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Original article

EFFECT OF ROYAL JELLY INGESTION FOR FOUR WEEKS ON HEMATOLOGICAL BLOOD MARKERS ON SWIMMERS

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Abstract

Purpose. Royal jelly is an ergogenic aid used for the purpose of preventive medicine by athletes. Its effects on human beings have not been completely known. Investigating the impact of different doses of royal jelly on swimmers' hematological blood markers was aimed in this study.

Methods. 40 healthy swimmers at the age of 18-25 years, performing the same training program, participated in the study. The athletes were divided into 4 groups and each group consists of 10 athletes. 2 gr/day to the first group, 1 gr/day to the second group, 500 mg/day to the third group and placebo to the fourth group were given. In a 4-week training period of 2 hours per day and 5 times a week, totally 20 km swimming was performed. Blood samples were taken at rest after 12 hours of starvation and hematological analyses were done before the royal jelly ingestion and 4 weeks later.

Results. Significant differences were found in erythrocytary (RBC), leucocyte (WBC) and Platelet (PLT) parameters of the swimmers. While a decrease was found in HCT, CHCM, CH and HDW variables; an increase was found in MCV, MCH and MCHC.While a decrease was found in different groups of WBC, BA%, LY% and BA# variables, there was an increase in EO% of 1 gr royal jelly group. Also, there was a significant increase in PLT, MPV, PCT and PDW variables.

Conclusions. It was found that some differences on the hematological variables may be related to the exercise, and 4-week royal jelly supplementation with these quantities and time did not have sufficient effect. It was suggested that it can be effective with higher doses and in a long time.

Key words. Royal jelly, hematologic parameters, swimmer, exercise, ergogenic aids.

Introduction

At the present time, it is known that physical activity and moderate exercise are important factors to prevent disorders and to live healthy (Nielsen, Skjonsberg, Lyberg, 2008). It is possible to say that, except for physical activity, natural foods are also effective to improve health status and prevent disorders, and so increase the performance (Clark, 2008). Sedentary people fulfill the mental and physical requirements with daily foods. This situation is different in athletes because while physical activity is increasing, athlete can not fulfill the nutritional requirements. Therefore, individuals need vitamins, minerals, essential amino acids and many biological substances whose prior function is to fulfill the body requirements. Because of these requirements, except for the talent and training, many ergogenic substances have appeared to assist athletes and improve physical performance. Some types of ergogenic aids such as pharmacological, mechanical, physiological, psychological ones and natural foods are available among these ergogenic substances. While some kinds of these substances can damage, some of them are natural nutrients (Joksimoviç, Stankoviç, Joksimoviç, et al. 2009; Zorba, Mollaoğulları, Erdemir, 2000).

One of the natural nutrients used to achieve sporting success is royal jelly. Royal jelly is a kind of nutrient secreted by the hypopharingeal and mandibular glands of the worker bees for growth of young larvae and a main food of the queen bee (Echigo, Takenaka, Yatsunami, 1986; Guo, Saiga, M. Sato, et al., 2007; Oršolić, 2013). It is composed of protein, lipid, free amino acids, vitamin and sugar (Oršolić, 2013;Silici, Ekmekçioğlu, Kanbur, 2010; Lercker, Savioli, Vecchi, et al., 1986;Kanbur, Eraslan, Silici, et al., 2009) and used for the treatment of many diseases due to the nutrient-rich ingredients (Nagai and Inoue, 2004).

During exercise, a sum of fluid flows from vein to tissue and density of erythrocyte, hemoglobin and plasma proteins increases (Karacabey, Peker, Paşaoğlu, 2004; Özdengül, 1998). The amount of leukocyte in blood increases with the contribution of leukocyte which sticks on the blood vessel wall when blood stream is increased by exercise.Also, hormonal changes contribute to this increasement Khansari, Murgo, Faith, 1990; Waern and Fossum, 1993; Akgün,

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1994). With the exercise, all kinds of stress lead to increasement of leukocyte, this increasement is more significant during intensive exercise.

