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The Effect of Wrestling Exercise in Morning and Afternoon on Some Hematological Indices

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Abstract

Hematological parameters are very vital and crucial in sport medicine for diagnosing, controlling and preventing purposes. The aim of this study was to compare the effects of wrestling exercise inthemorningandafternoononsomehematologicalindices.Thesemi-experimentalstudywasconducted. The study subjects consisted of wrestlers from Neyshabur 19 wrestler volunteer were randomly assigned to two experimental (n=12) and control (n=7) groups. Experimental group participated in similar wrestling exercises in the morning and afternoon. Blood sampling was performed before and immediately after morning and afternoon exercise to determine the hematological characteristics. To compare the two groups, multivariate test was used and the significant level was determined at P<0/05. The results showed that wrestling exercise led to significant increase in PLT in the morning (P=0/003) and afternoon (P=0/013). Increase in PLT was higher in the morning than afternoon with Eta squared 0/45 and 0/35 respectively. Furthermore, the RDW and MPV significantly decreased (P=0/01) in the afternoon than morning session in the experimental group although was not significant compared to the control group. It should be considered that in high-risk individuals the blood platelets during heavy exercise may increase so these people should be provided with the proper recovery. Furthermore, positive changes of hematological indices were higher in the afternoon than morning and require less effort. However, doing further research on the exercise time seems necessary.

Keywords: exercise, wrestling, hematological indices, morning, afternoon

Introduction

Championship in the Olympic Games, World and Continental among countries has gained unprecedented importance effort has been made to improve the performance of athletes, also sports scientists are more involved in this field and more research has

been done in the physical sciences (Dehkhoda et al. 2008).

On the other hand, hematological indices are vital and necessary in sports medicine. The criteria are used for diagnosing, controlling and preventing purposes (Younesian et al. 2004). Exercise may affect blood parameters. Physical and physiological response also plays an important role, in hematology (Astrand & Rodalf, 1986). When hematology is analyzed; the effect of acute exercise on hematological levels is seen different. It is stated that these differences depend on the severity, duration, exercise at different times of day and frequency of exercise as well as physical and physiological conditions of subjects (Kocet eT al. 2009).

When the duration of exercise increases, redistribution of body fluids becomes specially important in maintaining the efficiency of performing sports skills and this issue not only will affect the time of training and the match, but also it is vital for good health (Amir-Sasan & Sari Saraf, 2002).

It has been reported that interventions such as physical activity have reverse effects or cause a decrease in blood indices and improves these indices. Changes in hematologic parameters such as decreased hematocrit and increased hemoglobin content or platelet count is associated with aerobic exercise in young persons (Bobeuf et al. 2009). On the other hand, increased hematocrit occurs as the result of short-term activities and excretion of the body fluids and changes in the rigidity of red blood cells (Brun, 2002). It has been reported that intense activity causes the hemolysis of red blood cells (Salonen, 1992) and often hematological status lower than normal is observed in athletes who are involved in intense exercise (Biancotti et al. 1992). Results from previous studies indicate that acute exercise increased hemolysis of red blood cells and athletic hemolytic of transient anemia through mechanical stroke, oxidative stress and even hematuria. Increase in indices of leukocytes and thrombocytes is observed after a session of exercise through hormonal changes and increased blood flow, released from the spleen, bone marrow and lungs (Tayebi et al. 2011).

Many studies have been done on the effect of exercise on hematologic parameters which expressed different results (Hemat Far, 2001). Karakoc et al. (2005) investigated effect of 90 minutes standard soccer exercise on thrombocytes and erythrocyte indices. They reported that the distribution width and the number of red blood cells had no significant change after exercise. Also a significant decrease in hemoglobin and mean cell volume and an increase in platelet number were reported. In another study Schumacher et al. (2000) studied red blood cell indices in elite cyclists. They observed a significant decrease in hemoglobin and hematocrit after the competitions season. A Reduce in hemoglobin, mean cell hemoglobin concentration of red blood cells, the number of red blood cells and a slight increase in mean cell volume, were reported in the competitions season. Wu et al. (2004) observed an increase in white blood cells after a 24-hour Ultramarathon race.

