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

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
W R E S	263.01 ± 195.57	239.08 ± 172.21	3.35 ± 2.83	5.52 ± 2.43	5.18 ± -0.83	3.44 ± 11.8
T L	Close Ellipse Area	Perimeter	Standard F-B	Standard M-B	C.o.p Y	C.o.p X
E R S	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.

REFERENCES

İbiş, S., İri, R., Aktuğ, Z.B. (2015). Effect of leg volume and mass of female volleyball platers on balance and reaction time. International Human Sciences Journal. 12(2),1296-1308.

Liman, Ö.N. (2008). Effect of Aerobic-step and plates exercises on strength, flexibility, anaerobic power, balance and power composition. Master's degree Thesis, Gazi University Institute of Medical Sciences, Ankara

Siriphorn, A. ve Chamonchant, D. (2015) Wii balance board exercise improves balance and lower limb muscle strength of overweight young adults. J Phys Ther Sci, 27, 41–46, 2015

Muehlbauer, T., Gollhofer, A., Granacher, U. (2015). Associations between measures of balance and lower-extremity muscle strength/power in healthy individuals across the lifespan: a systematic review and meta-analysis. Sports Med. [Epub ahead of print]

Astrand, P.,Rodahl, K., Dahl, H. A., Stromme, S. B. (2003).Textbook of workphysiology: Physiologicalbases of exercise (4th ed.), Canada.

Dore, E., Bedu, M., França, N. M. ve Praagh, E. V. (2001). Anaerobic cycling performance characteristics in prepubescent, adolescent and young adults females, European Journal of Applied Physiology., 84, 476-481.

Zorba, E., Özkan, A., Akyüz, M., Harmancı, H., Taş, M., Şenel, Ö., (2010). Relation between leg volume, leg mass, anaerobic performance and leg power of wrestlers.

International Human Sciences Journal [In the link]. 7:1. Contact: http://www.insanbilimleri.com

Esbjörnson, M., Sylven, C., Holm, I. & Jansson, E. (1993). Fast Twitch fibers may predict anaerobic performance in both females and males. *International Journal of Sports Medicine*. 14(5): 263.

Martin, R. J. F., Dore, E., Twisk, J., Van Praagh, E., Hautier, C. A. & Bedu, M. (2004). Longitutudial changes of maximal short-term peak power in girls and boys during growth. Medicine and Science in Sport and Exercise. 36(3): 498-503.

Akyüz, M., Özkan, A., Taş, M., Sevim, O., Akyüz, Ö., Uslu, S. (2013). Determınatıon and relationships of strength profiles of junıor female basketball Turkısh Natıonal Team players. International Journal of Science, Culture, and Sport, 1(3); 34-41.

Özkan, A. (2011). The Role of Leg Volume and Mass in Assessment of Anaerobic Performance and Isokinetic Strength, Ankara University, Institute of Medical Sciences, Phd Thesis, Ankara, Turkey.

Taş, M., Sevim, O., Özkan, A., Akyüz, M., Akyüz, Ö., Uslu S. (2013). The role of circumferential measurement of some values in determining anaerobic performance and strength values in junior female basketball Turkish National Team players. International Journal of Science, Culture, and Sport, 1(3); 12-20.

Özkan, A., Türkmen, M., Bozkuş, T., Kul, M., Soslu, R., Yaşartürk, F.; Aydin, R., Oz, U. (2018). Determination of the Relationship between Healthy Lifestyle Behaviors, Physical Fitness, and Risk Factors of Coronary Heart Diseases in University Students. *Education Sciences*, 8(2), 51.

Kılınç, F., Özen, G. (2015). Comparison of anaerobic power values and heart rate of elite free and Greco roman wrestlers.

Aydos, L., Taş, M., Akyüz, M., Uzun, A. (2009). Analysis of the relation of strength and some antropometric parameters of young elite wrestlers. *Education and Sports Sciences Journal*, *11*(4).

Johnson, G. O.,Cisar, C. J. (1987). Basic conditioning principles for high school wrestlers. *The Physician and sportsmedicine*, *15*(1), 153-159.

Kılınç, F., Aydoğan, A., Ersoy, A., & Yavuz, A. (2012). Training on power applied strength combined preparation wrestlers periods effects on performance. *Journal of Human Sciences*, *9*(1), 398-411.

