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The effect of vitamin E and A supplementation on some hematological parameters and lactate levels of elite taekwondo players

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Abstract

In this research it was aimed to investigate the effect of vitamin E and A supplementation on some hematological parameters of exercising taekwondo players. 21 healthy male elite taekwondo players were used as subjects. Subjects were separated into three groups. 300 mg/d vitamin E was given to vitamin E group, 100 mg/d vitamin A was given to vitamin A group and no vitamin supplementation was given to control group for 6 weeks. Taekwondo exercise was applied to all groups for 5 days per week during 6 weeks. Fatigue protocol was applied to subjects two times as pre-supplementation and post-supplementation. Blood samples from all groups were taken four times the 1st and 6th week before and after the exercise. Some hematological (RBC (red blood cell), WBC (white blood cell), PLT (platelet), HGB (hemoglobin), LYM (lymphocyte), HCT (hematocrit), MCV (mean corpuscular volume), MCH (mean corpuscular hemoglobin), MCHC (mean corpuscular hemoglobin concentration), RDW (red cell distribution width), MPV (mean platelet volume), PCT (procalcitonin), PDW (platelet distribution width) parameters and lactate levels determined from taken blood samples were measured. It was determined significant level ($p<0.05$) increase in HGB, HCT, RDW, PDW, MCV, MCH, MPV, PCT and lactic acid amounts in samples taken after exercises, after and before supplementation. It was determined a decrease in HGB, HCT, PLT, MPV, RDW values in the vitamin E and A groups according to the control.

Keywords: Hematological parameters, lactate levels, taekwondo, vitamin A, vitamin E.

INTRODUCTION

The success in sports requires excellent performance. The methods which can help in providing excellent performance capacity have attracted the interest of medical sciences for long time (22). Exercise affects blood parameters and carries importance in terms of various blood pathologies (7). Exercise is one of the biggest stress sources of the body exposes. The organism replies to the stress by different kind of physiological changes in metabolic, hormonal and immune system (32,33). During exercise, various levels of stress hormones are secreted into the blood based on the intensity of exercise and these hormones become quite effective on leukocyte and lymphocyte and their sub-groups in the blood (2,4,11,32,33).

The protection of balances in the formation and destruction of oxidants in biological systems is important in maintaining biological integrity of the cell and tissue. There are various antioxidants against harmful effects of free radicals in the cells. To prevent damages of the free radicals in the body, many oxidant materials such as vitamins A, E and C serve in the body (21). There is not any finding that extra vitamin use for increase the performance. But it is known that some vitamins used against negative effects the stress forms. The chemistry and biology of vitamin E has been the subject of intensive study for more than 50 years. Functions of vitamin E have been studied by various investigators, the antioxidant function of vitamin E remains the most well established; in fact, vitamin E is the most effective lipid-soluble antioxidant present in our cells (24).

Vitamin E is a α-tocopherol which takes place so much in the nature and has very high antioxidant activity. α-tocopherols form the first defense line that takes place in cellular and sub-cellular membrane phospholipids and protects multiunsaturated fatty acids against lipid peroxidation (1). Vitamin E improves the shape of increased haematocrit and damaged leukocyte in hypoxic rats (10,13).

In this research it was aimed to investigate the effect of vitamin E and A supplementation on some hematological parameters of exercising taekwondo players.

MATERIAL & METHODS

Participants

The research was carried out on 21 healthy male elite taekwondo players studying in S.U. Physical Education and Sport High School. It was paid attention to that age and body weight means of subjects in all groups be close to each other's (age average: 21.68 ± 0.53; body weight average: 65.71 ± 2.20). This 21 subject divided three groups. At first group, 300 mg/d vitamin E (alpha-tocopherol) and at second group 100 mg/d vitamin A (retinol) will be applied orally for 6 weeks. These two groups were named as Vitamin E and Vitamin A Group consecutively. Last group was arranged as control group and no supplementation was applied. All groups were made taekwondo exercise for 5 days per week.

Exercise Program

Exercises were arranged as technical taekwondo exercise being 5 days per week and 2 hours per day for 6 weeks. Exercises of Monday, Tuesday and Thursday were made in moderate intensity, exercises of Wednesday in sub-maximal intensity and exercises of Friday in maximal intensity as technical taekwondo exercises.