Hematologic parameters display different behaviors exhibit acute exercise at different times of day (Erdemir, 2013). Understanding the effects of time of day on the responses of haemorheological variables to exercise could provide some significant information for prescribing exercise for patients and healthy people (Ahmadizad, 2010).

According to our knowledge, no research has investigated effects of power and collision sports on the hematologic parameters. Therefore, the present study plans to compare the effects of wrestling exercise in the morning and afternoon on some hematological indices.

Methods

The semi- experimental study was conducted. Statistical population consisted

of wrestlers form Neyshabur, who compete in provincial or national matches and were regularly engaged in wrestling exercises. 19 wrestling volunteers were randomly assigned to two experimental (n=12) and control (n=7) groups. The mean and standard deviation of anthropometric data of the two groups are provided in Table 1.

Table 1 Anthropometric characteristics and experience in participants (mean ± SD)

groups \ Indicators	Age (years)	Weight (kg)	height(cm)	body mass index (kg/m^2)	training experience (years)
C	19.5±3	78.95±18.25	171±9.89	26.71±3.7	5.25
W	19.4±2.87	78.26±19.26	172.9±6.14	25.96±4.83	5.1

C: controls, W: wrestlers

All subjects completed the consent form and medical history. Experimental group participated in two similar sessions of wrestling exercise in the morning and afternoon; while the control group did not exercise. Breakfast of all subjects in the morning exercise was the same and in the afternoon exercise, similar breakfast and lunch were provided. Training programs contained wrestling training and practicing common wrestling skills. First the subjects warmed-up for 20 minutes. After warming-up, they practiced wrestling for three two-minute sets. There was 30 seconds rest between the sets. Then they rested for three minutes. Common wrestling skills were practiced which included four 30-second techniques, it two times each lasting for two minutes with 30 seconds rest between the times. After three minutes, the athletes wrestled for two times, three minutes each, and the last part was a 10-minutecool-down. Total exercise time was 65 minutes. Blood sampling was performed before and immediately after morning and afternoon exercise. In each sampling 5 ml of blood sample was collected from the vein in the sitting position in order to expand the supply of blood (blood cell count). Blood samples were taken immediately to a tube containing anticoagulant K3EDTA and in the valid clinical laboratories were analyzed for hematological indices including the number of red blood cells, hemoglobin and hematocrit, MCH, MCHC, MCV, RDW, white blood cell count, platelet count, MPV, PDW and P-LCR using Cell Counter (Sysmex K-1000 IVB = 15.20) that made in Japan.

Statistical methods

All data were presented as mean ± standard deviation. Pre- and post-exercise values for the dependent variables were analyzed to determine if the distributions were normal using Kolmogorov-Smirnov (K-S) Normality test. A multivariate repeated test was used to compare two experimental and control groups. In addition, dependent t-test used to verify the differences within the group in the morning and afternoon session and changes in haematological indices in the morning session than afternoon. All the statistical analysis was performed with software SPSS (version 18) and the significant level was determined at P<0/05.

Results

The results of the control and experimental group are provided in Tables 2 and 3. The results showed that wrestling exercise led to significant increase in PLT in the morning (P=0/003) and afternoon (P=0/013). Increase in PLT was higher in

the morning than afternoon with Eta squared 0/45 and 0/35 respectively.

Furthermore, the RDW and MPV significantly decreased (P=0/01) in the afternoon than morning session in the experimental group although was not significant compared to the control group. Other hematological parameters did not change significantly in experimental group.

Table 2 changes of hematological indices in response to wrestling exercise in participants (mean ± SD)

