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Examination of Some Physical, Hematological Parameters and Iron Status of Greco-Roman Wrestlers in the Age Category of Cadets by Weight Classes

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KEYWORDS Wrestling.Fitness.Leukocyte.Erythrocyte.Thrombocyte.Ferritin

ABSTRACTThis research is conducted to examine physical, hematological parameters, and iron status of Greco-Roman wrestlers. A total of 55 healthy Greco-Roman wrestlers in the age category of Cadets including 18 lightweight, 20 middleweight and 17 heavyweight wrestlers participated in the study, voluntarily. Physical fitness, hematological parameters and iron status were measured. Kruskal-Wallis Test, a non-parametric test, was used for the comparison of three independent groups. Tukey HSD test was used to determine the source of difference. Some significant differences were found in values of the handgrip strength test, VO_2max.test and body fat percentage according to the results of this study. Some significant differences were found in hematological parameters and neutrophils, lymphocytes, monocytes, mean corpuscular volume, platelet distribution width, iron and ferritin which all are iron status values. The source of differences in physical, hematological parameters and iron status are formed of values of lightweight Greco-Roman wrestlers. Physical structure differences may have the effects of trainings differentiated by weight classes.

INTRODUCTION

Today, there are two styles in wrestling for men which is one of the most important sports of the modern Olympic Games. Greco-Roman is a classic style that only allowed the upper body movements. Both lower and upper body wrestling are allowed in freestyle wrestling and this constitutes the other form of the wrestling (Lopez-Gullon et al. 2011).Both in two styles, the victory condition is met either by holding an opponent's shoulders or scapulae (shoulder blades) on the wrestling mat for a prescribed period of time or scores of the wrestlers for their performance in two three-minute periods (Yoon 2002). Such as in most sports, also in wrestling, aerobic and anaerobic energy systems operate at various levels (Callan et al. 2000). Wrestling is a sport that dynamic and isometric muscle strength, body composition requiring strength and endurance and hydration status affect the performance, considerably (Horswill 1992).A match between two high-skilled Greco-Roman wrestler is characterized by high intensity of competitive actions and high-demand technical and tactical skills along with appropriate level of speed, strength, both speed and strength endurance (Khalmukhamedov et al. 2004).The purpose and content of wrestling trainings are to develop these characteristics. One of the factors affecting the training is the physical structure of the individual (Gokdemir 2000). Optimal body composition is a matter of concern for wrestlers because wrestlers participate in matches by their body weights and need to set their weights before each match. For this reason, as majority of wrestlers want to minimize their total body weight and the amount of fat in their bodies, they also want to increase the lean tissue mass in their bodies (Yoon 2002). However, the relationship between body fat percentage and success in wrestling has not been shown in the previous studies (Horswill 1992; Yoon 2002).Measuring the current state of a wrestler by using physical aptitude tests, both provides information to a wrestler and his coach about the physiological capacity of the wrestler and allows making a comparison between his capacity and reference ranges of his peer groups. At the same time, the assessment of current state reveals the strengths and weaknesses of the athlete and accordingly, enables the development of optimal training programs (Mirzae et al. 2009). Studies conducted shows that general physiological profiles of successful wrestlers have high anaerobic strength

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and capacity, muscular strength and aerobic strength, above-average flexibility and lean body structure with mesomorphic structure at the maximum level (Horswill 1992; Yoon 2002). Exercise can affect the blood parameters. Physical and physiological responses have great importance in hematology (Astrand et al. 1986).Hematological parameters are necessary and important for purposes such as control, check, prevention and diagnosis in sports medicine (Younesian et al. 2004). Hematological examination is especially important for the evaluation of health and performances of athletes in situations such as high training loads, strong psychophysiological stress during matches, changes in homeostasis and shifting of biochemical and hematological values out of physiological range (Banfi 2008; Mercer et al. 2005). Changes in red blood cells and human iron metabolism are thought to play an important role in prediction of optimal physical performance by use of hematological parameters(Dopsaj et al. 2013). Iron plays an important role in many cellular processes such as DNA synthesis and electron transport. In addition, it is an important constituent of oxygen-carrying hemoglobin in the blood. On the other hand, ferritin is one of the determinants commonly used for the status of iron stores. For this reason, iron deficiency can affect physical performance (Schumacher et al. 2002). Nutritional anemia is widely seen for sports branches in which especially weight reduction is common. Gymnasts, wrestlers, and endurance runners are the most prominent members of this category (Shaskey et al. 2000). Red blood cell (RBC), hemoglobin (HGB), hematocrit (HCT), medium corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), red blood cell volume distribution width (RDW), serum iron (SI), serum iron binding capacity (SIBC), serum ferritin (SF) can be demonstrated as useful tools in monitoring iron deficiency (Dopsaj et al. 2013). There are sufficient number of studies about wrestling focused on hematological parameters, iron status and examination and follow-up of physical values but there are only a limited number of studies examining these parameters by weight classes. For this reason, the aim of our study is to examine whether some physical, hematological parameters, and iron status of the Greco-Roman wrestlers in the age group of cadets who are involved in long-term wrestling trainings change by the weight classes or not.