Bruce Test Protocol (Fatigue Protocol)

Fatigue protocol was applied to subjects two times as pre-supplementation and post-supplementation. The incline and the speed of the treadmill were increased at three minute intervals and Bruce Test Protocol was applied as most often being used in clinical exercise. Running exercise was given to each subject on the treadmill that they arrived to their own maximum VO_2 until fatigue. If subjects couldn't continue exercise was determined by taking their own statements and by looking at heart rate with the help of polar telemeter. It was paid attention to subjects to arrive maximal heart rate (220-age).

Hematological Measurements

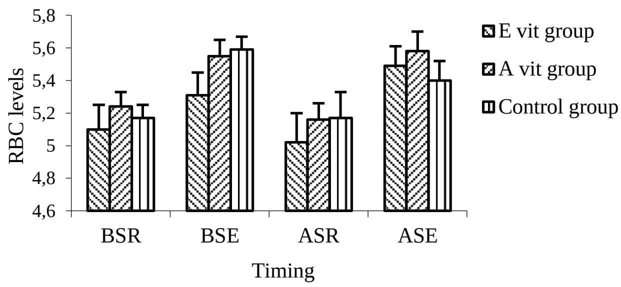
RBC, WBC, PLT, HGB, LYM, HCT, MCV, MCH, MCHC, RDW, MPV, PCT, PDW were measured with Hemacell Counter (Stks) from blood samples taken into anticoagulation tubes four times in the 1st and 6th week before and after the exercise, and lactate levels were measured with enough blood taken from the earlobe in lactate analyzer (VARIO photometer, Germany).

Statistical Analysis

Descriptive statistics (mean ± SEM) were calculated for all variables. One-way analysis of variance (ANOVA) and Duncan's Multiple Range Test were used to assess the difference between groups. The differences within each group are determined by using the Related T test. Significance was accepted for all analysis at the level P<0.05. All statistical analyses were performed with the statistical package for the social sciences (SPSS Inc., Chicago, IL, USA).

RESULTS

The values of the hematological parameters in all groups were presented in table 1 and also in figures.



BSR: Before supplement resting; BSE: Before supplement exhausting; ASR: After supplement resting; ASE: After supplement exhausting.

Figure 1. The means of RBC levels (pg/ml).

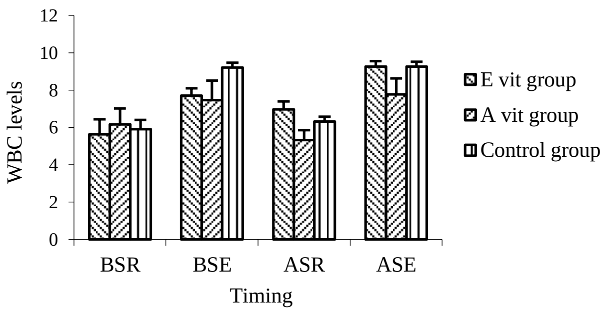


Figure 2. The means of WBC levels (K/mm^3).

Table 1. Hematological parameters and lactat levels of subjects.