hematologic Variables \ Measuring time		Before the morning exercise	After the morning exercise	Before the afternoon exercise	After the afternoon exercise
White blood cell (WBC) ($\times 10^3$ / µL)	W	7.02±1.21	7.90±1.38	8.17±1.33	9.53±1.38
	C	6.86±1.14	6.66±1.52	7.62±1.84	8.48±1.60
Red blood cell (RBC) ($\times 10^6$ / µL)	W	5.61±0.52	5.39±0.33	5.53±0.33	5.48±0.32
	C	5.22±0.23	5.23±0.21	5.53±0.30	5.49±0.31
Hematocrit (HCT) (%)	W	48.68±4.51	46.57±3.15	48.53±3.31	47.64±3.44
	C	45.40±1.41	45.31±1.51	47.68±2.59	46.90±2.26
Hemoglobin (HGB) (g / dL)	W	16.26±1.27	15.57±1.17	16.24±1.13	15.95±1.13
	C	15.28±0.73	15.26±0.71	16.02±1.04	15.82±1.06
Mean count of hemoglobin (MCH) (pg)	W	29.03±1.41	28.87±1.31	29.36±0.96	29.11±0.95
	C	29.27±1.43	29.16±1.33	28.98±1.43	28.80±1.33
Mean concentration of hemoglobin count (MCHC) (g / dL)	W	33.43±0.91	33.42±0.98	33.46±0.46	33.51±0.48
	C	33.63±0.78	33.67±0.80	33.60±0.92	33.73±1.05
Mean corpuscular volume (MCV) (fL)	W	86.81±2.44	86.39±2.43	87.77±2.72	86.94±2.56
	C	87.01±4.10	86.70±4.0	86.33±4.37	85.47±4.25
RBC distribution width (RDW) (fL)	W	12.53±1.27	12.43±1.12	12.54±0.66	*12.14±0.53
	C	12.54±0.67	9.17±8.86	12.42±0.68	12.28±0.70

C: controls, W: wrestlers, (*) Significant at $p < 0.05$ in wrestlers

Table 3 changes in platelet characteristics in response to wrestling exercise in participants (mean ± SD)

hematologic Variables (platelet) \ Measuring time		Before the morning exercise	After the morning exercise	Before the afternoon exercise	After the afternoon exercise
Platelet count (PLT) ($\times 10^3$ / μL)	W	244.83±44.0	276.08±44.89**	262.64±32.69	283.45±33.31**
	C	266.86±26.62	267.28±32.45	281.36±25.87	283.33±33.07
Mean platelet volume (MPV) (fL)	W	4.46±8.94	7.07±7.23	8.68±5.78	6.78±7.72*
	C	4.46±8.94	6.97±6.77	10.32±0.84	9.80±0.70
Platelet distribution width (PDW) (fL)	W	12.38±1.72	12.14±1.50	12.73±1.20	12.52±1.47
	C	11.40±0.93	11.33±1.27	12.57±1.46	11.93±0.94
Large platelets (P-LCR) (%)	W	23.32±12.02	25.12±6.29	27.90±6.78	25.76±6.18
	C	21.70±4.85	21.53±5.76	28.10±6.36	24.85±5.40

C: controls, W: wrestlers, (*) Significant at $p< 0.05$ in wrestlers, (**) Significant at $p< 0.05$ in wrestlers than controls

Discussion

The present research studied the effects of two sessions of wrestling exercise in the morning and afternoon on hematological parameters. Except for PLT, none of the hematological variables changed significantly in response to wrestling exercise in the morning and afternoon. The results of this study showed RDW and MPV significantly decreased (P=0/01) in the afternoon than morning session in the experimental group although was not significant compared to the control group. The findings of Tayebi et al. (2005) are consistent with the results of this study. They have also reported that RBC, MCH, HGB, HCT and MCHC remained unchanged after exercise while RDW significantly decreased. But in contrast to the results of the present study they observed that MCV and WBC increased in response to exercise. They claimed that these changes were independent from plasma volume, and attributed them to the increase in the regeneration of red blood cells and rate of iron transfer from bone marrow into erythrocytes circulating. Tayebi et al. (2007), observed similar results, but they found no significant change in RDW and a significant reduction in MCV and noted that their results were independent from plasma volume but were due to a decrease from macrocytic anemia to normal range.