METHODOLOGY

Subjects: A total of 55 healthy Greco-Roman wrestlers in the age category of Cadets including 18 lightweight, 20 middleweight and 17 heavyweight wrestlers who have been accommodating as boarders in the *Milas*Wrestling Training and Education Center at least for two years, participated in the study, voluntarily. These wrestlers were divided into three classes by the weight categories as lightweight (39kg-50kg), middleweight (54kg-69kg) and heavyweight (76kg-100kg) wrestlers (FILA 2010). Healthy athletes, who have been training wrestling at least for two years, were included in the study.

Training Content: Endurance, strength, special technical workouts, quick strength workouts and tactical workouts and exercises for games specific to the sports branch and competition. The exercises and workouts had have been made 5 days a week and each one was about 90 minutes.

Height (cm) and Weight (kg) Measurements: Height was measured to the nearest 0.1 cm by using a stadiometer. Weight was measured to the nearest 0.1 kg on an electronic scale (Seca Corp, Birmingham, United Kingdom).

Aerobic Power: The 20-meter shuttle run test followed previously described protocols where participants ran back and forth between two lines set 20 m. apart. Participants commenced running at an initial speed of 8.5 $km \cdot h^{-1}$, which increased by 0.5 $km \cdot^{h-1}$. The pace was established by an audio signal emitted from a compact disc. Participants were given a warning if they did not reach the line in time with the audio signal, and the test was stopped if the participant could not reach the line for two successive shuttles or if the participant stopped voluntarily. Completed shuttles were converted to total distance covered and velocity at exhaustion for statistical analysis. According the results from the study, the value ofmaks. VO_2 was found as $ml/kg/min^{-1}$(Leger et al. 1982).

Handgrip Strength: The handgrip strength of the dominant hands was evaluated using a handgrip dynamometer (Takei, Tokya, Japon). The test was performed in the standing position. The subject held the dynamometer in the hand to be tested with the arm at right angles and the elbow by the side of the body. Subject was then asked to squeeze the dynamometer with her maximum isometric effort for a 5 s period. Test was repeated 2 times with both hands. 30 s resting intervals were provided between measurements and the highest score was recorded (ACSM 2000).

30-second Curl-up: The subjects lied on their back, with their knees at right angles (90 degrees) and feet flat on floor the negative changes in all variables. The subject then attempted to perform one complete sit-up during 30 seconds. Number of performed sit-ups was counted (Sparling 1997).

Body Composition: *The* Bioelectrical impedance (Tanita TBF- 401A, Tokyo, Japon) measurements were made adhering to the manufacturer's guidelines. The measurements were performed with the subjects stepping onto the measuring platform without shoes and after wiping the soles of their feet. Measurements were taken at a similar time point each day after an overnight fast and limited physical exertion in an attempt to reduce measurement error. From weight, height, age, sex and bioelectrical impedance, BF was calculated from a built-in equation of the analyser. The amount of BF is expressed as a percentage of total weight. The analyser produces a printout with data of the BF after every measurement (Prins et al. 2008).

Flexibility: Flexibility was measured with the sit and reach test using the procedures of the Eurofit directive. Subjects sat on the floor with knees extended and feet placed at 90 degrees against a box. Testing was performed without shoes. The edge of the box was 15cm behind the zero point for measurement such that if the fingertips were in line with the box edge, a flexibility score of 15cm was assigned. The participants were asked to reach forward slowly and extend forward as far as possible, in a smooth stretching movement. Scores were measured to the nearest 0.5cm. The best of three trials was recorded (Haugen et al. 2014).

Balance: Balance was measured using the Flamingo balance test from the Eurofit test battery. Subjects balanced on one leg (without shoes) on a 3 cm. wide plank, 4 cm. above the ground, for 60 seconds. Participants held the other foot with their hand. When in balance a 60 second timer was started. The time was stopped each time an error (falling off the plank or letting go of the foot). The result was registered as numbers of errors made before achieving 60 seconds of balance time. Subjects who fell repeatedly with minimal balance time were assigned an error score of 30 (Haugen et al. 2014).

30-meter Sprint: The 30-meter sprint test was used to determine quickness and speed. The sprint time for 30 m. was measured using photocell (Newtest 300 Series Powertimer, Finland) positioned at the starting and finishing lines at a height of 1 m. Participants started from a standing position, placing their forward foot 0.5 m behind the sensor. The measurement of the time was performed twice. The faster time was selected for additional analysis (Imai et al. 2014).

Reaction Time: Reaction type was measured by using Newtest 300 Series Powertimer device. This device can record visual and auditory reaction time in terms of 1/1000 seconds. Five-repetition adaptation test was performed before the measurements recorded. Athletes made their hands ready on the buttons before the order. The measurement started after the order of the person who made the measurement. 10-repeated mixed reaction time values of all the participants were got and the result was found by calculating the arithmetic mean after excluding the best (the highest) and the worst (the lowest) values (Tamer 2000).