The main reason of this increasement is that blood pressure (especiallysystolic blood pressure) and fluid filtrationtowards tissues increase. Another reason is that osmotic pressure increases because of that the products of metabolism increase in interstitial fluid and so fluid flows into the tissues (Karacabey, Peker, Paşaoğlu, 2004; Özdengül, 1998). Adecrease characteristicallyoccurs in hemoglobin and hematocrit values in athletes performing intensive exercise program and it is called as athlets anemia (Londeann, 1978).

There is a positive relationship between fluidity of blood and aerobic performance. The decrease in plasma viscosity and fibrinogen density, and ergogenic aids assumed as an advantage for the volunteers doing exercise can provide more oxygen for active muscles. There is a tendency for athletes to use ergogenic aidsunconsciously for improvement of aerobic performance (Zorba, Mollaoğulları, Erdemir, 2000). Physical exercise capacity depends on the oxygen-carrying capacity for the tissues which work with maximum oxygen consumption. Oxygen content provided for tissues is determined by blood volume which arrives in the tissue and oxygen-carrying capacity. The most important factor to determine the oxygen-carrying capacity is hemoglobin concentration and erythrocyte number in circulation (Yapıcı, 2006).

In this study, it was aimed whether there is an effect of royal jelly supplementation with the same exercise programs on swimmers' hematological parameters.

Methods

Subjects. Forty healthy swimmers at the age of 18-25 years, performing the same training program, voluntarily participated in the study. The athletes were randomly divided into 4 groups and each group consists of 10 athletes.2 gr/day to the first group, 1 gr/day to the second group, 500 mg/day to the third group and placebo (cornstarch) to the fourth group were given. Royal jelly capsules, produced with the permission of the Ministry of Agriculture and Rural Affairs of Turkish Republic, were given to the 30 athletes in the volunteer group one time a day 20-30 minutes before breakfast for 4 weeks.

The swimmers performed totally 20 km swimming training 2 hours per day and 5 times a week for 4 weeks. The volunteers did not use any kind of vitamin, medicine or supplement since 2 months before the study and until the end of the study. Ethical committee permission were obtained from Erciyes University Deanery of Medical Faculty as well as written, informed consent from the volunteers.

Physical measurements of the Volunteers

The measurements of body height (via seca tape measure), weight and body composition (via Tanita BC 418 MA) were taken.

Royal jelly

Royal jelly used in this study was provided from Civan Beekeeping (Bursa, Turkey) and it was kept at -20 ^{0}C until the beginning of the study. Royal jelly and placebo (cornstarch) were filled into the capsules (500 mg). The filled capsules were put in the deep-freezer at -20 ^{0}C to protect.

Determination of the Amino acid content of Royal Jelly

Royal jelly used in this study was bought from the company whose analyses were already done (M. Kanbur, G. Eraslan, S. Silici, et al., 2009; S. Silici, S., O. Ekmekçioğlu, G. Eraslan, et al.,2009), and in accordance with this previous chemical analysis, the content of the royal jelly was determined.

Collecting Samples and Biochemical Analyses

Approximately 4 ml blood sample was taken into the tubes containing EDTA for CBC from each volunteer two times, at rest before starting the study and after the 4-week training period.Hematological values of the samples, obtained from volunteers, were tested at the central laboratory of Erciyes University Hospital. The blood samples were analyzed by using the device named Siemens Advia 2110i hematology system.

Statistical Analysis

SPSS 13.0 statistical software package was used for data analyses.The data distribution was tested with the Shapiro-Wilk test. The statistics of variables were briefly reported by using mean and standard deviation. Pre- and post-test results of the groups were tested with one-sample t-test, and intergroup comparisons were analyzed with one-way analysis of variance. To determine the distinctnessTukey HSD test was conducted. Significance level was taken as 0.05.