Variables	Groups	Before Supplementation		After Supplementation	
		Resting	Exhausting	Resting	Exhausting
RBC (M/mm^3)	E vitamin	5.10±0.15^{b}	5.31±0.14^{a}	5.02±0.18^{b}	5.49±0.12^{a}
	A vitamin	5.24±0.09^{b}	5.55±0.10^{a}	5.16±0.10^{b}	5.58±0.12^{a}
	Control	5.17±0.08^{b}	5.59±0.08^{a}	5.17±0.16^{b}	5.40±0.12^{ab}
WBC (K/mm^3)	E vitamin	5.63±0.81^{b}	7.71±0.39^{b}	6.97±0.42^{Ab}	9.26±0.28^{a}
	A vitamin	6.16±0.86^{b}	7.46±1.04^{a}	5.32±0.54^{Bb}	7.77±0.85^{a}
	Control	5.91±0.50 ^{b}	9.21±0.25^{a}	6.31±0.26^{ABb}	9.25±0.26^{a}
PLT (K/mm^3)	E vitamin	286.14±18.81^{b}	328.85±26.13^{a}	242.85±22.33^{c}	265.28±23.62^{ABb}
	A vitamin	246.85±12.45^{b}	283.85±15.75^{a}	211.42±13.21^{c}	234.00±14.33^{Bbc}
	Control	257.14±8.52 ^{b}	308.28±14.24^{a}	235.71±11.35^{c}	294.42±7.57^{Aa}
HGB (g/dL)	E vitamin	15.62±0.10 ^{b}	16.52±0.15^{a}	14.31±0.28^{Bc}	15.71±0.22^{Bb}
	A vitamin	15.67±0.40^{b}	16.71±0.44^{a}	14.11±0.29^{Bc}	15.45±0.31^{Bb}
	Control	15.85±0.28^{c}	17.30±0.32^{a}	15.31±0.38^{Ac}	16.64±0.19^{Ab}
LYM (K/mm^3)	E vitamin	2.52±0.60^{b}	2.64±0.38^{Bb}	2.21±0.16^{b}	3.75±0.15^{ABa}
	A vitamin	2.34±0.24^{ab}	2.63±0.51^{Bab}	1.62±0.31^{b}	3.06±0.42^{Ba}
	Control	1.95±0.29^{b}	4.08±0.26^{Ab}	1.89±0.15^{b}	4.08±0.10^{Aa}
HCT (%)	E vitamin	44.7±0.59^{b}	47.20±0.44^{Ba}	43.41±1.00^{b}	48.55±0.65^{Ba}
	A vitamin	44.71±086^{bc}	48.48±0.61^{Aba}	43.22±0.29^{c}	47.18±0.64^{ABab}
	Control	45.17±0.84^{b}	49.30±0.81^{Aa}	44.04±0.67^{b}	49.68±0.51^{Aa}
MCV (fL)	E vitamin	87.68±1.72^{b}	90.92±1.06^{a}	86.95±1.62^{c}	88.48±1.85^{a}
	A vitamin	85.45±2.23^{b}	87.50±2.07^{a}	84.75±1.96^{b}	86.71±2.05^{a}
	Control	87.28±0.82^{b}	88.14±0.71^{a}	87.31±0.48^{b}	90.01±0.50^{a}
MCH (pg)	E vitamin	30.54±0.89^{a}	31.52±0.50^{a}	28.70±0.84^{b}	28.68±0.73^{Abb}
	A vitamin	29.97±1.06^{b}	30.22±1.11^{a}	27.90±1.05 c	28.07±1.02^{Bc}
	Control	31.47±0.23^{a}	30.91±0.37^{a}	28.71±0.46^{b}	30.67±0.33^{Aa}
MCHC (g/dl)	E vitamin	35.00±0.25^{a}	34.82±0.16^{a}	32.91±0.41^{Bb}	32.57±0.17^{Abb}
	A vitamin	35.02±0.41^{a}	34.42±0.54^{a}	32.81±0.53^{Bb}	32.01±0.45^{Bc}
	Control	35.17±0.35^{a}	35.05±0.22^{a}	34.32±0.42^{Aab}	33.55±0.32^{Ab}
RDW (%)	E vitamin	14.74±0.22^{b}	15.41±0.22^{a}	13.90±0.21^{c}	14.62±0.15^{Bbc}
	A vitamin	15.34±0.69^{ab}	15.77±0.58^{a}	14.44±0.40^{b}	15.90±0.41^{Aa}
	Control	15.01±0.14^{a}	14.98±0.24^{a}	14.35±0.13^{b}	15.40±0.29^{Aba}
MPV (fL)	E vitamin	10.5±0.28^{Ba}	11.02±0.39^{Ba}	8.40±0.04^{Bb}	9.34±0.49^{Bb}
	A vitamin	12.93±0.71^{Aa}	14.35±1.25^{Aa}	9.29±0.41^{Abc}	9.92±0.39^{Abb}
	Control	12.08±0.98^{Aba}	11.23±0.80^{Bab}	10.14±0.66^{Ab}	11.24±0.79^{Aa}
PCT (%)	E vitamin	0.3±0.01^{b}	0.37±0.02^{a}	0.20±0.01^{Bd}	0.24±0.02^{c}
	A vitamin	0.31±0.01^{b}	0.40±0.02^{a}	0.19±0.01^{Bd}	0.22±0.01^{c}
	Control	0.30±0.01^{b}	0.37±0.01^{a}	0.25±0.01^{Ac}	0.27±0.01^{bc}
PDW (GSD)	E vitamin	18.28±0.41^{a}	18.28±0.33^{a}	17.24±0.05^{b}	17.97±0.32^{ab}
	A vitamin	19.05±0.36	19.24±0.44	18.15±0.58	18.57±0.24
	Control	18.54±0.29	19.12±0.35	18.24±0.34	18.18±1.00
LAK (mmol/L)	E vitamin	2.52±0.49^{c}	9.14±1.70^{a}	2.52±0.16^{c}	8.82±1.17^{b}
	A vitamin	2.86±0.37^{c}	8.45±0.23^{a}	2.38±0.24^{c}	7.83±0.40^{b}
	Control	2.79±0.43^{b}	9.07±1.91^{a}	2.97±0.38^{b}	8.57±1.87^{a}

