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The Effect of Morning Aerobic Exercise on Some Hematological Parameters in Young, Active Males

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Abstract

Purpose: This study is to investigate the impact of an eight-week morning aerobic training on some hematological parameters in young, active males.

Material and Methods: 26 male, university students without any previous smoking experiences or regular exercise programs (age, 19/23 $\pm$ 1/07 years and BMI, 22/53 $\pm$ 5 kg/m^2) were randomly selected and divided into two groups: control and exercise. The exercise group (13 students) did an 8-week aerobic training three times a week with the intensity of 55% to 75% of maximum heart rate but the control group just (13 students) did their everyday activities. Blood samples were collected before the first session of aerobic training and after the last session, at a specific time (7:00 a.m.) from both control and exercise group. The second blood samples were collected after the heart rate of the exercise group returned to its resting values and were used to examine the following parameters: clotting and bleeding times, amount of fibrinogen, hemoglobin, hematocrit and number of red and white blood cells and platelets. A timer, a fibrinogen kit and a cell counter were used in this phase. Student t-test and paired T-test were run to analyze the obtained results. The significance level was set at P= 0.05.

Results: The findings showed that during an 8 – week morning exercise the number of red blood cells, hemoglobin levels, and hemotocrit percentage increased. Fibrinogen levels and prothrombin formation time have also increased significantly (P≤0.05), while the bleeding times and the number of platelets decreased significantly.

Discussion and Conclusion: The findings of this study reveal that an eight – week morning aerobic training does not have any negative effect on hematological parameters of young , active males with healthy metabolic, kidney and cardiorespriatory systems.

Key words: Hematological factors, Morning aerobic training, Active males

Introduction

Physical fitness is an active state that enables a person to do everyday activities without being easily tired, participate in leisure activities enthusiastically and overcome difficult situations[1].

According to cardiologists and sports science experts, physical activity can increase cardiovascular efficiency through increasing the working potential of lungs and heart that leads to the reduction of blood pressure and harmful fast in the blood[2]. Nowadays public exercise, especially morning exercise, specially jogging and working out, is popular among different groups of people due to its ease and convenience[4]. It also can improve the mental state of people [2,3].The heart institute of America states that of the most important risk factors of cardiovascular diseases is lack of physical exercise [4]. Due to the popularity of morning exercise, it is important to do some research on whether it is dangerous or not[2]. On the other hand, sports managers have had extensive plans to publicize morning exercise and it is also widely welcomed culturally. Therefore investigating the effects of morning exercise is of vital importance.

Madadi (1997) studied the effects of a session of an acute physical activity on the amount of hemotocrit, red blood cells, and hemoglobin in elite wrestlers. The results revealed that hematological parameters significantly increased after the acute physical activity session as compared to the resting position[5].

Mohammadzadeh(1994) maintained that the average amount of fibrinogen in middle – aged

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athletes increased 24/1 mlg/ DL compared to non-athletes. The findings also showed that middle-aged athletes suffer less from thrombolytic disorders compared to non-athletes [6]. Parukar (1985) in a study on 21 medical students, stated a reduction in clotting time after exercise[7]. Yonshy (1991) found that clotting time increased 6-18% in the morning in 24-30 year old males and su`ggested that due to an increase in clotting potential in the morning, the participants were more likely to suffer from heart or brain strokes[9].

Khalaghi(2001) studied the effects of a period of aerobic exercise on the amount of hemoglobin, hematocrit, number of red blood cells and plasma volume changes in athletes. The results confirmed that although aerobic exercise has favorable effects on cardiovascular compatibility, both aerobic and anaerobic exercises lasting for 6 weeks have the same impact on hematological parameters[10].

Piri(2001) in a study on the effect of morning exercise on the amount of fibrinogen argued that morning exercise does not change the amount of fibrinogen significantly [23].

In another study, Hansen et al (1990) investigated the relationship between plasma levels and external clotting inhibitors. Through experiments on people in different exercise groups, he realized that light exercises have less impact on external activity of clotting compared to vigorous exercises. They argued that additional activity of the external pathway in vigorous exercises improves clotting system performance [27].