Results

Table 1. Physical characteristics of subjects by groups before and after intervention

Variables		Placebo	500 mg	1 gr	2 gr
		M±SD	M±SD	M±SD	M±SD
Age (Year)		20.90±1.45	21.90±2.77	21.20±0.92	21.70±1.34
Body Height (cm)		168.90±10.06	172.10±9.92	168.70±7.10	174.50±7.28
Body Weight (kg)	Pre	61.69±15.37	64.34±14.73	60.45±10.90	65.80±11.80
	Post	61.90±15.68	64.68±14.28	60.75±10.36	65.77±11.76
BMI (kg/height (m)^2)	Pre	21.36±2.99	22.33±4.61	21.14±3.01	21.53±2.99

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	Post	21.42±3.07	21.69±2.89	21.20±2.85	21.50±2.95
Fat (%)	Pre	17.15±5.15	13.27±4.42	13.56±6.96	14.81±5.78
	Post	16.54±5.05	12.61±4.75	13.35±7.88	14.91±5.84

M, mean; SD, standard deviation; n, number of subjects.

No significant difference was found in body weight, body mass index (BMI) and body fat percentage (Fat %) of placebo group, 500 mg, 1 gr and 2 gr royal jelly groups according to the pre-and post-exercise both intragroup and intergroup comparisons (p>0.05) (Table 1)..

Table 2. Erythrocyte parameters of subjects by groups before and after intervention

Variables		Placebo	500 mg	1 gr	2 gr
		M±SD	M±SD	M±SD	M±SD
RBC $10^6/\mu L$	Pre	4.43±1.35	5.17±0.51	4.93±0.92	4.96±0.35
	Post	4.73±0.57	4.99±0.60	5.09±0.43	4.86±0.31
HGB (g/dL)	Pre	13.96±1.79	15.29±2.03	14.52±1.72	14.49±1.14
	Post	14.16±1.60	14.82±1.80	14.57±1.93	14.73±1.21
HCT (%)	Pre	41.68±4.73	44.88±4.60	43.11±4.68	42.88±2.87
	Post	41.29±4.42	**42.92±4.59****↓	43.07±4.51	42.69±3.06
MCV (fl)	Pre	86.34±4.08	86.72±3.35	83.96±3.07	86.59±3.56
	Post	87.50±4.57	86.11±3.31	84.55±4.72	**87.94±3.14***↑
MCH(pg)	Pre	28.86±1.45	29.55±2.12	28.19±1.61	29.21±1.63
	Post	**29.97±1.85****↑	29.71±1.64	28.58±2.38	**30.34±1.26****↑
MCHC (g/dL)	Pre	33.45±0.83	34.03±1.43	33.53±0.89	33.74±0.64
	Post	**34.25±0.79****↑	34.50±1.00	33.75±1.30	**34.50±0.63****↑
CHCM(g/dL)	Pre	34.17±0.90	34.61±1.12	34.24±1.24	34.56±0.88
	Post	**32.39±1.46*****↓	33.59±2.98	33.01±2.14	**32.77±1.33*****↓
CH(pg)	Pre	29.25±1.37	29.88±1.86	28.61±1.88	29.73±1.55
	Post	**28.19±1.38*****↓	28.74±2.57	**27.76±1.85****↓	**28.70±1.81*****↓
RDW(%)	Pre	13.79±0.69	13.53±1.05	13.86±1.10	13.87±0.60
	Post	13.83±0.52	13.44±1.24	14.07±1.04	14.02±0.52
HDW(g/dL)	Pre	2.74±0.18	2.73±0.20	2.76±0.18	2.89±0.27
	Post	**2.47±0.24*****↓	2.53±0.24	**2.59±0.24***↓	**2.55±0.21*****↓

M, mean; SD, standard deviation; n, number of subjects.
Significant differences before and after intervention:*p<0.05 **p<0.01 ***p<0.001 ↓: Decrease ↑: Increase
Red Blood Cells (RBC), Hemoglobin (HGB), Hematocrit (HCT), Mean Red Cell Volume (MCV), Mean Cell Hemoglobin (MCH), Mean Cell Hemoglobin Concentration (MCHC), Red Cell Distribution Width (RDW), Cellular Hemoglobin Concentration Mean (CHCM), Hemoglobin Concentration Distribution Width (HDW)

