ACTA MEDICA LITUANICA. 2006. VOLUME 13 No. 2. P. 119–124

The influence of creatine food supplement and its complex with vitamins MULTIVITA$^+$ on athletes' adaptation to physical loads

Kazys Milašius*,

Rūta Dadelienė,

Eglė Kemerytė-Riaubienė

Vilnius Pedagogical University, Vilnius, Lithuania

Creatine has found a wide application in enhancing the physical performance and functional capacity among sportsmen during short-term exercising. However, comprehensive studies on the effect of creatine and its complex with vitamins on endurance training athletes and the peculiarities of adaptation to long-term physical loads, aerobic capacity, blood morphological and biochemical indices are lacking.

The aim of this study was to elucidate the effect of creatine monohydrate and its complex with MULTIVITA$^+$ vitamins on the athletes' blood and urine morphological and chemical indices.

Materials and methods. The study groups consisted of endurance-training athletes (runners, skiers, biathlonists). After the first examination when the blood morphological and biochemical indices had been determined, all subjects were divided into two groups (E_1 and E_2), ten subjects in each. The first (E_1) group was supplemented for 5 days with the creatine mono-hydrate at a dose 0.3 g/kg and for 15 days at a dose 0.1 g/kg of body mass. Group E_2 was supplemented for 5 days with the creatine monohydrate at a dose 0.3 g/kg and for 15 days at a dose 0.1 g/kg of body mass and one capsule of the MULTIVITA$^+$ vitamins daily. Blood and urine biochemical and morphogical indices were determined three times.

Results and discussion. The investigation showed that erythrocyte count and hemoglobin concentration had a tendency to increase, however, hematorcit remained unchanged in both groups. It shows a slight positive effect of the food supplement on the hematological system. The decreased ESR value presumed that this food supplement had an antiphlogistic effect. Leucocyte count increased in group E_2 significantly. Creatine metabolism in the organism had no influence on urine biochemical composition and pH. The creatinekinase enzyme had a tendency to increase in both groups.

Key words: creatine food supplement, vitamins, sportsmen, blood biochemical picture

INTRODUCTION

The influence of different physical loads on athletes' organism is very specific. Modern sports, with their high physical and emotional loads, reach the maximum of human physiological abilities and require a new level of athlete's adaptation. This level is obtainable mostly by supporting different kinds of nutrition with supplements exerting a specific effect on the human organism. Indeed, nutrition influences nearly all processes in the body, involved in energy production and recovery from exercise, and many athletes turn to ergogenic aids (1–5).

In sport nutrition, supplements should be applied to supplement the diet by increasing the dietary intake, supplementing the organism during heavy training or as a means to prevent the underperformance and enhancing recovery in athletes (6, 7).

Creatine has found a wide application in enhancing the physical performance and functional capacity among sportsmen during short-term exercising. There are many scientific researches related to creatine and its effect on

* Address for correspondence: Kazys Milašius, Vilnius Pedagogical University, Department of Sport Methodics, Studentu 39, LT-08106, Vilnius, Lithuania. E-mail: kazys.milasius@vpu.lt

increasing muscle mass and muscle strength (8–20). Most researches emphasize the effect of creatine in its combination with glucose (21–25); however, comprehensive studies on the effect of creatine and its complex with vitamins on endurance-training athletes and the peculiarities of adaptation to long-term physical loads, aerobic capacities, blood morphological and biochemical indices are lacking.

The aim of our study was to elucidate the effect of creatine monohydrate and its complex with MULTIVITA$^+$ vitamins on the athletes' blood and urine morphological and chemical indices.

MATERIALS AND METHODS

We examined 20 athletes aged 20–24 years (runners, skiers, biathlonists). After the first examination when the blood morphological and biochemical indices had been determined, all subjects were divided into two groups (E_1 and E_2), 10 subjects in each. The first (E_1) group (average body mass 76.70 ± 1.98 kg, muscular mass 42.08 ± 1.29 kg) [26] was supplemented for 5 days with the creatine monohydrate (Multipower Co.) at a dose 0.3 g/kg and for 15 days at a dose 0.1 g/kg of muscular mass.

