled brands to the way they are displayed on the screen alone. It can be said that the advertising activities carried out by these brands on media and sales points in addition to sports broadcasts are also affective on the recall rates. Therefore, for brand recall, it may be considered a more affective approach for businesses to advertise or sponsor in different content and format but not through a single communication channel.

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The influence of Structured Physical Activity Intervention on Fundamental Motor Skills Development of Children with Mild and Moderate Autism Spectrum Disorder

Mr MUNEER P[1] & Dr D. SULTANA[2]
PhD. Research Scholar[1]
Professor[2], Department of Physical Education & Sports, Pondicherry University, Puducherry- 605014.
Email: muneermp7@gmail.com

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Abstract

The children with Autism Spectrum Disorder (ASD) have impairment of gross motor skills. However, the motor deficiency is not a part of diagnosis of ASD. Majority of the people with ASD have motor imbalanced that affected serious health issues, body posture and PA performance. The major purposes of the study were to examine the impact of a structured physical activity programme on gross motor skills development on mild and moderate ASD. In order to achieve this purposes, the researcher has firmed two objectives namely (1) influence of PA intervention on gross motor development (locomotors & object control skills) of children with ASD and (2) influential comparisons of treatment effect between mild and moderate children with ASD. Purposive sampling technique was implemented to recruiting participants and a total of 20 samples were fixed after screening with the chronological age range in between 6 to 10 years and they deployed in two groups based on the degree of autism (Mild and Moderate). The total duration of experimentation last to 14 weeks, three times per week and each session having 40-60 minutes. Outcome variables (DV) were measured in three-time period (initial, mid, & post-test) and repeated measures ANOVA was used to find out the significant differences. The present study, demonstrate the substantial benefits for children with ASD through the structured PA programme. The locomotors skills have shown the statically significant (mild group $f=52.66^*$, $P<0.05$/ Moderate ASD $f=54.92^*$, $P<0.05$). In terms of object control skills also found significant differences with the effect of PA intervention (Mild ASD $f=60.51^*$ $P<0.05$/ Moderate ASD $f=77.28^*$ $P<0.05$). However, the group-wise comparison showed not significant difference between mild and moderate ASD. The present study concluded that 14 weeks structured PA programme was showed the gross motor skills development of children with mild and moderate ASD.

Keywords: Autism Spectrum Disorder, Physical Activity, locomotor, Object control, fundamental skills.

Introduction

The Autism Spectrum Disorder is a condition of social and communication impairments, it may occur due to the abnormality of biological and cognitive development among the children. The children with ASD have shown symptoms that fluctuating individually that vary from mild to severe conditions. The difficulties of socialization, communication and mental imagination that are the sufficient capture of an autistic person are universal nature (American Psychiatric Association 2013). Prevalence of autism spectrum disorder has increased statically in all over the world today. Approximately, earlier it was 1: 10000 in 1980 but latest estimation revealed that 1:68, it is almost 120% of hiking in USA (Autism Society of America, 2014; V. C. N. Wong and S. L. H. Hui, 2008). Majority of the children with ASD have difficulty in participate the physical activity programme due to poor motor planning, lack of locomotors and objective skills of these children (Pan, 2011). Many of the studies proved that children with ASD have poor and delayed motor skills development (Hilton et al., 2012; Ming et al., 2007; Fournier et al., 2010). Moreover, abundant study revealed that children with ASD have a high degree of motor impairment (Allen et al., 2017). In terms of gross and fine motor skills of children with ASD had significantly poor motor quotient comparatively children with TD (Provost B. et al., 2007; Jasmin E et al., 2009). Many of the autistic children have been denied to the participation of physical activity programme and perhaps, these children have limited opportunity to engaging physical activity classes because of their impairment of communication and social difficulties (K. R. Fox & C. Riddoch, 2000; C. Y. Pan & G. C. Frey, 2006). There are numerous health problems have been significantly improved due to sedentary behaviour of these children and which leads an increased rate of overweight and obesity of Autistic children (Must et al., 2016; Hill et al., 2015; Broder-fingert et al., 2014; Curtin et al., 2010). More often the children with ASD have poor coordination, lack of body balance, low level of health fitness, muscular strength and declined body movement control (Pan et al., 2016; Schopler et al., 2011; Tyler et al., 2014; Kern et al., 2013; Borremans et al., 2010). Majority of the scholars are believed that there is a strong relationship between physical activity and ASD but In fact, the gross motor skills impairment is not the part of Autism diagnosed criteria (Berkeley S L et al., 2001). Strong evident based on the regular physical activity enhance motor skills, reduce tensions, and maintain a better healthy life for all the people (Houwen, S., Hartman, E., & Visscher, C, 2010). And physical activity provided to control anxiety, low motivation, depression, stress and positive social interaction (Pan .C & Frey G. C, 2005; Ozgun, et al., 2017). Indeed structured PA intervention have to provide not only the health benefit but also improve the socialization, developmental-behavioural skills and avoided isolation from their peer groups (J. Muller et al., 2009; D Garcia Villamisare & J Dattlo 2011; D. Saldana et al., 2009). The developing country like India the prevalence of ASD has increased significantly. There are numerous studies were conducted in the field of Autism, unfortunately, majority of the study which dealing in psychological aspects and in the field of physical activity intervention was very rare existed especially, assessment of daily activity level (Pan & Frey, 2006). Moreover, the limited study was conducted in the field of physical activity intervention of ASD in India because of the unavailability of the participants and parental support. In this study, the researcher has tried to be proved how often influenced by14 weeks structured physical activity intervention on fundamental motor skills development of children with Autism Spectrum Disorder.