As a result of pre- and post-exercise intragroup comparisons, while there was a significant decrease in HCT of 500 mg royal jelly group (p<0.01); in CHCM of placebo and 2 gr royal jelly groups (p<0.001); in CH and HDW of placebo, 1 gr (p<0.05) and 2 gr (p<0.001) royal jelly groups; there was a significant increase in MCV of 2 gr royal jelly group (p<0.05); in MCH and MCHC (p<0.01) of placebo and 2 gr royal jelly groups. Besides, there was no statistical significant difference in RBC, HGB and RDW of placebo, 500 mg, 1 gr and 2 gr royal jelly groups; in HCT of placebo, 1 gr, 2 gr royal jelly groups; in MCV of placebo, 500 mg and 1 gr royal jelly groups; in MCH, MCHC and CHCM of 500 mg and 1 gr royal jelly groups; CH and HDW of 500 mg royal jelly group (p>0.05) (Table 2).

As for the pre- and post-exercise intergroup comparisons, no statistical significant difference was detected in RBC, HGB, HCT, MCV, MCH, MCHC, CHCM, CH, RDW and HDW among erythrocytary parameters of placebo, 500 mg, 1 gr, 2 gr royal jelly groups (p>0.05).

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Table 3. Leukocyte parameters of subjects by groups before and after intervention

Variables		Placebo	500 mg	1 gr	2 gr
		M±SD	M±SD	M±SD	M±SD
WBC10^3/µL	Pre	7.57±2.08	9.05±3.83	8.70±1.40	9.12±1.84
	Post	7.74±2.44	7.14±1.62	**7.09±1.43*↓**	**7.50±1.49*↓**
NE %	Pre	56.84±5.70	60.69±10.29	59.60±6.89	63.47±7.72
	Post	61.64±8.23	60.03±5.33	57.51±7.63	59.46±9.57
EO %	Pre	1.96±1.03	2.10±1.25	1.63±0.69	1.50±1.25
	Post	1.65±0.97	2.94±2.51	**2.23±0.57*↑**	2.33±1.80
LY %	Pre	33.09±4.59	28.84±8.63	30.06±5.91	27.23±6.64
	Post	29.84±6.93	28.26±4.56	31.98±6.58	30.27±8.20
BA %	Pre	0.68±0.55	0.49±0.34	0.73±0.35	0.69±0.36
	Post	0.29±0.12	**0.24±0.13*↓**	**0.30±0.12**↓**	**0.27±0.13**↓**
MO %	Pre	5.36±1.02	6.03±1.49	6.02±1.23	5.34±1.34
	Post	4.90±0.97	6.31±2.68	6.13±0.90	5.42±1.28
NE# 10^3/µl	Pre	4.37±1.53	5.79±3.65	4.75±1.27	5.89±1.75
	Post	4.90±2.01	4.27±0.94	4.13±1.22	4.55±1.39
LY# 10^3/µl	Pre	2.45±0.50	2.35±0.29	2.57±0.41	2.40±0.34
	Post	2.21±0.62	2.05±0.73	2.23±0.53	**2.20±0.38*↓**
MO# 10^3/µl	Pre	0.39±0.08	0.53±0.22	0.52±0.09	0.48±0.14
	Post	0.37±0.10	0.42±0.11	0.43±0.08	0.40±0.08
EO# 10^3/µl	Pre	0.21±0.19	0.19±0.13	0.14±0.06	0.13±0.10
	Post	0.12±0.06	0.19±0.18	0.16±0.04	0.17±0.11
BA# 10^3/µl	Pre	0.06±0.06	0.15±0.26	0.06±0.03	0.14±0.27
	Post	0.02±0.01	0.02±0.01	**0.02±0.01***↓**	0.02±0.01