Group E_2 (average body mass 76.31 ± 3.21 kg, musculare mass 41.09 ± 1.80 kg) was supplemented for 5 days with creatine monohydrate at a dose 0.3 g/kg and for 15 days at a dose 0.1 g/kg of muscular mass and one capsule of the MULTIVITA$^+$ (MULTIPOWER company) vitamins daily.

Blood and urine biochemical and morphological indices were determined three times: before athletes were supplemented with creatine monohydrate (Study I), after 5 days of supplementing with a large dose of creatine monohydrate (Sudy II), and after 15 days of supplementing with a smaller dose (Study III).

The study groups consisted of endurance-training athletes (runners, skiers, biathlonists).

To evaluate blood morphological and biochemical indices, blood samples were taken from the vein.

We studied the peripheral blood picture, determined erythrocyte counts (RBC), hemoglobin concentration (HGB), hematocrite (HCT), erythrocyte sedimentation rate (ESR), leucocyte counts (WBC), leukocyte formula: the percentage of granulocytes (GRA), lymphocytes (LYM) and monocytes (MON) were measured with the Micros-60 (France) hematological analyzer.

Blood biochemical indices (creatinekinase and creatinine concentration) and urine biochemical indices (creatinkinase and creatinine concentration, specific weight of urine (SG) and its pH were determined with the aid of a REFLOTRON-IV (Boehringer Manheim, German) biochemical analyzer.

In statistical analysis, we calculated the mean indices $\bar{X}$, standard error ($S\bar{x}$), standard deviation (S). To determine statistical differences among the indices, Pearson's correlative analysis was done (r). To determine statistical significance, we applied the 95% criterion ($p < 0.05$).

RESULTS

The investigation showed that all indices of blood morphology, biochemical composition and urine test in both groups had been within the physiological mark before the subjects were supplemented with creatine and creatine complex with multivitamins (Tables 1, 2).

Administration of creatine (E_1 group) increased erythrocyte counts in blood from 5.07 ± 0.07 to $5.19 \pm 0.08 \times 10^{12}$ ($p = 0{,}283$) (Table 1). Erythrocyte counts in subjects belonging to group E_2 increased also from 4.80 ± 0.09 to $4.97 \pm 0.13 \times 10^{12}$ ($p = 0{,}294$) (Table 2). We found that hemoglobin concentration had a tendency to increase only in the subjects, administered the creatine complex with vitamins ($p = 0{,}476$) (group E_2). All this process was accompanied by a decreasing hematocrit percent age and rate of erythrocyte sedimentation.

Analyzing the leucocyte formula, we found that leucocyte count had a tendency to increase. All these changes were more pronounced in the group supplemented with creatine in complex with vitamin (group E_2) (Table 2). After 5 days of administrating the creatine and vitamin complex, the indices of leucocyte count increased from 5.18 ± 0.38 to $5.69 \pm 0.29 \times 10^9$ ($p = 0{,}301$). Using this complex for 14 days more, the leucocyte count increased to $6.85 \pm 0.48 \times 10^9$, and this increase was statistically significant ($p < 0.05$). Also in group E_1 the leucocyte count had a tendency to increase.

Food supplementation with vitamins (group E_2) had a positive effect on granulocyte count ($p < 0.05$) and monocyte percentage. These indices increased in the subjects' blood, meanwhile the lymhocyte percentage remained stable.

Analysis of the athletes' blood biochemical data showed that after 5 days of supplementing creatine alone (group E_1) the concentration of creatinekinase increased from 194.60 ± 22.54 to 277.97 ± 23.58 u/l ($p < 0.05$) and in group E_2 from 160.35 ± 16.50 to 207.50 ± 20.99 u/l.

The creatinkinase concentration decreased while applying smaller doses of creatine (215.35 ± 28.30 u/l), whereas in group E_2 supplemented with creatine in complex with vitamin the concentration of creatinkinase continuously increased (to 251.80 ± 15.10 u/l, $p < 0.001$).