One of the reasons that might have led to difference results in the present study in WBC compared to other studies could be the especial and unique type and nature of the wrestling training. Because the WBC increase in most studies have found (Ghanbari Niaki et al. 2005, Havil et al. 2003, Hulmi et al. 2010, Tayebi et al. 2005 & Wu et al. 2004) may also be due to the neutrocitos resulted from the effects of catecholamines and cortisol and some other factors involved in an acute collision exercise, such as wrestling (Wu et al. 2004). Given the role of phagocytic neutrophils and their increase during inflammation, result this studies was not far-fetched, because intense exercise may lead to muscle tissue injury and white blood cells increase as a result of this injury. Perhaps some other factors such as increased activity of sympathetic nervous system, increased cardiac output and changes in capillary endothelial cells, play a role in releasing these cells that are attached to the wall, into circulation (Tayebi et al. 2011). However, as noted in a study nature of the practice is possible reasons for the not changed.

Another important finding of the present study was the PLT increase in both morning and afternoon sessions, with a more severe change in the morning compared to the afternoon session, MPV reduction in the morning than afternoon session and other platelet parameters did not change. Other indicators of blood did not change significantly in this study. An increase in PLT and no change in RDW and P-LCR were observed in many other studies (Karakoc et al. 2005 & Tayebi et al. 2005, 2007). Platelets are produced in the stimulating conditions such as intense exercise (Yilmaz et al. 2004). The number of platelets increases as a result of exercise because new platelets are released from the vascular bed of the spleen, bone marrow and other platelet deposits in the body. Secretion of epinephrine as a response to exercise intensity, leads to the intense contraction of the spleen, where nearly one thirds of the body platelets are stored. In other words the training session has been so intense that has probably caused little injuries which in turn have stimulated the production of platelets as the coagulative factor. This mechanism can explain the observed increase of platelets in the present study (El-Sayed et al. 2004, 2005 & Yilmaz, 2004). Changes in the size and volume of platelets may increase blood coagulation, which in turn is derived from this form of exercise that stimulates platelet-activation in the place of thrombosis formation.

Conclusion

According to research results, about the platelets increase, and stimulation and activation of possible of thrombosis events, it should be considered that the increase in the number of platelets during heavy exercise may have adverse thrombogenic effects in high risk individuals (Gielen et al. 2001). This should be taken into account in designing the exercise sessions. Athletes should aim to achieve this through proper recovery and cooling down immediately after exercise, taking into account the issues of public health, having adequate rest and optimal nutrition in terms of energy, vitamins, minerals and water. The results also indicate that positive changes in hematologic indices is higher in the afternoon session, so afternoon exercise is more suitable, however, doing further research on the exercise time seems necessary.

Reference

Ahmadizad S and Bassami M. (2010). Interaction effects of time of day and sub-maximal treadmill exercise on the main determinants of blood fluidity. *Clinical hemorheology and microcirculation*, 45.2: 177-184.

Amir-Sasan R and Sari Saraf V. (2002). Effect of intense aerobic activity on red blood cell indices of male athletes. *Motion,* 9:99-89.

Astrand PO and Rodalf K. (1986). Work Physiology Physiological Bases of Exercise, McGraw-Hill Book Company, New York, USA.

Biancotti PP, Caropreso A, Di Vincenze GC, Ganzit GP, Gribaudo CG. (1992). Hematological status in a group of male athletes of different sport.*J Sports Med Phys Fitness*, 32 (1); 70 – 5.

Bobeuf F, Labont´e M, Khalil A, Dionne IJ. (2009). Effect of resistance training on hematological blood markers in older men and women: a Pilot Study. *Curr Gerontol Geriatr Res,* 1-4.

Brun JF. (2002). Exercise hemorheology as a three acts play with metabolic actors: is it of clinical relevance? *Clin Hemorheol Microcirc*, 26(3):155–74.

Dehkhoda MR, Gaini A, Rajabi H, Ghanbari-Niaki A, Sarafnejad A. (2008). The impact of aerobic activity with a period of maximum oxygen uptake and performance of Spirulina on some indexes of immune trained men after exhaustive exercise. *Movement and Exercise Science magazine*, 9(1):46-29.

El-Sayed MS, Ali N, El-Sayed Ali Z. (2005). Aggregation and activation of blood platelets in exercise and training . *Sports Med*, 35(1): 11-22.

El-Sayed MS, El-Sayed Ali Z, Ahmadizad S. (2004). Exercise and training effects on blood homeostasis in

health and disease: an update. *Sports Med*, 34(3): 181-200.