Cisar, C.J., Johnson, G.O. & Fry, A.C. (1987). Preseason body composition, build and strength as predictors of high school wrestling succes. **J Appl Sports Sci. Res**.,1:66-70

C. Sinan Aslan, Coşkun Büyükdere, Yusuf Köklü, Ali Özkan, N. Şahin Özdemir. Determination of the relation between body composition, anaerobic performance and back strength of lower-elite sportsmen. International Journal of Human Sciences, 8(1); 1612-1628, 2011

Rezasoltani, A., Ahmadi, A., Nehzate-Khoshroh, M., Forohideh, F. & Ylinen, J. (2005). Cervical muscle strength measurement in two groups of elite greco-roman and unfree style wrestlers and a group of non-athletic subjects. **Br. J. Sports Med**. 39(7):440-443

Schmidt, W.D., Piencikowski, C.L. & Vandervest, R.E. (2005). Effects of a competitive wrestling season on body composition, strength and power in national collegiate athletic association division ııı college wrestlers. **Journal of Strength Cond. Research.** 19(3):505-508

Vardar, S.A., Tezel, S. Öztürk, L., Kaya, O. (2007). The relationship between body composition and anaerobic performance of elite young wrestlers. **Journal of Sports and Medicine**.6(CSSI-2): 34-38

Hazır, T., Aşçı, A., Açıkada, C., Ergen, E., Tınazcı, C., ve Hazır, S., Somatotype characteristics of national level Turkish Athletes. The 10th ICHPER- SD EUROPE CONGRESS, November17-20, 2004, Antalya,. 2004.

Özkan, A., Mitat, K. O. Z., & Ersöz, G. (2011). Determination of optimal load in Wingate anaerobic power test. *Spormetre Physical Education and Sports Sciences Journal*, *9*(1), 1-5.

Broeder, C. E., Burrhus, K. A., Svanevik, L. S., Volpe, J. O. S. E. P. H., & Wilmore, J. H. (1997). Assessing body composition before and after resistance or endurance training. *Medicine and science in sports and exercise*, *29*(5), 705-712.

Karlı, Ü. (2006). Analysis of Body Composition in Elite Level Wrestlers. Published Phd Thesis, Hacettepe University Institute of Medical Sciences, Ankara.

Şimşek, D., Ertan, H. (2011). Postural control and sports: postural sensor-motor strategies and postural winging for sports branches. *Spormetre Physical Education and Sports Sciences Journal*, *9*(3), 81-90.

Erkmen, N., Suveren, S., Göktepe, A. S., Yazicioğlu, K. (2007). Comparison of balance performances of sportsmen for different branches. *Spormetre Physical Education and Sports Sciences Journal*, *5*(3), 115-122.

Altinkök, M., ve Ölçücü, B. (2012). Analysis of postural control and agility performances of 10 years old tennis players before the match. *Selçuk University Journal of Physical Education and Sport Science*, *14*(2), 273-276.

Okudur A., Sanioğlu A. (2012). Analysis of the relation between balance and agility for tennis players at the age of 12. *Selçuk University Journal of Physical Education and Sport Science, 2012; 14(2): 165–170.*

Tetik S., Koç M. C., Atar Ö., Koç H. (2013). Analysis of the relation between static balance performance and game value scale for basketball players. *Turkish Kickbox Federation Sports Scienes Journal Volume: 6, Sayı:1, January, Issn:1309-1336.*

Canbolat, B. (2017). Analysis of some performance variables affecting balance of Taekwondo-men. *Published master's degree Thesis, Bartın University,* Institute of Educational Sciences).

Davlin, C. D. (2004). Dynamic balance in high level athletes. *Perceptual and motor skills*, *98*(3_suppl), 1171-1176.

Uzun, M., Özlü, K., Dalbudak, İ., Köse, B., & Gürkan, A. C. A (2017). Review Study On The Anthropometric Characteristics And Some Physiological Parameters Of Some Judoısts. Academic Social Researches Journal Year: 5, Issue No: 60, December 2017, s. 253-282

Köse Bereket, Atan Tülin. Effect of Different Warm-Up Methods on Flexibility Jumping and Balance, Journal of Physical Education & Sports Science, 2015; 9 (1):85-93 (ISSN 1307-6477).