Five days of administration of the food supplement had a positive influence on blood creatinine concentration. This index increased from 67.06 ± 5.40 to 78.32 ± 1.53 μmol/l in group E_1, and smaller changes were observed in group E_2 (from 73.35 ± 2.43 to 74.85 ± 4.18 μmol/l).

These results showed that the creatine complex with vitamins had a slight effect on blood creatinine concentration.

We found that the creatine food supplement increased the creatinine concentration in urine. This increase in both groups was statistically significant (E_1 and E_2 $p < 0.001$).

The same changes were found after 20 days of supplementing creatine and the creatine complex (E_1 $p < 0.05$, E_2 $p < 0.001$). No statistically significant changes in the indices of urine specific weight were noted when the food supplements were administered.

Table 1. **Blood morphological and biochemical indices in athletes supplemented with creatine monohydrate (group E_1)**

Indices		RBC 10^{12}	HGB g/l	HCT %	ESR mm/val	WBC 10^{9}	GRA %	LYM %	MON %	CK u/l	Creatinine in blood µmol/l	Creatinine in urine mmol/l	Urine	
													SG g/cm^3	pH
Physiological marks		**3.8–5.8**	**110–165**	**35–50**	**1–10**	**3.5–10**	**40–70**	**17–48**	**4–10**	**24–190**	**23–97**	**8–27**	**1.01–1.025**	**5–6**
Study I														
$\overline{X}$		5.07	161.10	51.60	5.80	5.32	53.80	35.40	4.50	194.60	67.06	15.45	1.02	5.50
$S\overline{x}$		0.07	2.00	0.64	1.01	0.41	2.52	3.26	0.93	22.54	5.40	1.29	0.00	0.17
S		0.21	6.31	2.01	3.19	1.30	7.97	10.31	2.95	71.28	17.06	4.07	0.00	0.53
Study II														
$\overline{X}$		5.18	160.80	52.50	5.00	5.48	59.42	34.76	5.82	277.97	78.32	27.72	1.02	5.30
$S\overline{x}$		0.02	1.45	0.31	1.10	0.40	2.50	2.31	0.39	23.58	1.53	1.27	0.00	0.15
S		0.08	4.59	0.97	3.46	1.27	7.91	7.32	1.22	74.57	4.83	4.02	0.00	0.48
Study III														
$\overline{X}$		5.19	159.30	44.08	3.60	6.11	58.03	36.33	5.64	215.35	76.67	26.78	1.03	5.50
$S\overline{x}$		0.08	1.33	0.48	0.58	0.40	2.12	2.03	0.42	28.30	3.75	3.83	0.01	0.27
S		0.26	4.22	1.50	1.84	1.26	6.71	6.43	1.32	89.50	11.86	12.12	0.03	0.85
Significance														
I–II–III	**p**	0.352	0.705	1.396	0.251	0.356	0.241	0.912	0.293	0.065	0.106	0.002	0.543	0.726
I–II	**p**	0.140	0.905	0.219	0.598	0.783	0.131	0.875	0.208	0.020	0.060	2.356	0.331	0.388
I–III	**p**	0.283	0.463	2.047	0.075	0.184	0.215	0.811	0.280	0.573	0.166	0.012	0.399	1.000
II–III	**p**	0.928	0.457	1.482	0.274	0.280	0.677	0.616	0.755	0.106	0.688	0.818	0.492	0.526

Abbreviations: RBC – erythrocyte counts, HGB – hemoglobin concentration, HCT – hematocrite, ESR – erythrocyte sedimentation rate**,** WBC – leucocyte counts, leucocyte formula: GRA – granulocytes, LYM – lymphocytes, MON – monocytes, CK – creatinekinase

Table 2 **Blood morphological and biochemical indices in athletes, supplemented with creatine monohydrate and vitamin complex (group E_2)**