Edington (1990) suggested that after an exercise session, clotting time decreased and thrombopastin protein level increased for about 20% and maintained that the effect of exercise on the process of clotting remained at a high level until 8 hours after the exercise[8].

The aforementioned studies reveal that the effect of regular exercise with different intensities on the performance of the hematological parameters is not the same. Moreover, hematologic responses to physical activity are also influenced by the exercise time (during the day or at night). Nowadays, studies of physical education, sports sciences, medical sciences and other related sciences showed that sports and exercise have positive impacts on the body's performance and health, so any dangerous cases should be discovered and modified.

Although, there have been some doubts on dangers of morning exercise over the past decades, no valid reasons have been presented. Since morning exercise is one of the easiest and cheapest ways of obtaining physical fitness, especially for people who are busy during the day, such doubts may result in discouragement and anxiety. Many studies have been done on the effect of exercise and physical activity on hematological parameters like different kinds of lipoids, physical fitness and health. However, few studies have investigated morning exercise in particular. This study is also different from other studies in terms of the training protocol it used which was based on aerobic exercise with an incremental intensity in early hours of the day. The researchers tried to answer the following question:

Do morning exercises have any significant impact on some homological parameters?

Material and Methods

This quasi – experimental study included 26 male participants from Malayer university (age 19/23 ± 1/07 years, height 176/88 ± 8/94 cm, weight 69/69 ± 14/56 kg) who were selected based on the results of an interview and a health questionnaire maintaining that they have not participated in a fitness program and did not suffer from any serious disease that needed everyday use of medicine during the six months before the study. The participants were physically and physiologically healthy and were randomly divided into two equal groups of control and exercise. Polar belt and cell counter were used to measure heart rate and hematological factors, respectively.

The exercise group took part in a fitness program 3 times a week and for 8 weeks, while the control group did every day activities and did not have any regular fitness program. The fitness program started at 6:00 a.m. and lasted for 45 minutes. It included a 15 – minute warm up, and a 30 – minute rhythmic aerobic activities with 55% - 75% of maximum heart rate. The heart rate (±5 beats) for each participant was determinedusing a polar belt. The participants' heart rate and the correct way of doing the exercises were controlled by an aerobics instructor. In the end the participants did a 15 – minute of stretching activates to cool down. At the end of the treatment phase, (i.e. on the last session), when the heart rate of the exercise group returned to the resting levels, the second blood samples were collected at a medical laboratory. 2 cc of blood were taken from the participants' ear lobes by a

specialist and clotting and bleeding times were analyzed using a timer. Fibrinogen levels were determined using a fibrinogen kit. The amount of plasma, hemoglobin, myoglobin, hematocrit, and red and white blood cells were also measured. The basic metabolism for each participant was calculated applying Harris-Benedietformula[28].

BMR (Kcal) =66/473 + 13/751×(weight) + (5/003×(height) – 6/755×(age)

To analyze the data, student t-test for dependent and independent groups was used. In this study the significance level was set at p = 0/05. Leven's test that was run to homogenize the data did not show any significant differences between the two groups ($P \geq 0.05$). means and means of percent change within the groups were also compared.

Results

The findings from control and exercise group, namely mean and SD of height, age, weight, BMI and Basal metabolism are shown in (table 1).

The findings show that during an 8 – week morning exercise, the number of red blood cells, hemoglobin levels, and hemotocritpercentage increased. Fibrinogen levels and prothrombin formation time also increased significantly ($P \leq 0.05$)while the bleeding times and the number of platelets reduced significantly (table 2).

Table 1: Participants' Descriptive data

Variables / Statistical index	Age (years)	Height (centimeter)	Weight (kilogram)	Body mass index	Basal metabolism (k cal)	
					Control group	Group exercise
Mean	19.23	176.88	69.69	22.53	1771.55	2246
SD	1.07	7.94	14.56	5.00	159.25	129.68

Table 2: Comparing means and change percentage of the two groups before and after exercise.

