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Examining the relationship between body composition values and performance indicators in wrestlers at the World Cup

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Key words: wrestling, Body Mass Index, success, world cup

Abstract

Background and Study Aim. The aim of this study was to investigate the effect of body composition on the performance of wrestlers from the top ten national teams. The study was carried out on a sample of 78 Greco-Roman wrestlers (aged 20–30 years) from the top 10 Greco-Roman wrestling teams taking part in the World Cup held in Tehran in 2015.

Material and Methods. Demographic characteristics were recorded from information cards, body mass index (BMI) using the BMI Formula ($BMI = kg/m^2$), and Body fat percentage was determined (PBF) using Tanita (TBF-300 A). The success rate of wrestlers based on their performance in the World Cup was also collected. Data were analyzed using the SPSS19 package program. The K-S test, was used for normal distribution of data; the Pearson and Spearman correlation coefficient to investigate the relationship between variables averages; paired T test and Anova to evaluate the mean difference between the variables, and the LSD test was used to compare the averages among groups.

Results. No difference was observed in the mean of BMI and PBF among the teams. There was a significant relationship between BMI and PBF and some of the performance indicators. There was no significant relationship between BMI, PBF, and the titles won by the participating teams was observed.

Conclusions. In this study, we interpret the present findings to confirm previous observations of the general athlete population about the negative effect of elevated BMI and PBF on selected parameters of sports performance. The present results indicate that excess body mass has a more negative effect on performance indicators in participating teams.

Introduction

Championships, and World Cups. This combat sport is based on a weight class system that aims to balance out the physical characteristics between wrestlers and therefore increase the percentage of performance that depends on technical and psychological skills. To be successful in international competitions, wrestlers must achieve an excellent level of physical fitness and physical condition. A suitable training program and dietary status are very important for increasing the level of sportive performance in wrestlers. A good and balanced diet for the wrestlers provides a high level of a healthy body, increased lean body mass, and low-fat percentage status

[Luciana 2012]. Depending on training type, fat mass is reduced. As the duration of the training is longer, the source of energy which is used by the body will change its direction through the fat, and body fat will become active. It is known that there is a decrease in body fat depending on the usage of fats [Yorulmaz 2005]. Research on body fat percentage conducted on active athletes showed that the average values of body fat between 6% and 15% are considered as acceptable [Pense and Turnagol 2006]. Excess fat cells in the body will have a braking effect on the muscles, so the movements will be limited because the muscles cannot perform their tasks efficiently and effectively [Yorulmaz 2005]. Studies published revealed that the percentage of body fat, speed, agility, and reaction

time has been the fundamental components of successful sports performance [Nepolion and Rani 2014].

Optimal body composition is a concern of the wrestler because competitors are matched by bodyweight and must 'make weight' prior to each meeting. They generally want to minimize the body fat level and the total body weight without losing their body strength and power [Yoon 2002]. The whole-body level of body composition characterizes body size and configuration, which is often described by anthropometric measures such as body weight, skinfold thicknesses, circumferences, and body mass index (BMI) among others [Shen et al. 2005]. BMI is employed globally to classify humans as normal, overweight, and obese. For health, BF and BMI are associated with reduced physical fitness, as it has been indicated by research conducted. The aim of this study was to present the effects of BMI and PBF of adult male wrestlers in national teams of different countries on the performance were investigated.

Material and Methods

Subjects

The subjects consisted of elite Greco-Roman wrestlers from the best teams in the top 10 countries (Hungary, United States, South Korea, Azerbaijan, Iran, Kazakhstan, Russia, Turkey, Finland, Armenia) in the world. They participated in the World Cup Greco-Roman wrestling competitions in Iran/Tehran in 2014. The wrestlers have more than 10 years of experience and are wrestlers with degrees in the Olympic, World, Europe, Africa, and Asia continents. The weight of wrestlers was in 59, 66, 71, 75, 80, 85, 98, 130 kg.