Objectives of the study

The primary motive of the present study was to analyze the influence of physical activity intervention of gross motor skills outcome on children with ASD. The secondary objectives of the study were to clarify the group-wise comparison for gross motor skills due to 14 weeks of structured PA intervention programme.

Materials and Procedure

All the procedures of the present study have maintained the systematic standard and properly executed as well. The University Ethical board has been approved for the entire study protocol in 2018. The researcher has collected parental and teachers consent form in the begging of the study protocol.

Participants: all the participants were recruited from Satya Special School, Pondicherry, India. Their chronological age in between 6 -10 years old at the time of data collection. The inclusion criteria were fixed as a child with ASD diagnosed, a total of 20 samples was finalized after the screened. The recruitment process began with the parental consent form and a detailed explanation was presented to the teacher as well as parents. All the selected samples were being an assessment of medical checkups and exclusion of children if who have a disorder other than the ASD. Recruited samples were placed for an experimentation process and along with their daily school routine. Majority of the participants has difficulties in verbal communication, denied eye contact, and some of them have repetitive behaviour (hand flapping, head rotation, body rocking). The participants who skipped the consecutive three training session would be excluded from the study. The researcher has ensured that all the participants have to get equal opportunities while conducting the training session. All the participants were being assessed gross motor skills (DV) an three consecutive time period in terms of, initial test from the beginning, mid-test after 6 weeks of PA programme, and finally post-test after the experimentation got over. The total duration of the physical activity intervention programme lasts for 14 weeks three times per week, each session includes not more than 60 minutes.

Table -1, Participant's description

Groups	N	Age Mean / SD	ASD Degree Mean / SD	BMI
Mild ASD	10	9.50 / 1.354	84.30/ 8.908	17.4
Moderate ASD	10	9.600/ 1.578	129.80 / 13.78	19.3

Apparatuses: The following tools were used for the assessment of participants. Parental and teachers consent form were collected from the binging of the study, 1) Indian Scale for Assessment of Autism (ISAA) which was used for the assessment and Degree of autism among the participants. ISAA tool included 5 points of a rating scale from one to five, a total of 40 testing items, in fact, all the assessment has done by the clinical observation, and information taken from the parents or caretakers. 2) Test of Gross Motor Development (TGMD-3) for users to evaluate dependent

variables. The TGMD has included 13 individual skills items which included locomotors and object control skills as well. All the test have a scoring rate of pass (one) and field (zero), each participant has to get two chances in each skill. In terms of, standardized criteria for each tool included in the study measures always keeping high (D. A. Ulrich).

Behavioural description of the participants

The investigator himself sits in the regular class, along with the children for one week prior to the actual investigation starts and carefully observes for all the students' classroom behaviour and character. Generally, all the participants have some common characters like impairment of verbal communication, avoidance of eye contact, and many of them have repetitive stereotypical behaviour. Out of twenty participants, two were girls and the girls have shown severe symptoms when compared to their peers who were boys. The one girl who was calm and quiet inside the classroom but she makes sounds and her hits her head vigorously on the wall when she gets disturbed. She always screams with a high voice, she won't sit in the chair; she seems very disturbed when someone touches. Her parents revealed that she always preferred to roam around and she was attracted to the comic book. She will be calm when she gets the comic book; so all the time, the teacher used to do the same thing every day. The investigator also noticed one boy who always disturbed the entire class by hitting other classmates and he may flap his hands while seeing others cry. If the teacher shouts at him in the meantime, he may run to the corner of the classroom and his whole body shivers; he covers both the ears with his hands, also sometimes rotate and roll his eyes. Majority of the participants showed common ASD symptoms and interestingly, all the children are obedient to the class teacher. Unfortunately, they have a very week attention span. Therefore, the investigator had demanded all the parents to be present at the time of the PA programme.