M, mean; SD, standard deviation; n, number of subjects.
Significant differences before and after intervention:*p<0.05 **p<0.01 ***p<0.001 ↓: Decrease↑:Increase
White Blood Cells (WBC), Lymphocyte (LY), Neutrophil (NE), Monocyte (MO), Eosinophil (EO), Basophil (BA)

According to the pre-and post-exercise intragroup comparisons, while there was a significant decrease in WBC of 1 gr and 2 gr royal jelly groups (p<0.05); in BA# of 1 gr royal jelly group (p<0.001); in BA % of 1 gr, 2 gr (p<0.01) and 500 mg (p<0.05) royal jelly groups; in LY# of 2 gr royal jelly group (p<0.05); a significant increase was found in EO % value of 1 gr royal jelly group (p<0.05). Besides, no statistical significant difference was found in MO#, NE#, EO# numbers and NE%, LY% and MO% values of placebo, 500 mg, 1 gr and 2 gr royal jelly groups; in WBC value of placebo and 500 mg royal jelly groups; in EO % and BA# values of placebo, 500 mg and 2 gr royal jelly groups; in BA% value of placebo group; in LY# value of placebo, 500 mg and 1 gr royal jelly groups (p>0.05).

As for the pre- and post-exercise intergroup comparisons, no statistical significant difference was found in WBC, LY#, MO#, EO# and BA# numbers, and NE%, EO%, LY%, BA% and MO% values among leukocyte parameters of placebo, 500 mg, 1 gr, 2 gr royal jelly groups (p>0.05) (Table 3).

Table 4. Thrombocyte parameters of subjects by groups before and after intervention

Variables		Placebo	500 mg	1 gr	2 gr
		M±SD	M±SD	M±SD	M±SD
PLT 10^3/µL	Pre	281.90±67.45	260.10±57.60	262.80±42.92	244.70±69.45
	Post	**310.40±67.50*↑**	273.50±73.77	**313.90±64.81**↑**	274.00±59.82
MPV (fl)	Pre	8.21±0.26	8.23±0.36	8.32±0.41	8.34±0.47
	Post	**8.71±0.42**↑**	8.76±0.52	**8.99±0.48***↑**	**9.07±0.76***↑**
PCT (%)	Pre	0.43±0.66	0.21±0.04	0.22±0.03	0.42±0.64
	Post	0.27±0.07	0.25±0.06	**0.28±0.05***↑**	0.25±0.04
PDW (%)	Pre	41.76±2.78	41.16±4.72	42.76±3.89	42.32±4.02
	Post	41.49±4.32^{ab}	37.30±8.54^{a}	42.05±6.01^{ab}	**46.69±5.77^{b*}↑**

M, mean; SD, standard deviation; n, number of subjects.Significant differences before and after intervention:
p<0.05**p<0.01***p<0.001↓: Decrease↑:Increase,ab: No significant difference between the groups which have the same letter and in the same line.
Platelets (PLT), Mean Platelet Volume (MPV), Platekrit (PCT) and Platelet Distribution Width (PDW)

As a result of pre- and post-exercise intragroup comparisons, a significant increase in favour of post-exercise values was found in PLT value of placebo ($p<0.05$) and 1 gr royal jelly ($p<0.01$) groups; in MPV value of placebo ($p<0.01$), 1 gr and 2 gr ($p<0.001$) royal jelly groups; in PCT value of 1 gr royal jelly group ($p<0.001$) and PDW value of 2 gr royal jelly group ($p<0.001$). However, no significant difference was detected in PLT value of 500 mg and 2 gr royal jelly groups; in MPV value of 500 mg royal jelly group;in PCT value of placebo, 500 mg and 2 gr royal jelly groups, and in PDW value of placebo, 500 mg and 1 gr royal jelly groups ($p>0.05$).