In this study, the effects of BMI and PBF on performance in senior male wrestlers in national teams from different countries were investigated.

Collection of Research Data

The data were gathered in four stages: at the beginning, the demographic characteristics of the wrestlers (age, country, etc.) were obtained.

At the second stage, height was assessed by using a portable stadiometer. Bodyweight and BF% were determined by using foot-to-foot bioelectrical impedance (i.e., the Tanita 300, Tanita Corporation of America, Inc., Arlington Heights, Illinois). The Tanita 300 demonstrated strong evidence of concurrent validity ($r = 0.94$; $P < 0.001$) 25 when compared with the "criterion standard" of dual-energy x-ray absorptiometry for body fat assessment. The Tanita 300 is a commonly used bioelectrical impedance field measure because of its portability and accuracy in determining BF%.

At the third stage, the Body Mass Index (BMI) was calculated using the standard formula; $BMI (kg/m^2) = BW (kg)/height^2 (m^2)$ [Kagawa, Ishida and Nakamura 2014; Mikkil et al. 2014].

At the fourth stage, the results of the competition were evaluated by the score sheet written by wrestling referees to obtain the performance of the wrestlers to determine their performance (match-winning, match losing, 1, 2, 4, 5 point techniques, and passive-caution) and success rate.

Statistical Analysis

The data obtained from wrestling score sheets were evaluated by using the SPSS19 package program. The Kolmogorov-Smirnov test was used to learn the normality of the data. Pearson test method, which is one of the parametric tests, was used to determine the relationship between normal variables. For non-normal variables, it was analyzed by Spearman Correlation Coefficient which is one of the nonparametric tests. One Way Analysis of variance (ANOVA) was used to determine if there were statistically significant differences between the means of two or more independent groups. If the null hypothesis is rejected in a one-way analysis of Variance and there is a difference between the groups, in order to look at the differences between the groups, LSD was used, which is a multiple comparison test, which allows us to evaluate the statistical significance of the differences between the groups. $p < 0.05$ was accepted at the level of significance [Berkan 2015].

Results

Table 1. BMI Status of Greco-Roman Wrestling Teams Participated in The World Cup

	ANOVA				
	Body Mass Index Averages of Wrestlers in Teams				
	Sum of squares	Sd	Square average	F	P
Between groups	14.38	9	1.59	.098	1.000
in groups	1104.27	68	16.23		
Total	1118.66	77			

As seen in Table 1, There was no statistically significant difference between the mean of the BMI's of the teams ($p > 0.05$).

According to the results in table 2, there was a negative correlation between BMI and 4 points according to the result ($p < 0.05$). There was a low correlation between BMI and passive-strike acceptance ($p < 0.05$). In addition, there was no relation between the percentage of winning, losing a match, the techniques of 1, 2 and 5 points ($p > 0.05$).

Data are presented in Table 3. BW, PBF, FFM average status of countries.

As seen in Table 4, there was no statistically significant difference between PBF averages of the Teams ($p > 0.05$).

According to the results in Table 5, There was a negative correlation between PBF and 4 points of wrestlers

Table 2. Evaluation of the Relationship between Wrestlers' BMI and Performance Greco-Roman Wrestling

		Pearson Correlation			Correlations			Spearman Correlation	
		Win %	Los %	1 Point Tech	2 Point Tech	4 Point Tech	5 Point Tech	Passive-Caution	
BMI	R	-.001	.001	-.018	-.177	-.276*	-.045	.232*	
	P	.995	.995	.876	.121	.015	.696	.041	
	N	78	78	78	78	78	78	78	

Abbreviations: **R**, correlation, **P**, P-value, **N**, Number, **SD**, standard deviation, **TECH**, technical points, **WIN**, winner, **LOS**, loser, **BMI**, Body Mass Index

Table 3. Distribution of Wrestling Teams according to BW, PBF and FFM Average Descriptive Statistics