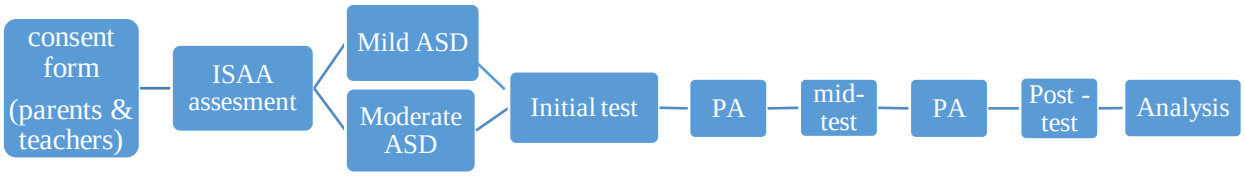


Figure 1 *framework of the study*

Experimental design of the study

A quasi- Experimental without control group research design was included in the study. There are two experimental groups were presented, such as group I (Mild ASD) and group II (Moderate ASD). Therefore, both group has been participated for interventional PA programme for 14 weeks (total of 46 sessions), three times in a week. The dependent variable such as locomotors skills and object control skills were being assessed by three-time period, initial test (beginning), mid-test,

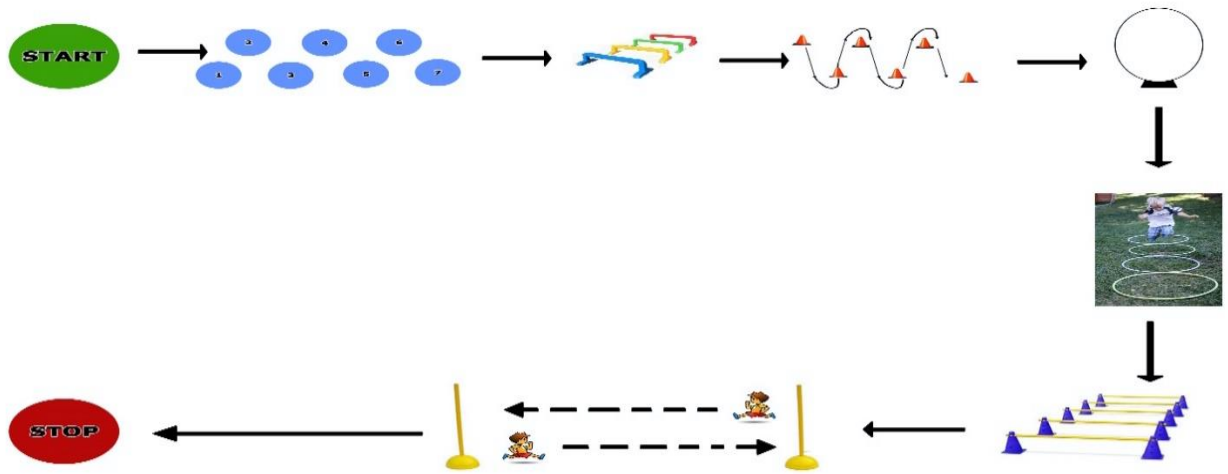
and post-test (after the experimentation). The researcher has focused on the quantitative aspect of the research study.

PA Intervention Programme

The physical activity programme was framed on the basis of PA guideline and national recommendation of PA for special children (DSM-V; treatments on autism; and the benefits of physical activity). The PA programme has been made in a well-organized structured form. All the activity were being conducted in the school activity arena (Hall, 15*10 meter squire)**.** The researcher had ensured that all the participants have medically and physically fit enough to engage in the activity with the help of a school nurse and Physiotherapist. The investigator has to assure that the presence of each parent and class teacher at the time of PA programme, detailed explanation and demonstration was made by the investigator to the teachers and parent at the beginning of the programme. Meanwhile, the investigator asked the parents to communicate with the children about the programme. Parents can assist the children if they needed and always be motivated during activity perform and engorged students after finished each session of programme. Indeed the ASD children have a high degree of motivation needed in fact, the people of ASD have problem with mood swings so that parents can only helping out the particular situation.

The PA programme has been classified in three specific phases 1, starting phase (warming up; 15 minutes) 2, major phase (main activity; 40 minutes) and 3, Limbering phase (cooling down; 5 minutes). Participants can start with green signal and end with red, and all the participants have completed all the station of exercise compulsory. In between the station of exercises, participants can either walk or jogging without breaking. Perhaps, all participants have to be completed in each station of exercise compulsory.

Figure II, *Diagram of PA programme*



1 to 3 weeks 3 repetition per individual; 4 to 6 weeks 4 repetition per individual;
7 to 9 weeks 5 repetition per individual; 10 to 14 weeks 6 repetition per individual.

The researcher, two-class teacher and each parent (mother) were companied in the entire PA programme. The total of 42 sessions of training lasts 14 weeks period, trice in a week Monday, Wednesday, and Friday.

Data collection methods

The quantitative aspect of the study protocol was applied in the present study. In terms of, data collection and methodology of the study have well established. All the data were collected by the researcher in the form of parametric. The assessment of the degree of Autism by used Indian Scale for Assessment of Autism (ISAA) at the beginning of the study. The primary data (DV) was collected in the three-phase such as Initial, mid-test, and post-experimental test. The repeated-measures ANOVA was used as statistical tools to find out the significant difference between IV and DV. The Bonferroni was used to assess the significant difference of the mean score among initial to mid, initial to post-test, and mid to post-test differences. All the statistical analysis was carried by the SPSS 20 and Microsoft Excel 2013.