Hematological Parameters and Iron Status: White blood cell (WBC), neutrophils (NEU), lymphocytes (LYMY), monocytes (MONO), eosinophils (EOS), basophils (BASO), red blood cell (RBC), hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume (MCV), mean count of hemoglobin (MCH), mean concentration of hemoglobin count (MCHC), RBC distribution width (RDW), platelet count (PLT), mean platelet volume (MPV), platelet distribution width (PDW) and platelet crit (PCT) were taken as bases to hemotological parameters. Iron, iron binding capacity (TIBC) and ferritin levels were measured as iron status (kit) values. Subjects were warned about not to eat or drink anything after 22:00 pm one day before their blood samples were taken. Blood samples were taken in laboratory between 8:30-09:30 in the morning on an empty stomach. Blood samples were taken into tubes with EDTA, hematological parameters and iron status (kit) were analysed with architect brand blood count device in Milas State Hospital laboratory.

Statistical Analyses: SPSS 16.0 Statistical packageswere used for analysing the data. Kruskal – Wallis Test, a non-parametric test, was used for the comparison of three independent groups. Tukey HSD test was used to determine the source of difference. The significance level was set as $p<0.05$.

RESULTS

The findings of this study that had been conducted to examine physical, hematological parameters and iron status of Greco-Roman wrestlers in the age group of Cadets by weight classes are given in the form of tables.In this study, the mean ages of lightweight, middleweight and heavyweight of wrestlers were found as 15.29±.84, 15.38±.74 and 15.11±2.19, respectively. The mean of body weights were as 45.20±4.25, 64.51±4.64 and 83.95±9.14 kg, respectively. The mean training years were found as 3.41±.71, 3.23±.88 and 3.27±1.56, respectively (Table 1).

Table 1:Means and standard deviation values of age, height, weight and training year

Variables	*Light weight X±SD(1)*	*Middle weight X±SD(2)*	*Heavy weight X±SD(3)*
Age (year)	15.29 ± .84	15.38 ± .74	15.11±2.19
Height (cm)	162.94±7.98	167.61±5.51	172.86±6.72
Body weight (kg)	45.20±4.25	64.51±4.64	83.95±9.14
Training year (year)	3.41± .71	3.23± .88	3.27±1.56

A statistically significant difference was found in values of hand grip strength, body fat percentage and VO_2 max. The difference in values of handgrip strength was because of the reason that the averages of lightweight wrestlers were lower than the averages of middleweight and heavyweight wrestlers. The difference in body fat percentage resulted from the fact that values of heavyweight wrestlers were higher than the others and the difference in values of VO_2 max resulted from the fact that values of heavyweight wrestlers were lower than the other (Table 2).

Significant differences were found in NEU, LYMY and MONO values. The difference in the value of NEU resulted from the fact that the values of lightweight wrestlers were lower than the values of middleweight and heavyweight wrestlers. The difference in the value of LYMY resulted from the fact that the values of lightweight wrestlers were higher than the others. The difference in the value of MONO was because of the fact that middleweight wrestlers had lower values when compared with the two other weight classes (Table 3).

A significant difference was found in MCV values. The difference resulted from the fact that

Table 2: Physical parameters values of Greco-Roman wrestlers in terms of weight

Variables	*Lightweight X±SD(1)*	*Middleweight X±SD(2)*	*Heavyweight X±SD(3)*	*Kruskal Wallisp*	*Tukey HSDp*
Handgrip (kg)	31.44± 5.54	41.70± 8.57	45.53±10.94	0.000***	1-2***,1-3***
Flexibility (cm)	35.05± 4.13	38.37± 8.76	39.72± 5.99	N.S	N.S
$MaksVO_2$ (ml.kg.min)	47.16± 4.74	47.77± 5.43	43.16± 4.92	0.008**	1-3*, 2-3*
Body fat %	5.13± 2.37	6.63± 2.25	15.76± 6.71	0.000***	1-3***,2-3***
Mixed reaction (sn)	.31± .04	.30± .10	.30± .04	N.S	N.S
Balance (sn)	25.33±18.99	28.03±29.49	24.07±21.78	N.S	N.S
30m. Sprint (sn)	5.09± .37	4.68± .42	5.09± .99	N.S	N.S

N.S: Not Significant, *p<0.05, **p<0.01,***p<0.001.

Table 3: Leukocyteer parameters of Greco-Roman wrestlers in terms of weight

Variables	*Lightweight X±SD(1)*	*Middleweight X±SD(2)*	*Heavyweight X±SD(3)*	*Kruskal Wallisp*	*Tukey HSDp*
White blood cell(WBC) k/uL	6.17±1.06	7.30±1.20	6.54±1.68	N.S	N.S
Neutrophils (NEU) %	49.54±5.12	59.00±7.54	55.70±4.12	0.000***	1-2***, 1-3*
Lymphocytes (LYMY) %	38.40±5.06	31.29±6.66	32.32±5.10	0.006**	1-2**, 1-3*
Monocytes (MONO) %	8.62±2.14	6.90± .75	8.95±2.31	0.007**	1-2*, 2-3**
Eosinophils (EOS) %	3.14±1.34	2.36±1.52	2.70±2.10	N.S	N.S
Basophils (BASO) %	.28± .09	.42± .21	.32± .15	N.S	N.S

N.S: Not Significant, *p<0.05, **p<0.01,***p<0.001.

the values of lightweight wrestlers were lower than the values of middleweight wrestlers (Table 4).