Countries' Name		N	M	S.S
ARM	Body weight mean	8	84.00	19.88
	PBF	8	11.71	4.20
	FFM %	8	88.28	4.20
	FM Kg	8	10.57	6.60
	LBM Kg	8	73.42	13.33
AZA	Body weight mean	8	85.12	21.40
	PBF	8	11.67	4.06
	FFM%	8	88.32	4.06
	FM (KG)	8	10.68	6.88
	LBM (KG)	8	74.43	14.66
FIN	Body weight mean	7	86.28	22.99
	PBF	7	12.70	5.07
	FFM%	7	87.29	5.07
	FM (KG)	7	11.91	8.37
	LBM (KG)	7	74.37	15.04
HUN	Body weight mean	8	84.62	20.36
	PBF	8	13.00	4.62
	FFM%	8	86.99	4.62
	FM (KG)	8	11.82	7.29
	LBM (KG)	8	72.80	13.15
IRI	Body weight mean	8	86.25	21.71
	PBF	8	10.80	4.02
	FFM%	8	89.19	4.02
	FM (KG)	8	10.06	6.97
	LBM (KG)	8	76.18	15.02
KAZ	Body weight mean	8	84.50	20.23
	PBF	8	12.96	4.43
	FFM%	8	87.03	4.43
	FM (KG)	8	11.72	7.39
	LBM (KG)	8	72.77	13.04
KOR	Body weight mean	7	82.42	20.09
	PBF	7	11.11	3.56
	FFM%	7	88.88	3.56
	FM (KG)	7	9.77	5.63
	LBM (KG)	7	72.65	14.48
RUS	Body weight mean	8	84.00	21.05
	PBF	8	11.73	4.20
	FFM%	8	88.26	4.20
	FM (KG)	8	10.60	7.11
	LBM (KG)	8	73.39	14.25
TUR	Body weight mean	8	85.50	21.14
	PBF	8	11.49	3.97
	FFM%	8	88.50	3.97
	FM (KG)	8	10.55	6.76
	LBM (KG)	8	74.94	14.53
USA	Body weight mean	8	84.50	21.30
	PBF	8	12.20	5.73
	FFM%	8	87.79	5.73
	FM (KG)	8	11.34	9.03
	LBM (KG)	8	73.15	12.88

Abbreviations: **ARM**, Armenia, **AZA**, Azerbaijan, **FIN**, Finland, **HUN**, Hungary, **IRI**, Iran, **KAZ**, Kazakhstan, **KOR**, South Korea, **RUS**, Russia, **TUR**, Turkey, **USA**, United States America, **PBF**, Percent Body Fat, **FFM**, Fat Free Mass, **FM**, Fat Mass, **LBM**, Lean Body Mass, **BW**, Body Weight. **KG**, Kilo Gram.

Table 4. PBF Statuses of Greco-Roman Wrestling Teams

	ANOVA				
	PBF				
	Sum of squares	Sd	Square average	F	P
Between groups	39.90	9	4.43	.226	.990
in groups	1334.81	68	19.6		
Total	1374.71	77			

Table 5. Evaluation of The Relationship between Wrestlers' PBF and Performance Greco-Roman Wrestling

		Pearson correlation			Correlations		Spearman correlation	
		WIN %	LOS %	1 point tech	2 point tech	4 point tech	5 point tech	passive- caution
PBF	R	-.005	.005	-.066	-.096	-.288*	-.045	.246*
	p	.963	.963	.565	.406	.011	.697	.030
	N	78	78	78	78	78	78	78

Abbreviations: **R**, correlation, **P**, P-value, **N**, number

($p < 0.05$). There was a low correlation between PBF and passive caution ($p < 0.05$). In addition, there was no correlation between the PBF and the percentage of winning, losing 1, 2, and 5-point techniques ($p > 0.05$).