variable	group	Mean ± SD		T	P Value	Change percentage	
		before	after			Control group	Group exercise
Number of red blood cells	Control group	5572±454	5680±411	0.598	0.561	2.59	1.93
	Group exercise	5728±301	5876±313	-1.205	0.251		
Number of white blood cells	Control group	6807±1661	7330±1233	-1.288	0.224	7.68	8.46
	Group exercise	6638±1262	6076±1216	1.468	0.168		
Number of blood platelet	Control group	240000±44862	250150±36751	-1.663	0.124	4.32	6.35
	Group* exercise	239620±50654	225310±41187	2.280	0.042		
Amount of hemoglobin (gr/mil)	Control group	15.82±1.11	15.5±1.23	1.101	0.294	1.52	0.51
	Group exercise	15.57±1.21	15.66±1.31	-0.406	0.692		
Hematocrit percentage (%)	Control group	48.5±8.9	50.13±9.9	-2.050	0.065	3.25	2.8
	Group exercise	47.9±8.2	49.3±7.9	-2.148	0.617		
Amount of fibrinogen (milgr/mil)	Control group	235±36.2	262±43.9	-4.997	0.055	9.99	14.51
	Group* exercise	237±30.32	261±68.9	-4.997	0.000		
Clotting time (Sec)	Control group	359±72.2	349±96.4	0.304	0.766	2.9	3.2
	Group exercise	365±77.7	338±49.1	1.040	0.319		
Prothrombin formation time (Min)	Control group	13.15±0.37	14±1	-3.811	0.002	6.46	4.15
	Group* exercise	13±0.00	13.54±0.52	-3.742	0.003		
Bleeding time (Sec)	Control group	178±47	162±40	0.847	0.415	9.3	10.07
	Group* exercise	188±49.5	152±24.7	2.620	0.022		

Discussion and Conclusion

The findings showed an insignificant increase in the number of red blood cells in both the control and the exercise group (2/59% and 1/93 respectively). This is in line with Madadi`s(1997) results, but contradicts the results of Ghorbani(1996), Khalaghi(2001) and Nikseresht(1994). Since the main function of red blood cells is carrying hemoglobin which transfers oxygen to lungs and tissues, the increase in the volume of red blood cells might be the result of an increase in the volume of the whole blood. However, this increase is not stable and permanent, and happens as a result of the release of reserved cells from the walls of veins or spleen rather than a real cell production [12]. The findings of the present study also showed a reduction in the number of white blood cells both in the control and exercise group (7/68% and 8/46% respectively) after the 8–week morning aerobic training. This

finding contradicts the findings of Farmayi (1998) [13], Nikseresht [11], and Shepherd (1992) [15] but is in line with those of Zardi (2000) [15]. The number of white blood cells may be influenced by physical activity, diet, infectious diseases, muscular diseases, hormonal changes (cortisol increase) and many other factors. It also increases during physical activity. The number of white blood cells also changes during the day: it reaches its maximum level at the end of the afternoon and drops down to its minimum level in the first hours of the morning [8-16]. As a result, the reduction in the number of white blood cells could be probably the result of increased blood circulation speed and consequently faster return of white blood cells to their reserve place. So the 8–week morning exercise may not have any significant impact on the exercise group's number of white blood cells. The present study also reveals a reduction in the number of platelets in both the exercise group (6/35%) and the control group (4/32%), which conforms the findings of Zeinali(1995) [4], but is in contrast with those of Aldemir(2005) [17], Selliere (1998) [12], Toy(1980) [18], Shephard(1992) [14], and Edington and Edgerton(1993). Evidence showed that the number of platelets increased after a session of light exercise. Platelets are one of the contributing factors in maintaining blood homeostasis in humans. They help blood clotting and prevent blood loss through forming platelets[8]. Exercise increases blood circulation towards spleen filtration, accelerating the omission of older cells, which in turn may reduce the number of platelets. Although exercise is shown to increase the production of new blood cells through stimulating bone marrow, it seems that a negative effect accompanies the positive feedback of erythropoietin. So the 8–week morning aerobic training did not seem to have a significant negative impact on the reduction platelets levels in the exercise group. The results also demonstrated an insignificant increase in the amount of hemoglobin, which was 1/52% in the control group and 0/51% in the exercise group. This finding conforms those of Madadi[5], Taghsimi(2002) [19], Nikseresh[11], Shepherd[14], Alimeh(2002) [20], and Godarzi[16]. Since 98% of oxygen in blood is transmitted via hemoglobin, there is a strong correlation between the oxygen carrying capacity of the blood and hemoglobin density. Although the number of red blood cells increases after physical activity, during exercise, especially running and jogging, the amount of serum proteins connecting to the hemoglobin decreases following a decrease in the level of iron in the red blood cells,[11] which in turn increases the amount of hemoglobin in the urine. Therefore the observed increase in the level of hemoglobin could be simply due to hemoconcentration. The results of the present study also showed an increase in the hemotocrit percentage which was 3/25% in the control group and 2/8% in the exercise group. This finding contradicts those of Ghorbani(1996) [20], Taghsimi[19], Alimeh[20], Khalaghi[10], and Nikseresht[11] but confirms the findings of Godarzi(1994) [16], and Shepherd[14], who also suggested the reduction of plasma volume and blood concentration following aerobic training. Plasma volume reduction increases the concentration of proteins and blood cells in the blood. With a 20-25 percent increase in the concentration of red blood cells, hemotocrit changes from 40% to 50%, without an increase in the number of red blood cells. As long physical activities usually increase blood concentration and hemotocrit, plasma volume and proteins are not always in the same ratio. It is Noteworthy that frequent, intensive exercise may increase hemotocrit levels over its natural range (from 45% to 55%) which increases blood viscosity for about 25%. . Another observed change in the present study was an increase in fibrinogen levels of the two groups (9/99 % in the control group and 14/51% in the exercise group). As one possible reason for this hematocrit increase could be dehydration, morning exercise may not have negative effects on this variable.