Table II, *Descriptive analysis of gross motor skills among the participants*

Groups	**Locomotors skills**			**Object control skills**		
	Initial-test Mean / SD	Mid-test Mean / SD	Post-Test Mean / SD	Initial- test Mean / SD	Mid- test Mean /SD	Post- Test Mean / SD
Mild ASD	11.900 / 4.459	13.800/ 3.293	22.000/ 4.595	17.1000/ 3.635	22.400/ 3.748	31.666 / 4.301
Moderate ASD	10.300/ 4.112	12.100/ 4.201	18.300/ 5.397	17.500/ 5.681	20.700 / 5.271	28.900 / 3.872

Table III, Comparison of the different test results (initial test, mid-test and post-test) for each DV skill of children with mild autism

Skills	Test	Mean	Std. Deviation	F	df	Sig.	Pairwise comparison tests	ofSig.
Locomotors Skills	Initial	11.90	4.45845	52.66*	2	.000	Initial - Mid	.105^{ns}
	Mid	13.80	3.29309				Mid - Post	.000*
	Post	22.00	4.59468				Initial - Post	.000*
Object Control Skills	Initial	17.10	3.63471	60.51*	2	.000	Initial - Mid	.005*
	Mid	22.40	3.74759				Mid - Post	.000*
	Post	31.50	4.08928				Initial - Post	.000*

Note: *The Alpha level of 0.05, *Significant at 5% level, NS: Not significant*

The mean score, standard deviations, F-value, and P-value of locomotors skills and object control skills at different test categories are given in the Table1.

The F-value and P-value of the variable locomotors skills are 52.666 and 0.000 respectively. Since the P-value is less than 0.05, we conclude that there is a significant difference in the mean score of locomotors skills among the different test categories of children with mild autism. The post hoc test using Bonferroni correction shows that there is a significant difference in the mean scores of mid-test and post-test, and the mean scores of the initial test and post-test. Therefore, we can conclude that the exercise training programme improves the locomotors skills of children with mild autism.

Similarly, the F-value and P-value of the variable object control skills are 60.506 and 0.000 respectively. Since the P-value is less than 0.05, we conclude that there is a significant difference in the mean score of object control skills among the different test categories of children with mild autism. The post hoc test using Bonferroni correction shows that there is a significant difference in the mean scores of the initial test and mid-test, the mean scores of mid-test and post-test, and the mean scores of initial test and post-test. Therefore, we can conclude that the exercise training programme improves the object control skills of children with mild autism.

Table IV, Comparison of the different test results (initial test, mid-test and post-test) for each skill (DV) of children with moderate autism

Skills	Test	Mean	Std. Deviation	F	df	Sig.	Pairwise comparison tests	ofSig.
Locomotors Skills	Initial	10.30	4.11096	54.92*	2	.000	Initial - Mid	.015^{ns}
	Mid	12.10	4.20185				Mid - Post	.000*
	Post	18.30	5.39650				Initial - Post	.000*
Object Control Skills	Initial	17.50	5.68135	77.28*	2	.000	Initial - Mid	.014
	Mid	20.70	5.27152				Mid - Post	.000*
	Post	28.90	3.87155				Initial - Post	.000*

Note: *The Alpha level of 0.05, *Significant at 5% level, NS: Not significant*

The mean score, standard deviations, F-value, and P-value of locomotors skills and object control skills at different test categories are given in the Table2.

The F-value and P-value of the variable locomotors skills are 54.915 and 0.000 respectively. Since the P-value is less than 0.05, conclude that there is a significant difference in

the mean score of locomotors skills among the different test categories of children with moderate autism. The post hoc test using Bonferroni correction shows that there is a significant difference in the mean scores of the initial test and mid-test, the mean scores of mid-test and post-test, and the mean scores of initial-test and post-test. Therefore, we can conclude that the exercise training programme improves the locomotors skills of children with moderate autism.

Similarly, the F-value and P-value of the variable object control skills are 77.275 and 0.000 respectively. Since the P-value is less than 0.05, conclude that there is a significant difference in the mean score of object control skills among the different test categories of children with moderate autism. The post hoc test using Bonferroni correction shows that there is a significant difference in the mean scores of the initial test and mid-test, the mean scores of mid-test and post-test, and the mean scores of initial test and post-test. Therefore, we can conclude that the exercise training programme improves the object control skills of children with moderate autism.

Figure III, *Graphical representation of locomotors and object control skills of children with mild and moderate ASD.*