A significant difference was found in PDW values. The difference resulted from the fact that the values of lightweight wrestlers were lower than the values of middleweight wrestlers (Table 5).

A significant difference was found in values of iron and ferritin. The difference in the values of iron resulted from the fact that the values of lightweight wrestlers were lower than the values of middleweight wrestlers and the difference in the values of ferritin resulted from the fact that the values of lightweight wrestlers were lower than both the values of middleweight wrestlers and the values of heavyweight wrestlers (Table 6).

Table 4: Erythrocyteer parameters of Greco-Roman Wrestler in terms of weight

Variables	*Lightweight X±SD(1)*	*Middleweight X±SD(2)*	*Heavyweight X±SD(3)*	*Kruskal Wallisp*	*Tukey HSDp*
Red blood cell (RBC) M/uL	5.35± .38	5.25± .36	5.24± .34	N.S	N.S
Hemoglobin (HGB) g/dL	14.60± .74	14.88± .73	14.34±1.49	N.S	N.S
Hematocrit (HCT) %	42.83±2.41	44.40±2.11	42.90±3.88	N.S	N.S
Mean corpuscular Volume (MCV) fL	79.98± 2.86	84.76±6.54	81.62±3.21	0.032*	1-2*
Mean count of hemoglobin (MCH) Pg	27.22±1.23	28.44±2.58	27.29±1.58	N.S	N.S
Mean concentration of hemoglobin count (MCHC) g/dL	34.05± .48	33.52±1.02	33.43±1.22	N.S	N.S
RBC distribution width(RDW) %	13.35± .37	13.37± .88	13.62± .48	N.S	N.S

N.S: Not Significant, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

Table 5: Thrombocyteer parameters of Greco-Roman Wrestler in terms of weight

Variables	*Lightweight X±SD(1)*	*Middleweight X±SD(2)*	*Heavyweight X±SD(3)*	*Kruskal Wallisp*	*Tukey HSDp*
Platelet count (PLT) K/uL	294.58±41.13	265.15±42.72	251.00±59.51	N.S	N.S
Mean platelet volüme (MPV) fL	9.48± .37	9.98± 1.24	9.83± 1.18	N.S	N.S
Platelet distribution width (PDW) %	13.25± 2.92	15.49± 1.45	14.57± 2.33	0.041*	1-2*
Platelet crit (PCT) %	.27± .03	.26± .03	.25± .06	N.S	N.S

N.S: Not Significant, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

Table 6: Iron status parameters of Greco-Roman wrestlers in terms of weight

Variables	*Lightweight X±SD(1)*	*Middleweight X±SD(2)*	*Heavyweight X±SD(3)*	*Kruskal Wallisp*	*Tukey HSDp*
Ironug/dL	89.17±22.29	115.90±31.80	96.47±22.60	0.038*	1-2*
Iron Binding capacity (TIBC) ug/dL	393.56±32.81	375.00±29.24	366.79±23.69	N.S	N.S
Ferritinng/ml	21.55± 5.76+	42.47±18.97	59.13±29.83	0.000***	1-2*, 1-3***

+under the reference value, N.S: Not Significant, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

DISCUSSION

Physical Parameters: A high level of physical development is required for a high level of training. Physical development is the most important key element to which training is based upon. A wrestler under the umbrella of physical development should act in line with an understanding of improving his endurance, strength, speed and mobility and obtaining a high level of coordination and having an adaptable and developed body(Gokdemir 2000). Some significant differences were found in values of the hhand-grip strength test, VO_2max test and body fat percentage (BFP) according to the results of this study. However, no significant differences were observed in values of flexibility, speed, balance and reaction times. The difference in the values of hand grip strength resulted from the fact that values of the lightweight wrestlers were lower than the values of middleweight wrestlers and the values of heavyweight wrestlers. The reason of the difference in the value of VO_2 max resulted from the fact that the values of heavyweight wrestlers were lower than the values of lightweight wrestlers and the values of middleweight wrestlers. The difference in the value of BFP by weight classes resulted from the fact that heavyweight wrestlers have higher body fat percentages when compared to lightweight wrestlers and middleweight wrestlers.

The researchers can specify the literature review related to the present research as follows.