a,b,c: Different letters in the same line are significant for parameters($P<0.05$).
A,B: Different letters in the same column are significant for parameters($P<0.05$).

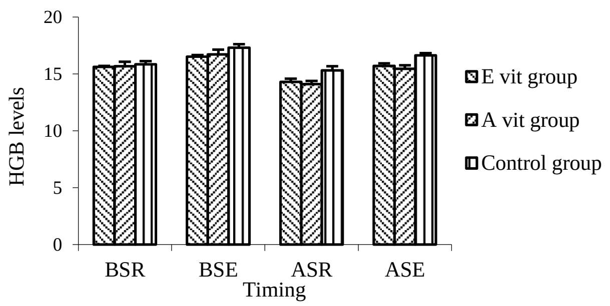


Figure 3. The means of HGB levels (g/dL).

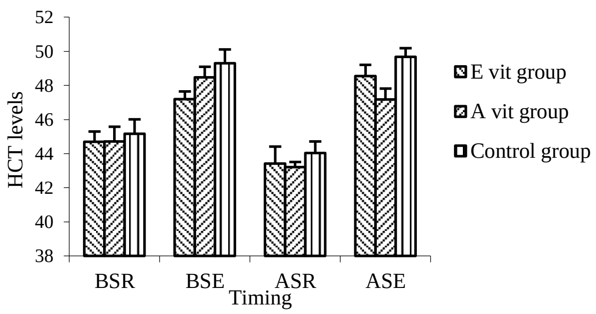


Figure 4. The means of HCT levels (%).

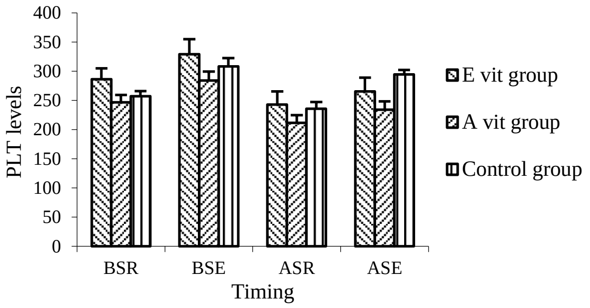


Figure 5. The means of PLT levels (K/mm³).

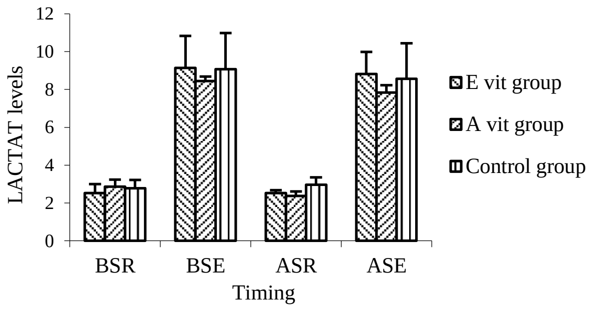


Figure 6. The means of lactate levels (mmol/L).