According to the post-exercise intergroup comparisons, a significant difference was seen in PDW variable of swimmers; while a significant decrease was found in 500 mg royal jelly group, there was a significant increase in 2 gr royal jelly group ($p<0.05$). No significant difference was found among placebo, 500 mg and 1 gr royal jelly groups; and among placebo, 1 gr and 2 gr royal jelly groups ($p>0.05$) (Table 4).

Discussion

It is known that bee products such as pollen and propolis have been used in science for various reasons until today. However, it is seen that there is no comprehensive study about royal jelly studied on athletes.

No significant difference was found in body weight, body mass index and body fat percentage values of placebo, 500 mg, 1 gr and 2 gr royal jelly groups in both intergroup and intragroup comparisons of pre- and post-exercise. It was thought that this is because the volunteers were trained athletes and except for the royal jelly any kind of extra diet program was not used.

While there was a significant decrease in HCT value of 500 mg royal jelly group, in CHCM of placebo and 2 gr royal jelly group, in CH and HDW of placebo, 1 gr and 2 gr royal jelly groups; a significant increase was found in MCV value of 2 gr royal jelly group, in MCH and MCHC values of placebo and 2 gr royal jelly groups according to pre- and post-exercise intragroup comparisons. This result was evaluated as a finding on royal jelly although it was not so significant. It was known that the values of erythrocyte parameters show an alteration with regular exercise (Patlar and Keskin, 2007). In a study made on rats by using royal jelly supplement, a significant increase was found in HCT value of exercise group (Ju-Fang, Lin-xiang, Jia-bin, et al., 2006). In another study conducted on people to investigate the effects of propolis supplement on erythrocyte and oxidative stress, it was seen that RBC and HGB values significantly decreased after giving propolis (Jasprica, Mornar, Debeljak, 2007). In the study made in order to examine the effects of glycerol support, a different kind of supplement, on some hematological parameters on athletes doing exercise regularly and sedentaries, no significant difference was detected in RBC, HGB and HCT values (Patlar and Keskin, 2007). In another study in which ambrotose supplement was used on healthy individuals, there was a statistical significant decrease depending on the exercise in haematocrit values of the group exposed to both ambrotose and exercise (Bloomer, Canale, Blankenship, et al., 2010). According to a study made on athletes, after usage of creatine (0.03 mg/kg) and multivitamin supplement (0.01 mg/kg) a significant increase was foundin HGB and RBC values, while no significant difference was detected in HCT levels (Milasius, Dadeliene, Ribaubine, 2006). In a study conducted on rats, there were some significant differences in RBC and HGB levels in intergroup comparisons after giving propolis (S. Mohammadzadeh, Shariatpanahi, Hamedi, et al., 2007). RBC number and HGB concentration are effective in muscular activities of athletes. Therefore, while there is an alteration in RBC and HGB levels, ıts reason can be the muscular activities. An alteration is seen inhemoglobin and erythrocyte levels of the individuals doing exercise (Broadbent, 2011). If the severity of exercise is increased, erythrocyte destruction increases. In consequence of exhausting and strenuous exercise, erythrocyte destruction accelerates; but the products of disjunction increase erythrocyte formation by stimulating the systems related to production of blood (Yapıcı, 2006). It is thought that the increase in MCV, MCH and MCHC occurred in relation to the exercise. In a similar way, in the study made by Noushad et al. (2012), significant increases were detected in erythrocyte parameters based on exercise. By reason of the fact that exercise influences many physiological conditions such as hematological indicators, it was concluded that the differences detected in the present study are related to the exercise.