Francihini et al. (2014) showed that skinfold thickness of heavyweight judo athletes were found to have the highest values as compared with lightweight and middleweight judo athletes. García-Pallarés et al. (2011) examined whether there is any difference between elite male freestyle wrestlers in terms of anthropometric, physical, neuromuscular and physiological parameters. 92 male wrestlers were divided into groups by their weight classes as lightweight, middleweight and heavyweight wrestlers. Some significant differences were found in the values of BFP, grip strength and back strength by their weight classes. The values of lightweight wrestlers are low. Karnincic et al. examined the effect of body weight on some selected physiological parameters in their study that they conducted in 2013. This study divided 60 athletes into 3 different groups by their weight classes as lightweight, middleweight and heavyweight wrestlers and each group consisted of 20 athletes. Each wrestler was subjected to a wrestling match and the heart rate, glucose and blood lactate values of these wrestlers were measured before and after these matches. The different body weights of athletes, did not affect lactate and glucose levels of athletes before, during and after the wrestling match. Lactate and glucose dynamics were found the same for all weight classes. Low significance level was found between lactate and glucose levels of lightweight wrestlers after 5 minutes of rest after the 3rd period of the match (Karnincic et al. 2013). Saad (2012) examined the physiological performances of Egyptian wrestlers competing in lightweight and middleweight classes both after the rest and the effort in his study that he conducted in 2012. A total of 30 wrestlers including 12 lightweight wrestlers with body weight ranging from 50kg to 60kg and 18 middleweight wrestlers with body weight ranging from 66kg to 84kg, participated in this study and these athletes were divided into two groups. As a result, although the body weights of the wrestlers differ significantly between two groups, the physiological variables for two groups were found very close to each other. Significant differences were found between parameters of lightweight and middleweight wrestlers such as blood glucose and dialostic blood pressure after the effort (Saad 2012).There are also some other studies stating that physical performance increases due to long-term wrestling trainings (Yamaner 2012).There some other studies revealing that physical performance increases (Cicioglu et al. 2007), that body weight, body fat percentage, strength and power values reduce (Ratames et al. 2013), that Greco-Roman wrestlers are stronger and powerful compared to freestyle wrestlers (Rezasoltani et al. 2005), and that especially the hand and forearm muscles and leg muscles of Greco-Roman wrestlers are more dominant as a result of the explosive force exhibited due to maximal force than the others (Bayraktar et al. 2012) during wresting season.

Hematological Parameters: The amount of leukocytes in the blood increases as a result of increased and accelerated blood flow with the mixing of leukocytes adhering to the vessel walls to the blood. Also, hormonal changes play a role in this increase (Waern et al. 1993). The more the stress accompanying exercises is, the more the increase in the amount of leukocytes becomes. This increase is more apparent and significant especially in intense exercises. The main reason for this increase is the increase in blood pressure during exercise (especially increase of systolic blood pressure), thus the increase in fluid filtration provided by capillaries of arterial tissue between tissues. Another reason, the increase of metabolites in the fluid between tissues as a result of increasing metabolism, thus increase in osmotic pressure and the withdrawal of water between tissues (Karacabey et al. 2004). The increase in thrombocytes can be explained with hemoconcentration due to exercise as well as increase in the number of blood-platelets due to the factors putting the body under stress and that this stress cause nervous system activity (Gunay et al. 2006).The averages of hematological values of our study were within the normal reference range. Significant differences were found in the values of NEU, LYM, MONO, MCV and PDW by weight classes. No significant difference was found for the values of WBC, EOS, BASO, RBC, HGB, HCT, MCH, MCHC, RDW, PLT, MPV and PCT. The differences in the values of NEU and LYM were resulted from the fact that the values of lightweight wrestlers were lower than both the values of middleweight and heavyweight wrestlers. The reason for the difference in the value of MONO resulted from the fact that the values of middleweight wrestlers were lower than both the values of lightweight and heavyweight wrestlers. The reason for the difference in the values of MCV and PDW resulted from the fact that the values of lightweight wrestlers were lower than the values of middleweight wrestlers.

There are some studies in the literature conducted on hematological parameters. Magazanik et al. (1988) examined the effect of chronic exercise on erythrocyte values and stated that this parameter decreases as a result of this effect.This increase in the number of leukocytes can be explained with the joining of marginal (very few) leukocytes into the blood circulation. Otherwise, the blood flow increases during the exercise and the circulation begins to accelerate. Leukocytes in the vessel wall join to the bloodstream and thus, the number of leukocytes in the blood increases(Chen et al. 1989).Ricci et al. (1988) found that hematological parameters decrease due to chronic exercise. Cakmakci (2009) could not found any significant difference between leaukocyte, thrombocyte, hemoglobin and hematocrit parameters of taekwondo athletes taken before and after their training camp. Kara et al. (2010)could not found any significant difference between hemoglobin, hematocrit, erythrocyte, leukocyte, and thrombocyte levels of elite athletes involved in two different sports branches. It has been reported that thrombocyte (PLT) level increases for wrestlers after the training according to the research conducted on wrestlers (Koushi et al. 2013).

There are some studies comparing athletes and sedentary groups in which stating lymphocytes are found low (Papa et al. 1989), high (Baj et al. 1994; Nieman et al. 1993) or do not change (Nieman et al. 1995; Tvede et al. 1991). There are some researches indicating that it does not significantly effect on the neutrophil (Hack et al. 1992;Pyne 1994; Baj et al. 1994), too. Some significant differences were found in thrombocyte and plasma variability according to the analyses of blood values performed on wrestlers. Significant differences could not be found in values of hemoglobin, hematocrit, erythrocyte and leukocyte (Yamaner 2012).Brandau et al. (2014) stated that participation in the Brazilian Jiu-Jitsu competition caused significant increases in leukocytes, neutrophils, monocytes, platelet count.