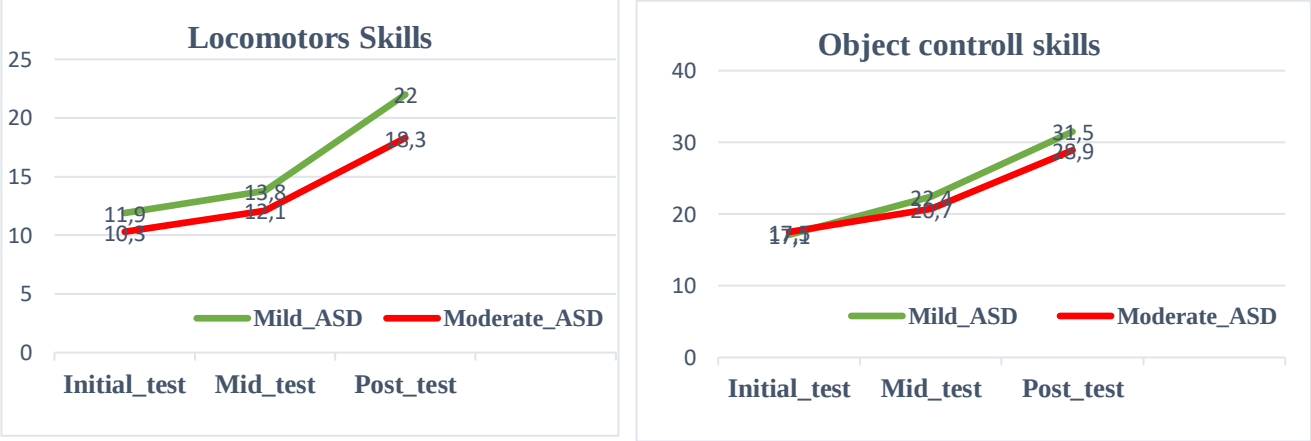


Table V, The group-wise comparison of gross motor skills (DV) among children with mild and moderate autism spectrum disorder.

Skills	Test	Autism type	Mean	Std. Deviation	t	df	Sig.
Locomotors Skills	Initial	Mild	11.90	4.458	0.834	18	.415[ns]
		Moderate	10.30	4.110			
	Mid	Mild	13.80	3.293	1.007	18	.327[ns]

			Moderate	12.10	4.202			
		Post	Mild	22.00	4.595	1.651	18	.116 ns
			Moderate	18.30	5.397			
Object Skills	Control	Initial	Mild	17.10	3.635	-0.188	18	.853 ns
			Moderate	17.50	5.681			
		Mid	Mild	22.40	3.748	0.831	18	.417 ns
			Moderate	20.70	5.271			
		Post	Mild	31.50	4.089	1.460	18	.162 ns
			Moderate	28.90	3.872			

Note: *The Alpha level of 0.05, *Significant at 5% level, NS: Not significant*

The group-wise comparison of locomotors skills of children with mild and moderate ASD. In terms of initial, mid and post-test the 't' value are 0.834, 1.007, and 1.651. The P-value is greater than the 0.05 (.415, .327, and 116) hens the t value shows that there is not a statically significant difference in group-wise comparison of locomotors skills. The object control skills t- value such as 0.188, 0.831, 1.460 respectively and all the t value are greater than the P-value (0.05) hence there is not a significant difference of group-wise comparison as well.

Discussion

The present study, the scholar had tried to investigate the benefits of well-designed physical activity intervention among children with ASD. The impairment of locomotors skills is very common among children with ASD (Berkeley et al., 2001; Memari and Ghaheri et al., 2013; Memari and Ghanouni et al., 2014; Memari and Ziaee et al., 2013). Perhaps, the investigator has fixed the structured physical activity intervention on gross motor skills development among children with ASD as a primary objective. Moreover, the investigator had tried to compare the group-wise improvements on DV due to impact on IV. Despite the majority of the scholars has revealed that PA programme is the key factor of all-round developmental process among the children specifically, children with ASD (Jansiewics et al., 2006; Minshew et al., 2004; Page & Boucher, 1998; Manjoiviona & Prior, 1995). Therefore, the researcher would be started with these statements and made a PA intervention on the baseline of the study objective.

The researcher has dealt with the quantitative aspect of the outcome rather than the qualitative outcome among the participants. For that, the study included specifically two groups of participants (Mild and Moderate ASD) on the basis of the degree of Autism (ratio of ISAA). The

specific target of the study dealt with the 14 weeks structured PA intervention on gross motor skills among Autistic children (ASD). In this study, demonstrate the substantial benefits for children with ASD through the PA intervention. In fact, ample studies were disclosed that improvement of health domains due to PA programme especially, children with ASD (Lang et al. 2010; Sowa & Muelenbroek 2012; Blair et al., 1989; Booth et al., 2000; Pate, Pratt, & Blair, 1995). Improvement of physical fitness and muscular strength (Andrew et al., 1979; Beasley, 1982; Bundschuh & Cureton, 1982; Fernhall, 1993; Frey et al., 1999; Nordgren, 1971; Pitetti & Tan, 1991; Pitetti et al., 1993; Rimmer, Heller, Wang, & Valerio, 2004; Schurrer, Weltman, & Brannel, 1985). The abundant literatures evident that pupil with ASD have numerous impairment in communication specifically, deficiency and delayed motor skills (Fournier et al. 2010; Hilton et al. 2012; Ming et al. 2007; Bhat et al. 2011; Leonard et al. 2014; Liu 2012; Lloyd et al. 2011; Shetreat-Klein et al. 2014; Teitelbaum et al.1998; Baranek, 1999; Ornitz, Guthrie, & Farley, 1977; Dewey, Cantell, & Crawford, 2007; Fournier et al.,2010; Hallett et al., 1993; Jansiewicz et al., 2006; Mostofsky et al., 2006; Noterdaeme et al., 2002; Srinivasan et al., 2013). Therefore, in this study investigator tried to get improvement on motor skills through structured PA intervention moreover, the investigator had achieved the study objectives as well. The study has been implemented positive outcome and the study result shows that the locomotor skills development of children with mild and moderate ASD due to the impact of structured PA intervention (Catama et al., 2017; Sallis et al., 1997; Sorensen & Zarrett, 2014; Houwen, Hartman, & Visscher, 2009; Bremer, Balogh, & Lloyd, 2015). The following 12 weeks physical activity intervention of children with ASD has proved significant improvement of gross motors skills and especially, the object control skills have been improved (Berkeley et al., 2001; Green et al., 2002; Mayes et al., 2007). According to Schalthesis et al., 2000 has revealed that improvement of socialization and increased motor skills through the regular participation of physical activity for children with ASD. Perhaps, reduced negative emotions and avoided isolation through regular activity play & PA intervention (Houwen, Hurtman & Visscher, 2009; J. Muller et al., 2009).