According to the pre-and post-exercise intragroup comparisons, while there was a significant decrease in WBC of 1 gr and 2 gr royal jelly groups; in BA# of 1 gr royal jelly group; in BA % of 1 gr, 2 gr and 500 mg royal jelly groups; in LY# of 2 gr royal jelly group; a significant increase was found in EO % value of 1 gr royal jelly group. In a study in which propolis supplement was used, no significant difference was found in WBC (Zorba, Mollaoğulları, Erdemir, 2000). In a study made on rats, after giving propolis, there was no significant difference in WBC level in intergroup comparisons (Mohammadzadeh, M.Shariatpanahi, Hamedi, et al., 2007). In another study conducted to examine the effects of glycerol support on some hematological parameters on athletes doing exercise regularly and sedentaries, WBC showed no differences in terms of the initial and last value of the supplementation, post-exercise WBC numbers significantly increased in all groups except for the sedentaries. However, it was stated that exercise and glycerol support in that amount (1,2 mg/kg/day) and duration (20 days) have no significant impact on WBC(Patlar and Keskin, 2007). In a study made to examine the effects of antioxidant supplements on athletes, a significant increase was found in WBC

value after 4-week exercise period (Nielsen, Skjonsberg, Lyberg, 2008). As a result of creatine (0.03 mg/kg) and multivitamin (0.01 mg/kg) supplementation on athletes, a significant increase was seen in WBC levels of creatine and multivitamin groups levels (Milasius, Dadeliene, Ribaubine, 2006). Also, in a study made rats, pumpkin seed flour was given at different doses (100-200-300-400 mg/kg) and there was a significant increase in WBC levels (Adepoju and Adebanjo, 2011).

It is known that regular exercise leads to substantial alterations in blood profile. These alterations can occurbased on the hormonal changes related to nutrition (Noushad, Ahmedi, Jafri, et al., 2012). As for exercise, there can be some significant differences in both leukocyte numbers and percentages of leukocyte parameters following 12-15 minutes exercise (Yapıcı, 2006). It was thought that the differences found in the present study are because of that the athletes are doing exercise regularly.

As for the platelet parameters, a significant increase in favour of post-exercise values was found in PLT value of placebo and 1 gr royal jelly groups; in MPV value of placebo, 1 gr and 2 gr royal jelly groups; in PCT value of 1 gr royal jelly group and PDW value of 2 gr royal jelly group according to the pre- and post-exercise intragroup comparisons. In the post-exercise intergroup comparisons, while a significant decrease was found in PDW variable of 500 mg royal jelly group, there was a significant increase in 2 gr royal jelly group. Literature supports that PDW value increases as long as the dosage of royal jelly increases. Amountof blood thrombocyte increases as a result of exercise because there is a thrombocyte secretion to blood from bone marrow, spleen and other storage of thrombocyte in organism (Koushki, Mollanovruzib, Rashidlamirc, 2013). In a study made on rats to examine the effects of exercise and royal jelly, there was a significant increase in PLT level of the group exposed to both exercise and royal jelly, compared to the group exposed just exercise (Ju-Fang, Lin-xiang, Jia-bin, et al., 2006). As a result of propolis supplementation on rats, there was no significant difference in PLT value in intergroup comparisons (Mohammadzadeh, Shariatpanahi, Hamedi, et al., 2007). Also, in the study conducted to examine the effects of glycerol support on some hematological parameters on athletes doing exercise regularly and sedentaries, no significant difference was found in PLT value (Patlar and Keskin, 2007). In a study made by giving pumpkin seed flour at different doses to rats, a significant increase was found in PLT level (Adepoju and Adebanjo, 2011). In another study including L-arginine supplementation on healthy men at the age of 18-25 years, a significant increase was detected in PLT count over the study. It was concluded that there is no difference based on the L-arginine and the decrease is related to the exercise (Corbett, 2009).

This study has some limitations: Firstly, the participants were informed about dietary measures but were not controlled, and diet was not recorded the day before the endurance exercise tests. Secondly, the exercise protocols were performed on highly physically trained individuals. Therefore, the responses observed may not be representative sample of sedentary individuals.

It is thought that the differences detected in the present study are related to the form of the exercise and the training level of athletes.

In conclusion, it is thought that 4-week royal jelly supplementation at different doses showed no adverse effect on hemogram for athletes, and also using different training programs and different doses (higher doses) on more volunteers in a long time can contribute to produce new knowledge.

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