Indices		RBC 10^{12}	HGB g/l	HCT %	ESR mm/val	WBC 10^9	GRA %	LYM %	MON %	CK u/l	Creatinine in blood. µmol/l	Creatinine in urine mmol/l	Urine	
													SG g/cm^3	pH
Physiological marks		**3.8–5.8**	**110–165**	**35–50**	**1–10**	**3.5–10**	**40–70**	**17–48**	**4–10**	**24–190**	**23–97**	**8–27**	**1.01–1.025**	**5–6**
Study I														
$\overline{X}$		4.80	150.70	48.20	5.50	5.18	55.40	33.80	5.30	160.35	73.35	17.09	1.02	5.33
$S\overline{x}$		0.09	2.15	0.79	1.22	0.38	2.74	2.71	1.26	16.60	2.43	0.63	0.00	0.17
S		0.27	6.78	2.49	3.87	1.21	8.67	8.57	3.97	52.48	7.67	1.98	0.00	0.50
Study II														
$\overline{X}$		4.87	151.40	48.80	5.60	5.69	57.43	35.18	7.34	207.50	74.85	27.72	1.02	5.30
$S\overline{x}$		0.07	2.76	0.71	1.83	0.29	3.33	3.15	0.47	20.99	4.18	1.81	0.00	0.15
S		0.23	8.73	2.25	5.78	0.92	10.54	9.95	1.50	66.38	13.22	5.72	0.00	0.48
Study III														
$\overline{X}$		4.97	153.60	42.47	3.50	6.85	60.48	32.98	6.54	251.80	78.24	26.29	1.02	5.50
$S\overline{x}$		0.13	3.36	1.14	0.76	0.48	3.22	2.80	0.80	15.10	2.82	1.54	0.00	0.22
S		0.40	10.63	3.61	2.42	1.52	10.19	8.84	2.51	47.75	8.92	4.86	0.00	0.71
Significance														
I–II–III	**p**	0.496	0.749	0.000	0.470	0.017	0.517	0.863	0.289	0.004	0.555	0.001	0.576	0.712
I–II	**p**	0.542	0.844	0.578	0.964	0.301	0.644	0.744	0.146	0.095	0.760	0.001	0.272	0.884
I–III	**p**	0.294	0.476	0.001	0.182	0.014	0.014	0.836	0.415	0.001	0.205	0.001	0.613	0.565
II–III	**p**	0.522	0.619	0.000	0.303	0.054	0.519	0.608	0.399	0.104	0.510	0.554	0.613	0.470

Abbreviations: RBC – erythrocyte count, HGB – hemoglobin concentration, HCT – hematocrite, ESR – erythrocyte sedimentation rate**,** WBC – leucocyte count, leucocyte formula: GRA – granulocytes, LYM – lymphocytes, MON – monocytes, CK – creatinekinase

DISCUSSION

Creatine exerts a great influence on the whole energetic process under heavy physical loads. Therefore it is important to monitor blood morphological and biochemical indices in athletes.

Our research data confirm that administering creatine in complex with vitamins has a higher positive effect on hematological indices than does creatine alone. It was emphasized by other researches (17, 24, 27, 28).

Leucocyte count depends on different external factors and the functional status of the organism. Our researches showed that creatine in complex with vitamins increased the indices of leucocyte count significantly. These changes in leucocyte formula were related to a decreasing erythrocyte sedimentation rate. These results characterized creatine as an antiphlogistic factor. Creatine has a positive influence on blood immune system (6, 11, 29).

The food supplement consisting of creatine and vitamins had a longer positive effect on the concentration of creatinkinase in our subjects' blood. Moreover, creatinekinase remains more active in blood for a longer time (17, 30, 31).

We found that creatine in complex with vitamin is easier assimilated by the organism and for its metabolism the organism needs to increase creatinekinase concentration (16, 32, 33).

Slight changes in urine biochemical composition showed that the protein metabolism process in the athletes' organism was normal. Physical activity, nutrition status, sleeping regime, temperature and other factors had no influence on protein metabolism.

CONCLUSIONS

Erythrocyte count and hemoglobin concentration had a tendency to increase, however, hematocrit remained unchanged in both groups during the whole research time, implying a slight positive effect of the food supplement on the hematological system. The decreased ESR value indicated this food supplement to have an antiphlogistic effect. Leucocyte count increased in group E_2 significantly. Creatine concentration increased significantly in both groups during the experiment. Creatine metabolism in the organism had no influence on urine biochemical composition and pH. Creatinekinase had a tendency to increase in both groups.