Table 6. Evaluation of the Relationship Between Obtained Title with PBF, BMI, by the Teams of the Participated in Greco-Roman Wrestling

	Correlations		
	Pearson correlation	PBF	BMI
Title of team	R	-.066	.014
achievement	p	.563	.905
	N	78	78

Abbreviations: **R**, correlation, **P**, P-value, **N**, number

Referring to table 6, there was no relationship between the degree of team achievement and PBF, BMI ($p > 0.05$)

Discussion

Wrestling is among the most popular and professionally organized sports branches. While wrestler's total BM relative to weight is similar across weight divisions, differences exist in body composition across athletes of varying BM. Our research question was: 'Is there any relationship of different BMI or PBF on the performance of elite wrestlers?' When we looked at the average age of the teams in our study, the average age of the Turkish team (23.87 ± 5.35) was determined as a younger team than the other teams. Also, the mean age of Iran's wrestling team (27.50 ± 1.60) was determined. In this case, the Iran wrestling team had the oldest team in the competition. The average height of the wrestlers was presented. According to the mean height of the teams, it was determined that the average of the IRI wrestlers (181.37 ± 9.27) was higher than the other teams. The overall average of the wrestlers was determined to be (177.25 ± 7.95), and the Kazakh wrestlers had a lower average height than the other wrestlers.

There was no statistically significant difference among the mean BMI of the teams ($p > 0.05$). Hassapidou and Manstrantoni [2001] found that wrestlers and control groups had similar BMI values. Andjelkovic *et al.* [2010] reported that there was no statistically significant difference between the BMI: 22.2 ± 1.5 mean of the players and showed that they are a homogeneous group. Kagawa, Ishida and Nakamura [2014] athletes reported their average weight and BMI values were similar between field players and goalkeepers. Luciana [2012] found that Italian national wrestlers anthropometric characteristics and body composition members in his study examined.

In this study we have found that there was a direct relationship between the BMI, PBF and performance of the wrestlers. There was a negative correlation between the wrestlers' BMI and 4 points. In addition, there was a low positive correlation between passive-caution. There was no correlation between BMI and match win percentage, match loss percentage 1, 2, and 5-point techniques. We were not able to find many studies in the literature that experience the relationship between successful performance and body composition in wrestling and other combat sports. We have found some studies on physical performance and body composition. In a study it was stated that there was a relationship between body mass index and leg strength and leg muscular endurance in young elite kabaddi athletes. Fakharian, Yunesian and Donyayi [2015] reported in their study the performance indicators and anthropometric and body composition relationship in body building champions. In the study conducted in the city of Shahrud, a significant positive correlation was found between body mass index and left and right hand's forces. A negative correlation between the body mass index and the number of pull-ups of the athlete was found to be significant. A significant relationship was observed between the body fat mass index and hip flexibility. A statistically significant relationship was found between body mass index and balance. It was emphasized that there was a significant relationship

between body mass index and anaerobic factors. Aydos, Akyuz and Uzun [2009] determined that the relationship between force measurements and some anthropometric parameters in the young elite wrestlers in the Turkish national team. Fakharian, Yunesian and Donyayi [2015], Aydos, Akyuz and Uzun [2009] reported the higher BMI, negatively affecting the performance of the athlete. If the BMI of the athlete is low, speed and quickness are positively affected. These data are compatible with our study. Due to high BMI, there was a negative correlation between 4 points and passive-caution.

There was no statistically significant difference between the mean scores of PBF. Kaynar [2014] found that there was no significant difference between pre- and post-training wrestlers' PBF and BFM values. Alpay, Karagoz, and Moghimi [2015] compared the body compositions of elite wrestlers; found no statistically significant difference between the body fat percentages. Demirkan et al. [2012] elite wrestlers selected among the athletes unselected by the national team PBF level, no significant difference was found between the values. The results of the current studies are compatible with our findings.