Iron Status: Some events such as intravascular hemolysis, gastrointestinal blood fluid increase and hematuria, develops during exercise due to iron deficiency in addition to intense leg movements during and after intense exercises, thus these lead to increase in the amount of hemoglobin (Beard et al. 2000; Deitrick 1991; Dressendorier et al. 1992). It was seen in the previous studies that iron and especially ferritin and iron store protein decrease in athletes. The reason for this may arise from an increasing loss of water in intestines and kidneys due to absorption and sweating modified by intestinal tract and a paired increase of the synthesis of iron-containing proteins (Lampe et al. 1986; Newhouse et al. 1988).In our study, iron and iron binding capacity are within normal reference ranges for all weight classes. Whilst, ferritin is within normal reference range for middleweight and heavyweight Greco-Roman wrestlers, it is low for lightweight Greco-Roman wrestlers. Significant differences were found in the values of iron and ferritin by weight classes. However, a significant difference could not be found in the values of iron binding capacity. The reason for the difference in the value of iron is that lightweight wrestlers have lower values compared to middleweight wrestlers. The difference in the value of ferritin was resulted from the fact that the values of lightweight wrestlers were lower than both middleweight and heavyweight wrestlers.

There are some studies and researches on the subject. Soslu et al. (2014) examined the iron and iron binding capacity and ferritin levels of 8 runners and 8 skiers at the level of national team after an exercise program of 12 weeks. Whilst, significant differences were found at the level of iron after the training, there were no significant differences in iron binding capacity and ferritin levels.Choudhary et al. (2011) examined the effect of exercise on iron status and hemoglobin levels of trained and nontrained study subjects. As a result, when they were compared to each other after the exercise, it was seen that serum iron was decreased and hemoglobin increased for nontrained individuals compared to trained individuals.It has been reported that the value of ferritin decreased (Pouramir et al. 2004; Wilkinson et al. 2002), and total iron binding capacity increased (Pouramir et al. 2004) after a long-term exercise. It was observed that the level of ferritin increased (Schumacher et al. 2002), did not change (Rahmani-Nia et al. 2007) whereas iron was reduced (Rahmani-Nia et al. 2007) after a medium and high-intensity exercise.

CONCLUSION

That doing long-term wrestling trainings cause different effects by weight classes can be attributed to the effort capacity of individuals. Training intensity, duration and frequency are thought to cause differences in physical and hematological parameters and iron status of wrestlers by weight classes. Besides, wrestling is a sports branch in which a tight weight control is available. It's likely to say that lightweight wrestlers are the most affected weight category by physical trainings and nutrition because of weight control and loss. Various researches on the effect of wrestling trainings on physical and hematological parameters and iron status values are available.

RECOMMENDATIONS

However, there is limited number of studies by weight classes. The findings of these researches should be supported by more researches. The trainers may be suggested to follow the hematological parameters and iron status, especially iron deficiency, as well as the physical performance of their wrestlers and to take the necessary measures.

REFERENCES

American College of Sports Medicine (ACSM) 2000. Strength training by children and adolescents. *Pediatrics*, 107: 1470-1472.

Astrand PO, Rodalf K 1986. *Work Physiology Physiological Bases of Exercise*. New York: McGraw-Hill Book Company.

Baj Z, Kantorski j, Majewska E, Zeman K, Pokoca L, Fornalczyk E, Tchorzewski H, Sulowska Z, Lewicki R1994. Immunological status of competitive cyclists before and after the training season. *Int J Sports Med*, 15: 319-324.

Banfi G 2008. Reticulocytes in sports medicine. *Sports Med*, 38: 187-211.

Bayraktar I, Deliceoglu G, Tekelioglu A, Hazir M 2012. Güreþ stillerine göre 15-17 yaþ aralýðýndaki güreþçilerin bazý fiziksel parametrelerinin karþýlaþtýrýlmasý. *Uluslararasý Hakemli Akademik Saglýk ve Týp Bilimleri Dergisi*, 2(2): 56-67.

Beard J, Tobtn B 2000. Iron status and exercise. *Am J Clin Nutr*, 72: 594-597.

Brandao F, Fernandes HM, Alves JV, Fonseca S, Reis VM 2014. Hematological and biochemical markers after a Brazilian Jiu-Jitsu tournament in world-class athletes. *Revista Brasileira de Cineantropometria & Desempenho Humano*, 16(2): 144-151.

Cakmakci E 2009. Effects of camp term on some hematological parameters in male taekwondoers. *Nigde University Journal of Physical Education and Sport Sciences*, 3(1): 21-29.

Callan SD, Brunner, DM, Devolve KL, Mulligan SE, Hesson, J, Wilber RL, Kearney JT 2000. Physiological profiles of elite freestyle wrestlers. *Journal of Strength and Condition Research*,14: 162-169.