The secondary objectives of the study which deals with examining the group-wise comparison of gross motor skills. Although, there was a significant improvement in gross motor skills through the PA intervention. In terms of group-wise comparison (Mild GP & Moderate GP) tables revealed that there were no significant differences. Some of the scholars believed that severity of Autism and imitation of skills are highly correlated but later study proved that gross motor skills have did not correlated with Autism severity (Ditza A et al., 2010; Kaur, Srinivasan, & Bhat, 2018). Moreover, many of the other benefited were observed by the investigator due to structured PA programme. Eversol M et al., 2016 has identified self-enjoyments through PA participation. The structured PA programme has been delighted to improvement many other factors rather than the GM development. Benefited of healthy outcome (Blair et al., 1989; Booth et al., 2000; Pate, Pratt,& Blair, 1995) reduced stereotypical behavior of children with ASD (Bahrami et al. 2012; Sorensen, C., & Zarrett, N.2014; Elliot et al., 1994; Yilmaz et al., 2004; Levinson & Reid, 1993; Prupas & Reid, 2001). The PA programme could be provided to the participants can improve social and behavioural changes. Many of the social changes were noticed by the researcher through PA participation such as team cooperation, given high-five to the teammate and parents.The repetitive behavioural changes could not be counted in this study, in fact, the teachers, parents and

investigator had observed some of the tremendous changes like reduced hand-flapping, screaming, and self-injurious behaviour while participating. Indeed reduced stereotypical behaviour due to play or structured PA programme (Wolfberg P, 1999; Anderson-Hanley, Tureck, & Schneider man, 2011).

Conclusion

Structured regular physical activity as a key factor of children's all-round developmental process of today's society. Unfortunately, the participation of Physical Activity program for children with ASD has faced more challenging and difficulties. In the present study, deals with offered Structured PA programme for children with ASD and investigator had tried to provide equal opportunity for all the participants. The purpose of the study was to examine the influence of structured physical activity interventional programme on gross motor skills of children with mild and moderate Autism. In terms of locomotors skills of children with mild (52.666*/ P-value 0.05,) and moderate (54.92* /P-value 0.05) autism have significantly improved due to 14 weeks structured PA programme. The object control skills such as mild (60.506*/ P-value 0.05) and moderate ASD (77.28*/ P-value 0.05), it has shown the significant differences due to 14 weeks structured PA programme. Moreover, the overall gross motor skills development has been taken place due to the structured PA programme for children with mild and moderate ASD. The researcher had failed to find out the significant differences between the mild and moderate ASD in terms of locomotors and object control skills due to the 14 weeks structured PA programme. Although the result of the study has to be provided significant improvement in gross motor skills due to PA programme

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Investigation of the Relationship between Functional Movement Screening Test Scores and Athletic Performance of Professional Football Players

Hasan AKA[1], Zait Burak AKTUĞ[1], Emre ALTUNDAĞ[2], Levent ŞAHİN[2]
[1]Niğde Ömer Halisdemir University, School of Physical Education and Sports, Niğde, Turkey
[2] Football Coach
E-Mail: zaitburak@gmail.com

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Abstract

The aim of this study is to investigate the relationship between Functional Movement Screening (FMS) test scores and athletic performances of professional football players. Twenty professional male football players participated in the study voluntarily. Functional movement patterns of the players were determined by FMS test kit and athletic performances were determined by Yoyo test, T drill test, vertical and horizontal jump test, 10 m and 20 m speed test. Spearman Correlation Analysis was used to determine the relationship between FMS test scores and athletic performances of football players. As a result of the study, no statistically significant relationship was found between FMS test scores and athletic performances of football players ($p<0.05$). In addition, the FMS test total score of the players (14.2 points) was found to be above the limit of injury (14 points). In conclusion, although FMS test scores provide important information about the quality of functional movements and the likelihood of injury, it is not a determinant of athletic performance. This may be due to the combination of several motoric characteristics of athletic performance, although FMS test scores are assessed individually.