There was a negative correlation between the wrestlers' PBF and 4 points ($p < 0.05$). Besides, there was a low positive correlation between passive-caution ($p < 0.05$). There was no correlation between PBF and match win percentage, match loss percentage, 1, 2, and 5-point techniques ($p > 0.05$). Saka et al. [2008] in their study showed that PBF 9% increased one-minute push-up 36%, shuttle 27% and pull-up increased 45% running time of 2400 meters decreased by 15% no significant change was observed in BMI. Fakharian, Yunesian, and Donyayi [2015] did not show a significant relationship between PBF and anaerobic power factors. Hassapidou and Manstrantoni [2001] found that PBF was lower for athletes compared to athletes with controls. When the relationship between body composition and respiratory volume and exercise performance was found by Rastgar, Soltani, and Fashi [2012] professional football players, the results showed that there was a statistically significant relationship between PBF and athletic performance. Devecioglu [2010] more body fat ratio of the boxers had a negative impact on their performance. A high body fat ratio may lead to a reduction in the strength, agility, and flexibility of the boxer and to an excessive loss of energy. According to the above studies, the high PBF, prevents the athlete's performance, and the lower PBF, will increase the speed and quickness of the athlete. In our study, similar results were achieved with the above studies. And if the body fat ratio is higher, the speed and rapidity of the athlete's movement decrease. And these studies show the positive relationship between PBF and passive-caution and a negative correlation between PBF and 4 points. There was no correlation between championship titles by participating teams with the mean of PBF and BMI in the Greco-Roman wrestling world cup Iran, Tehran.

Conclusions

In this study, we interpret the present findings to confirm previous observations among the population of general athletes about the negative effect of elevated BMI and PBF on selected parameters of sports performance. The present results indicate that the excess body mass has a more negative effect on performance indicators in participating teams. Due to the appearance of the negative relationship between wrestlers' BMI and PBF with 4 points and passive caution, it is recommended to keep BMI and PBF in normal (wrestling sport-specific) ratio. The specific body fat and lean mass ratio must be determined.

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Badanie zależności między wartościami składu budowy ciała a wskaźnikami wyników zapaśników biorących udział w mistrzostwach świata

Słowa kluczowe: zapasy, wskaźnik masy ciała (BMI), sukces, puchar świata

Streszczenie

Wprowadzenie i cel pracy. Celem pracy było zbadanie wpływu składu ciała na wyniki zapaśników z dziesięciu najlepszych drużyn narodowych. Badania przeprowadzono na próbie 78 zapaśników (w wieku 20-30 lat) z 10 najlepszych drużyn zapaśniczych biorących udział w Pucharze Świata w Teheranie. Materiał i metody. W czasie badania określono charakterystykę demograficzną za pomocą kart informacyjnych, wskaźnika masy ciała (BMI) obliczonego za pomocą wzoru BMI (BMI = kg/m²), procentową zawartość tkanki tłuszczowej (PBF) za pomocą urządzenia Tanita (TBF-300 A). Zebrano również dane dotyczące wyników zapaśników na podstawie ich występów w mistrzostwach świata. Dane analizowano przy użyciu programu pakietowego SPSS19. Do normalnego rozkładu danych zastosowano test K-S, do zbadania zależności między średnimi zmiennych - współczynnik korelacji Pearsona i Spearmana, do oceny średniej różnicy między zmiennymi - sparowany test T i Anova, a do porównania średnich między grupami - test LSD. Wyniki. Nie zaobserwowano różnic w średnich BMI i PBF pomiędzy zespołami. Stwierdzono istotną zależność między BMI i PBF a niektórymi wskaźnikami efektywności. Nie zaobserwowano istotnej zależności między BMI, PBF i poziomem zaawansowania uczestniczących zespołów.

Wnioski. W tym badaniu zinterpretowano obecne wyniki, aby potwierdzić wcześniejsze obserwacje wśród ogólnej populacji sportowców o negatywnym wpływie podwyższonego BMI i PBF na wybrane parametry wyników sportowych. Obecne wyniki wskazują, że nadmiar masy ciała ma bardziej negatywny wpływ na wskaźniki wydajności w uczestniczących zespołach.