Chen H,Tang Y, Jen CJ 1989. Effect of acute exercise on bleeding time, bleeding amount and blood celi counts: A comparative study. *Thromb Res*, 55: 503-510.

Choudhary S, Rajnee, Binawara BK 2011. Effect of exercise on serum iron, blood haemoglobin and cardiac efficiency. *Journal of Postgraduate Medical Institute (Peshawar-Pakistan)*, 26(1): 13-16.

Cicioglu I, Kurkcu R, Eroglu H,Yuksek S 2007. 15-17 Yaþ grubu güreþçilerin fiziksel ve fizyolojik özelliklerinin sezonsal deðiþimi. *Spormetre Bed Egt Spor Bil Derg*, 5(4): 151-156.

Deitrick RW 1991. Intravascular haemolysis in the recreational runner. *Br J Sporis Med*, 25: 183-187.

Dopsaj V, Martinovic J, Dopsaj M, Kasum, G, Kotur-Stevuljevic J, Koropanovski N 2013. Hematological, oxidative stress, and immune status profiling in elite combat sport athletes.*The Journal of Strength & Conditioning Research*, 27(12): 3506-3514.

Dressendorier RH, Wade CE, Frederick EC 1992. Effect of shoe cushioning on the development of reticulocytosis in distajice runners. *Am J Sports Med*, 20: 212-216.

FILA 2010. From <http://www.fila-wrestling.com/images/documents/regles/2009_wrestling _rules.pdf> (Retrieved on 28 February 2010).

Franchini E, Sterkowicz-Przybycien K, Takito MY 2014. Anthropometrical profile of judo athletes: Comparative analysis between weight categories. *Int J Morphol*, 32(1): 36-42.

García-Pallarés J, López-Gullón JM, Muriel X, Díaz A, Izquierdo M 2011. Physical fitness factors to predict male Olympic wrestling performance. *European Journal of Applied Physiology*, 111(8): 1747-1758.

Gokdemir K 2000. *Güreþ antrenmanýnýn bilimsel temelleri*. Ankara: Poyraz Ofset.

Gunay M, Tamer K, Cicioglu I 2006. *Spor fizyolojisi ve performans ölçümü*. Ankara: Gazi Kitabevi, Baran Ofset.

Hack V, Strobel G, Rau JP, Weicker H 1992. The effect of maximal exercise on the activity of neutrophil granulocytes in highly trained athletes in a moderate training period. *Eur J Appl Physiol*, 65: 520-524,

Haugen T, Hoigaard R, Seiler S 2014.Normative data of BMI and physical fitness in a Norwegian sample of early adolescents. *Scandinavian Journal of Public Health*, 42: 67–73.

Horswill CA 1992. Applied physiology of amateur wrestling. *Sports Med*, 14: 114–143.

Imai A, Kaneoka K, Okubo Y, Shiraki H 2014. Effects of two types of trunk exercises on balance and athletic performance in youth soccer players. *International Journal of Sports Physical Therapy*, 9(1): 47.

Kara E, Özal M, YavuzHU 2010. Comparison of the blood parameters and respiratory functions of elite wrestlers and basketball players. *Selcuk University-Journal of Physical Education and Sport Science*,12: 36-41.

Karacabey K, Peker I, Pasaoglu A 2004. Effect on ACTH cortizol insulin and glucose metabolism in volleyball players of different exercise applications. *Journal of Sports and Medical*, 12(1): 7-12.

Karninèiæ, H, Krstuloviæ S, Baiæ M 2013. The Influence of body weight on chosen physiological parameters in wrestling. *Journal of Human Kinetics*, 37(1): 119-127.

Khalmukhamedov RD, Tajibayev SS 2014. Dynamics of the parameters of general physical preparation of junior wrestlers within training stages. *International Journal of Wrestling Science*, 4(1): 20-22.

Koushi MH, Mollanovruzib A, Rashidlamirc A 2013. The Effect of wrestling exercise in morning and afternoon on some hematological indices. *International Journal of Applied Exercise Physiology*, 2(1): 11-17.

Lampe JW, SlavinJL, Apple FS 1986. Poor iron status of women runners training for a marathon. *Int J Sports Med*, 7: 111-114.

Leger L, Lambert J 1982. A maximal multistage 20-m shuttle run test to predict VO_2max. *Eur J Appl Physiol Occup Physiol*, 49: 1-12.

Lopez-Gullon MJ, MurielX, Dolores Torres-BoneteM, Izquierdo M,Garcia-Pallares J 2011. Physical fitness differences between freestyle and Greco-Roman elite wrestlers. *Archives of Budo*, *7*(4): 217-225.

Magazanik A,Weinstein Y, Dlin RA, Schwartzman MD, Allalouf D 1988. Iron deficiency caused by 7 weeks of intensive physical exercise. *Eur J Appl Physiol*, 57: 198-202

Mercer KW, Densmore JJ. 2005. Hematologic disorders in the athlete. *Clin Sports Med*, 24: 599-621.

Mirzaei B, Curby DG, Rahmani-Nia, F, Moghadasi M 2009. Physiological profile of elite Iranian junior freestyle wrestlers. *J Strength Cond Res*, 23(8): 2339-2344.