Keywords: Football, functional movement screening, athletic performance.

Introductıon

Functional movement skills are the basic skills that are essential for each sports branch and must be developed by the age of 10 (Balyi et al., 2013). The use of multiple joints and optimal body dynamics in these movements increase the efficiency and efficiency of movement patterns. The FMS test is a biomechanical screening and evaluation system based on 7 basic movement patterns (Abraham et al., 2015). This system reveals the kinetic chain interaction between mobility and stability required for basic performance (Chorba, 2010). Muscle strength, flexibility, range of motion, coordination, balance and proprioceptive mechanism are evaluated with FMS test (Cook et al., 2010). The determination of limitation and asymmetry in as a result of the FMS test, which assesses the mobility of athletes, depends on the effectiveness and quality of the movement pattern, not the number of repetitions or the weight lifted. Furthermore, the fact that FMS test is fast, noninvasive, inexpensive and easily applicable (Perry and Koehle, 2013) allows for more frequent evaluation of athletes in all branches.

Athletes' athletic performances are also influenced by their physical structure such as height, body weight, body mass index, and motor properties such as endurance, strength, speed and flexibility and agility (Kalyon, 1990; Mohammad & Tareq, 2016; Michailidis, 2018). The quality of movement in athletes and the success of complex movements affect athletic performances of athletes and also play a role in preventing possible injuries (O'connor et al., 2011; Frost et al., 2012). In addition, muscle strength and imbalance in motor control or weak muscle strength are other factors that cause injury (Chorba et al., 2010). Therefore, by improving the functional movements of athletes, while improving the basic movement quality, it can also eliminate the possibility of injury (Aktuğ et al., 2019; Bagherian et al., 2018).

When the literature is examined, studies about FMS test are frequently seen in recent years. The majority of these studies are related to determining the probability of injury to athletes. However, there are a limited number of studies examining the relationship between functional movements and athletic performance. It is seen that these studies are mostly aimed at infrastructure athletes and women athletes. In the football branch, a study for a team at the Super League level was not found in the literature review. Therefore, the aim of this study is to investigate the relationship between the functional movements and athletic performances of the senior football players.

Materıals And Methods

The study from the Turkey Football Federation joined a football team in the Super League as players, 20 male volunteers. It was taken into consideration that the players involved in the study consist of those who did not experience any sporting injuries in the last 6 months. The tests were conducted on the off days of the players and the players were asked not to participate in any sporting activities in the last 24 hours before the tests.

Data Collection Tools

Length and Body Weight Measurements

Football players' height and body weight were measured using a height-scales (Seca 700; Seca GmbH & Co. KG, Hamburg, Germany) with bare feet and only shorts and T-shirts on them.

Functional Movement Screening Test

The functional movements of the players were determined through the Functional Motion Screening test kit (Cook et al., 2006; Güzel & Kafa, 2017). Measurements were made by a certified specialist. The test consists of 7 movements (deep squat, hurdle step, in line lunge, shoulder mobility, active leg raise, trunk stability push up, rotary stability). The measurements of the players were made considering the basal condition of their bodies without heating. The players were informed about the test before the measurements started and the movements were shown. Each movement was repeated three times during the test. The players were asked to report any pain or discomfort to the measuring specialist during the exercise of the movements.

In the test, firstly unilateral movements (deep squat, trunk stability push-up) were measured. In two-sided tests; (hurdle step, in line lunge, shoulder mobility, active leg raise, rotary stability). During the scoring, the scores of the participants from both sides of their bodies were recorded. However, the lowest score from the movement was accepted as the result of the test. This procedure was applied for bilateral movements. Each test is scored between 0 and 3. The highest FMS test score was 21 (Cook et al., 2010). It is known that individuals with a total FMS test score less than 14 points have a greater risk of injury than individuals with a score higher than 14 points (Kiesel et al., 2007).

Athletic Performance Tests

The players were given a 15-minute warm-up protocol before the athletic performance tests. Before starting the tests, the athletes were given detailed information about the tests to be applied both verbally and in practice.

Yoyo Test: The Yoyo test was determined by Intermitten Recovery Test Level 2 in a field drawn with cones at a distance of 20 m in hybrid grass. The test was repeated 1 time.

T Drill Test: The T Drill test was carried out on hybrid turf by means of a New Test Powertimer instrument with cones arranged in T-shaped intervals of five meters each. The test was performed 3 times and the best value was included in the study.

Horizontal Jump Test: The horizontal jump test was determined with the Vert Jump instrument. The test was applied to athletes 3 times and the best result was included in the study.

Vertical Jump Test: The vertical jump test was determined with the Vert Jump instrument. The test was applied to athletes 3 times and the best result was included in the study.

10 and 30 Meters Speed Test: Speeds of athletes were determined on hybrid turf ground by New Test Powertimer**.** The tests were performed 3 times and the best value was included in the study.

Data Analysis

SPSS 24.0 package program was used in the statistical analysis of the data obtained in the study. To determine the relationship between FMS test scores and athletic performances of the participants, Spearman Correlation Analysis, one of the nonparametric tests, was used. In the study, the significance level was accepted as $p < 0.05$.