DISCUSSION

Hematological parameters are quite important for the aim of diagnosis, control and protection in sports medicine. The hematological response to stress is a strategy to increase the oxygen-carrying capacity of blood to cope with elevated energy demands (30). The number of leukocyte obtained from all groups was within normal leukocyte limits declared for humans. In addition, an apparent increase was observed in post-fatigue leukocyte number between before and after supplement. Tocopherol deficiency might also have a negative effect on lymphocyte survival and immune activity due to oxidative damage of the cell membrane, or the lymphocytes might have migrated from the blood into muscle tissue due to inflammation (9). Also, it has been reported that vitamin E deficiency may decrease the synthesis and accelerate the denaturation of hemoglobin by enhanced intracellular oxidative processes (30). Vitamin supplementation and exercise may be result in this increase. Woods et al. (34) did not observe a significant change in leukocyte and lymphocyte parameters between both two groups after moderate intensity aerobic exercise of 6 weeks. In contrast, it is declared that important increases in the total leukocyte, neutrophil, lymphocyte and monocyte numbers were observed after intense exercise in many studies (3,14,17,18,19,20,25,28,29). Kargotich et al. (15) determined significant increases in the total leukocyte number and its sub-groups in swimmers making intense swimming exercise and stated that this could be due to the stress caused by heavy swimming exercise. Scharhag et al. (26) found a relation between the increase in post-exercise leukocyte number and high cortisol concentration. Apparent increases determined in all groups after exercise support the findings that the exercise and stress increase leukocyte number based on both hemoconcentration and also hormonal changes.

It was observed that there wasn't any important change in erythrocyte number between all groups. But there was a significant increase before and after exercise within the group and that erythrocyte number obtained from all groups was within normal limits. Although there are numerous studies concerning the change of erythrocyte numbers during exercise, it can be said that there are differences in the obtained data. While some researchers declared that erythrocyte number increased after exercise (29), there were also researchers declaring that erythrocyte number decreased (12) or became the same (7). Also Silva et al. (27) reported that there is an increase in erythrocytes number but there is a decrease in hematocrit, hemoglobin concentration by the endurance training. Leonart et al. (16) declared that it wasn't observed any statistically difference in erythrocyte numbers of humans to whom vitamin E was given. Vitamin A and E application did not cause any statistically important change in erythrocyte in this research.

Also it was determined significant level ($p<0.05$) increase in HGB, HCT, RDW, PDW, MCV, MCH, MPV, PCT and lactate amounts in samples taken after exercises, after and before supplementation. Vitamin E supplementation leads to a decrease in platelet agreeability; and also vitamin A has this effect (24). This increase may be sourced by these vitamins supplementations. However it was determined a decrease in HGB, HCT, PLT, MPV, RDW values in the vitamin E and A groups according to the control. This probably may be sourced from conservative characteristics of these two vitamins.

It was shown in many studies that important increase occurred in platelet numbers after exercise (6,23). Beydağı et al. (8) declared that platelet number after acute submaximal exercise increased but bleeding and coagulation time decreased. In the same study it is pointed out that the increase in coagulation ability of the blood can be a result of the increase in platelet number and coagulation factors and also result of that lactate production accelerates coagulation (7). A good and regular exercise activity and low plasma volume help to prevent negative effects such as high haematocrit, high plasma fibrinogen, high blood viscosity, and the increase in platelet aggregation and the decrease in fibrinolysis (35).

Aquilo et al. (5) investigated the lactate levels of fifteen amateur male athletes with vitamin E (500 mg/d) and Vitamin A (30 mg/d) supplemented and they reported that blood lactate concentration was lower in the group that took supplements than in the control group. Tsakiris et al. (31) investigate the lactate levels of 10 basketball players with (200 mg/d) or without Vitamin E supplementation pre- and post-training. They declared that lactate levels were increased (P<0.001) in all groups post-training. Vitamin E supplementation induced lower increases in blood lactate concentration after an exercise. In our study lower increase of lactate levels were determined in vitamin E and A groups. Vitamin E and A supplementation may result in reduction of the increasing levels.

As a result of this study, it may be reported that, vitamin A and E supplementation has a positive effect on HCT, MCH, MCHC, RDW, MPV, PCT and lactate values. Also exercise has an increasing effect on hematological parameters.

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