Newhouse IJ, Clement DB 1988. Iron status in athletes: An update. *Sports Med*, 5: 337–352.

Nieman DC, Brendle D, Henson DA, Suttles J, Cook VD, Warren BJ, Butterworth DE, Fagoaga OR, Nehlsen-Cannarella SL 1995. Immune function in athletes versus nonathletes. *Int J Sport Med*, 16: 329-333.

Nieman DC, Henson DA, Gusewitch G, Warren BJ, Dotson RC, Butterworth DE, Nehlsen-Cannarella SL 1993. Physical activity and immune function in elderly women. *Med Sci Sports Exercise*, 25: 823-831.

Papa S, Vitale M, Mazzotti G, Neri LM, Monti G, And Manzoli FA 1989. Impaired lymphocyte stimulation induced by lond-term training. *Immunol Lett*, 22: 29-33.

Pouramir M, Haghshenas O, Sorkhi H 2004. Effects of Gymnastic exercise on the body iron status and hematologic Profile. *Iran Journal of Medicine Science*, 29(3): 140-141.

Prins M, Hawkesworth S, Wright A, Fulford, AJC, Jarjou, LMA, Prentice, AM, Moore SE 2007. Use of bioelectrical impedance analysis to assess body composition in rural Gambian children. *European Journal of Clinical Nutrition*, 62(9): 1065-1074.

Pyne DB 1994. Regulation of neutrophil function during exercise. *Sport Med*, 17: 245-258.

Rahmani-Nia F, Rahnama N, Masoumi S 2007. The effects of physical exercise on soluble transferrin receptor and other indicators of iron status in female taekwondoist. *International Journal of Sports Science and Engineering*, 1(3): 189-194.

Ratamess NA, Hoffman JR, Kraemer WJ, Ross RE, Tranchina CP, Rashti SL, Faigenbaum AD 2013. Effects of a competitive wrestling season on body composition, endocrine markers, and anaerobic exercise performance in NCAA collegiate wrestlers. *European Journal of Applied Physiology*, 113(5): 1157-1168.

Rezasoltani A, Ahmadi A, Nehzate-Khoshroh M, Forohideh, F, Ylinen J 2005. Cervical muscle strength measurement in two groups of elite Greco-Roman and free style wrestlers and a group of non-athletic subjects. *British Journal of Sports Medicine*, 39(7): 440-443.

Ricci G, Mosatti M, Vitali E, Vedovate M, Zanotti G 1988. effects of exercise on hematologic parameters serum iron, serum ferritin, red-cell 2,3 diphosphoglycerate and creatine contents and serum erythropoietin in long distance runners during basal training. *Acta Haematol*, 80: 85-98.

Saad AH 2012. Physiological profile of the young Egyptian wrestlers. *World*, 6(1): 45-50.

Schumacher YO, Schmid A, Grathwohl D, Bültermann D, Berg A 2002. Hematological indices and iron status in athletes of various sports and performances. *Med Sci Sports Exerc*, 34(5): 869-875.

Shaskey DJ, Green GA 2000. Sports haematology. *Sports Medicine*, 29(1): 27-38.

Soslu R, Kayacan Y, Dogan AA, Tas M, Kavurmaci H, Akyuz M 2014. The effects of a 12-week training program applied to adolescent elite athletes on their iron, iron binding and ferritin levels. *International Journal of Academic Research Part A*, 6(3): 47-50.

Sparling PB 1997.Field testing for abdominal muscular fitness.*ACSM's Health Fitness J,* 1(4): 30-33.

Tamer K 2000. *Sporda fiziksel ye fizyolojik performansýn ölçülmesi ve deðerlendirilmesi*. Baðýrgan Yayýmevi.

Tvede N, Steensberg J, Baslund B, Halkjaer Kristensen J, Pedersen BK 1991. Cellular immunity in highly trained elite racing cyclists during periods of training with high and low intensity. *Scand J Med Sci Sports,* 1: 163-166.

Waern M, Fossum C 1993. Effects of acute physical stress on immune competence in pigs. *Am J Vet Res,* 54: 596-601.

Wilkinson JG, Martin DT, Adams AA, Liebman M 2002. Iron status in cyclists during high-intensity interval training and recovery. *International Journal of Sports Medicine*, 23(8): 544-548.

Yamaner E 2012. *Güreþ eðitim merkezlerindeki adolesan sporculara ait büyüme-geliþme metabolik ve hormonal parametrelerin deðiþikliklerinin araþtýrýlmasý*. Ondokuz Mayýs Üniversitesi Saðlýk Bilimleri Enstitüsü Beden Eðitimi ve Spor Anabilim Dalý Yüksek Lisans Tezi, Samsun.

Yoon J 2002. Physiological profiles of elite senior wrestlers. *Sports Medicine*, 32(4): 225-233.

Younesian A, Mohammadion M, Rahnama N 2004. Haemathology of professional soccer players before and after 90 min match. *Cell Mol Biol Lett,* 9(2): 133-136.