Fındıngs

Table 1. Descriptive statistics of players

	N	$\overline{x}$ ± Sd
Age (year)	20	26,80 ± 4,75
Height (cm)	20	180,10 ± 8,14
Weight (kg)	20	78,20 ± 8,14
BFP (%)	20	8,35 ± 1,77

Table 2. Mean and standard deviations of FMS test scores and athletic performance test results of football players

	N	$\overline{x}$ ± Sd
Speed 10 m (sec)	20	1,80 ± ,085
Speed 30 m (sec)	20	4,15 ± ,137
T drill test (sec)	20	8,76 ± ,246
Vertical jump (cm)	20	60,4 ± 5,46
Horizantal jump (cm)	20	236,3 ± 13,3
Yoyo (m)	20	1766 ± 474,5
Deep Squat	20	1,85 ± ,587
Hurdle Step	20	1,45 ± ,510
In line Lunge	20	1,95 ± ,686
Shoulder Mobility	20	2,50 ± ,606
Active Leg Raise	20	2,05 ± ,759
Trunk Stability Push up	20	2,85 ± ,366
Rotary Stability	20	1,85 ± ,366
FMS Total Score	20	14,2 ± 2,19

Table 3. The relationship between FMS test scores and athletic performances of football players

		FMS total score	Deep squat	Hurdle step	In line lunge	Shoulder mobility	Active leg raise	Trunk stability push up	Rotary stability
Speed 10 m	R	,180	-,074	-,009	,153	-,225	,067	-,061	,195
	p	,446	,757	,971	,520	,341	,777	,799	,411
	N	20	20	20	20	20	20	20	20
Speed 30 m	R	,087	-,174	-,052	,137	-,292	-,104	,097	,049
	p	,715	,463	,827	,565	,211	,662	,683	,839

	N	20	20	20	20	20	20	20	20
	R	-,273	-,273	-,297	-,329	-,217	-,164	-,061	-,182
T drill test	p	,245	,244	,204	,156	,359	,490	,799	,442
	N	20	20	20	20	20	20	20	20
	R	,243	,112	,227	,439	-,149	,287	-,206	,498*
Vertical	p	,302	,637	,337	,053	,531	,220	,382	,025
jump	N	20	20	20	20	20	20	20	20
	R	-,031	,021	-,026	-,231	-,033	,100	,097	-,207
Horizantal	p	,897	,928	,913	,328	,891	,675	,683	,381
jump	N	20	20	20	20	20	20	20	20
	R	,435	,292	,305	,376	-,336	-,100	,231	,231
Yoyo test	p	,055	,212	,191	,102	,147	,676	,327	,327
	N	20	20	20	20	20	20	20	20

*p<0.05

When Table 3 was examined, no statistically significant relationship was found between FMS test scores and athletic performances (p<0.05).

Dıscussıon

This study was conducted to investigate the relationship between FMS test scores of professional football players and athletic performance tests (speed, endurance, jump and agility). According to the findings of the research, there was no statistically significant relationship between FMS total score and FMS subtests and athletic performance (p<0.05).

When the literature is examined, it is seen that there are studies examining the relationship between FMS test scores and athletic performance. In a similar study, no significant relationship was found between FMS test scores and athletic performances (balance, flexibility, agility, speed and vertical jump) of female volleyball players (Altundağ, 2018). In another study, the relationship between FMS test scores and athletic performances (jump, speed) of golf athletes was investigated and as a result no significant relationship was determined between these parameters. (Parchmann and Mcbride, 2011). Şahin et al. (2018) examined the relationship between FMS test scores and athletic performances (endurance, speed, agility, long jump) of athletes in their study on football players aged 14-16 years. As a result, a significant correlation was found between agility and active leg raise only from the FMS subtests (Şahin et al., 2018). In a study conducted on college footballers, no significant relationship was found between FMS test scores and strength and strength of players (Bradberry et al., 2010).

The above-mentioned studies support the results of the current study and show that there is no relationship between FMS test scores and athletic performance. This may be due to different reasons. The FMS test is a test battery that evaluates the limitation and asymmetry of movements step by step. Therefore, in the FMS test, while the individual movements are evaluated, different motor components are used together in athletic performance parameters of the athletes (such as strength, speed, endurance). Therefore, it may not be enough to explain athletic performance only with functional movements.

The FMS total score is a parameter that indicates the probability of injury to athletes. Although the FMS test average score of professional football players (14.2 points) is above

the limit of injury (14 points), it may be in favor of the athletes to develop functional movements because they are very close to the critical limit. Aktuğ et al. (2019) reported that corrective exercises improve FMS test scores and reduce the likelihood of injury.

As a result, the movements of the FMS test battery are either stable or slow. As for athletic performance, it is considered that there is no relationship between functional movements and athletic performance because the movements are performed in the shortest time and with the highest performance. In addition, when evaluating individual FMS test scores, the combination of several motoric characteristics of athletic performance factors may result in a limiting factor in determining a relationship between these parameters.

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