Erdemir I. (2013). The comparison of blood parameters between morning and evening exercise. *European Journal of Experimental Biology,* 3.1: 559-563.

Ghanbari Niaki A, Tayebi SM, Ghorbanalizadeh Ghaziani F, Hakimi J. (2005). Effect of a single session of weight-circuit exercise on hematological changes of physical education students. *J Sports Sciences*, 1(2): 77-88.

Gielen S, Schuler G, Hambrecht R. (2001). Exercise training in coronary artery disease and coronary vasomotion. *Circulation,* 103(1): 1-6.

Habibian M, Moosavi SJ, Tejari F, Moosavi-gilani SJ. (2011). Comparison the effects of one session aerobic exercise and resistance training on some of the coagulation markers of healthy young women. *Zahedan Journal of Research in Medical Sciences*, 12(4): 33-37.

Havil F, Ebrahim KH, Aslankhani MA. (2003). The effect of one session of progressive aerobic exercise on innate immune system of young and adult athletes. *Harakat Fall*, 17: 25-44.

Hemat Far A. (2001). Eight weeks of endurance running increasingly on selected blood factors and maximum oxygen consumption. *Olympics*, 8(16): 59-70.

Hulmi JJ, Myllymäki T, Tenhumäki M, Mutanen N, Puurtinen R, Paulsen G, Mero AA. (2010). Effects of resistance exercise and protein ingestion on blood leukocytes and platelets in young and older men. *Eur J Appl Physiol,* 109(2): 343-53.

Karakoc Y, Duzova H, Polat A, Emre MH, Arabaci I. (2005). Effect of training period on haemorheological variables in regularly trained footballers. *Br J Sports Med,* 39 (2): 1-4.

Kenney WL, Wilmore JH, Costill DL. (2012). Physiology of Sport and Exercise, *Human Kinetics*, USA.

Koc H, Tekin A, Ozturk A, Saraymen R, Gokdemir K, E. (2012). M., M. Afr. *J. Microbiol. Res.,* 6(9): 2027-2032.

Salonen JT, Nyyssonen K, Korpela H, Tuomilehto J, Seppänen R, Salonen R. (1992). High stored iron levels are associated with excess risk of myocardial infarction in eastern Finnish men. *Circulation*, 86(3): 803-11.

Schumacher YO, Grathwohl D, Barturen JM, Wollenweber M, Heinrich L, Schmid A, Huber G and Keul J. (2000). Haemoglobin, haematocrit and red blood cell indices in elite cyclists. Are the control values for blood testing valid? *Int J Sports Med,* 21(5): 380-5.

Tayebi SM, Agha Alinejad H, Kiadaliri K, Ghorbanalizadeh Ghaziani F. (2011). Assessment of CBC in physical activity and sport: a brief review. *Sci J Iran Blood Transfus Org*, 7(4): 249-265.

Tayebi SM, Ghorbanalizadeh Ghaziani F, Ghanbari Niaki A. (2007). Effects of a low intensity single session of circuit resistance exercise on hematologic variables in male physical education students. Abstracts of the 5th student's scientific congress on physical education and sport sciences. *Mazandaran University of Baboulsar*, 219.

Tayebi SM, Ghorbanalizadeh Ghaziani F, Ghanbari-Niaki A, Esmaeilzadeh Tolo MR, Hakimi J. (2005). Effect of a single session of circuit resistance exercise on serum hematologic changes in male physical education students. Abstracts of the 3rd student's scientific congress on physical education and sport sciences. *Ferdowsi University of Mashhad*, 38.

Wu HJ, Chen KT, Shee BW, Chang HC, Huang YJ, Yang RS. (2004). Effects of 24 h ultra-marathon on biochemical and hematological parameters. *World J Gastroentero, l* 10(18): 2711-4.

Yilmaz MB, Saricam E, Biyikoglu SF, Guray Y, Guray U, Sasmaz H, Korkmaz S. (2004). Mean platelet volume and exercise stress test. *J Thromb Thrombolysis,* 17(2): 115-20.

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.