This finding disagrees with the findings of Mohammadzadeh[6], Beard[21], and Godarzi[16] but is in line with those of Schnider[22]. Since fibrinogen (a fundamental factor in clotting) is a protein with a high molecular weight that is formed in the liver, an increase in the production of clotting factors in the liver, which is the case in over-trained professional athletes, may lead to the formation of wandering clots. So the observed changes in the fibrinogen levels in the exercise group were more probably the result of increased liver activity than morning exercise.

The findings of the present study also showed an insignificant reduction of the clotting times in the control (2/9%) and exercise group (3/2%). This

contradicts the findings of Godorzi[16], Shepherd [14], and Peiri [23], but is in line with the results of Mohammadzadeh[6], Parulker(1985) [7], Bartech(1982) [24], and Watts(1991) [25]. It also contradicts the findings of Schnider(1995) [22] and Yoneshi [9] who believed exercise could increase the speed of clotting. Patricia(1986) [26] investigated the correlation between exercise and coronary risk factors. An increase in the function of liver cells in producing clotting factors may increase the clotting time which is important in professional athletes but not in ordinary people. So the 8 – week morning exercise does not seem to have any negative impact on the clotting time .According to the data from the present study the prothrombin formation time showed a 4/15% increase in the exercise group and a 6/46% increase in the control group. Clot formation depends on the activity of over 50 different clotting and anti-clotting factors in blood and tissues. Any event happening inside the vessels (such as vessel rupture) may stimulate prothrombin activators to transform to thrombin in the presence of enough calcium, bringing about polymerization of fibrinogen molecules and in turn, changing them into fibrin threads within 10 to 15 seconds. As a result, any increase in the prothrombin formation time may be due to an increase in the activity of liver cells, which is not a negative factor for athletes, non athletes and patients with cardiovascular diseases. The findings of the present study revealed that an 8 – week morning exercise did not have a negative impact on prothrombin formation time of the participants. Bleeding time was also studied in the present research and the findings showed its reduction in both the control and the exercise group (4/3% and 10/07% respectively). This is in contrast to the findings of Godarzi[16], and Shepherd[14] who reported an increase in the bleeding time following exercise. . Although bleeding time increases during exercise as a result of the increase in capillary blood pressure that keeps the small vessels open, in laboratory measurements the bleeding time of a small scratch is 10 seconds that is independent from clotting mechanism and is more likely due to capillaries' vasoconstriction. It seems that people who take part in exercises with lots of movements enjoy higher metabolic, Kidney and cardiovascular health because of the changes in some of their homological factors. However it should be noted that formation of wandering clots as a result of exercising in vulnerable people (for example those with cardiovascular diseases) is very dangerous.

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