Received 8 February 2006
Accepted 7 May 2006

References

1. Balsom PD, Ekblom B, Söderlund K, Sjödin B, Hulltman E. Creatine supplementation and dynamic high-intensity exercise. Scand Journ Med Sci Sports 1993; 3: 143–9.
2. Greenhaff P. Creatine supplementation: Recent developments. Brit Journ Sports Med 1996; 30: 276–7.
3. Williams H, Kreider R, Branch Journ. Creatine: the power supplement, Human Kinetics 1999: 250 p.
4. Milašius K, Kemerytė-Riaubienė E, Vilkas A. Effect of Tot'hema and Feroglobin B_{12} food supplements on changes of blood indices in endurance-training sportsmen. Acta medica Lituanica 2003; 10(2): 104–9.
5. Pečiukonienė M, Stukas R, Kemerytė-Riaubienė E. Maisto papildai sportininkų mityboje. Sporto mokslas 2004; 1(35): 59–64.
6. Eberle S. Endurance Sports Nutrition. Champaign USA. 2000: 288 p.
7. Manore M, Thompson J. Sport nutrition for health and performance. Human Kinetics 2000: 514 p.
8. Söderlund K, Balsom P, Ekblom B. Creatine supplementation and high intensity exercise: Influence on performance and muscle metabolism. Clinical Sci 1994; 87: 120–1.
9. Viru M, Ööpik V, Nurmekivi A, Medijainen L, Timpmann S, Viru A. Effect of creatine intake on performance capacity on middle-distance runners. Coaching and Sport Sci Journ 1994; 1: 31–6.
10. Earnest C, Snell P, Rodriguez R, Almada A, Mitchell T. The effect of creatine monohydrate ingestion on anaerobic power indices, muscular strength and body composition. Acta Physiol Scand 1995; 153: 207–9.
11. Hultman E, Bergström J, Spriet L, Söderlund K. Energy metabolism and fatigue. In: Taylor A, Gollnick P, Green H (eds) Biochemistry of Exercise VII Champaign IL. Human Kinetics 1990; 73–92.
12. Ekblom B. Effects of creatine supplementation on performance. Amer Journ Sports Med 1996; 24: 38–39.
13. Ruden T, Parcell A, Ray M, Moss K, Semler J, Sharp R, Rolfs G, King D. Effects of oral creatine supplementation on performance and muscle metabolism during maximal exercise. Med Sci Sports and Exerc 1996; 28: 81 (abstract).
14. Thompson C, Kemp G, Sanderson A, Dixon R, Styles P, Taylor D, Radda G. Effect of creatine on aerobic and anacrobic melabolism in skeletal muscle in swimmers. Brit Journ Sports Med 1996; 30: 222–5.
15. Bosco C, Tihanyj J, Pucspek J, Kovacs I, Gabossy A, Colli R, Puivirenti G, Tranquilli C, Foti C, Viru M, Viru A.. Effect of oral creatine supplementation on jumping and running performance. Int Journ Sports Med 1997; 18: 369–72.
16. Greenhaff P. The nutritional biochemistry of creatine. Journ Nutrit Biochemistry 1997; 11: 610–18.
17. Clark JF. Creatine: A review of its nutritional applications in sport. Nutrition 1998; 14: 322–34.
18. Tarnopolsky M, Martin J. Creatine monohydrate increases strength in patients with neuromuscular disease. Neurology 1999; 52: 854–7.
19. Anomasiri W, Sanguanrungsirikul S, Saichandee P. Low dose creatine supplementation enhances sprint phase of 400 meters swimming performance. Journ Medical Assoc Thailand 2004; 87: 228–32.
20. Okudan N, Gokbel H. The effects of creatine supplementation on performance during the repeated bouts of supramaximal exercise. Journ Sports Med Phys Fitness 2005; 45(4): 507–11.

21. Saltin B, Gollnick P. Fuel for muscular exercise: role of carbohydrate. Exercise, nutrition and energy metabolism. 1988: 45–71.
22. Green A., Hultman E, MacDonald I, Sewell D, Greenhaff P. Carbohydrate feeding augments skeletal muscle creatine accumulation during creatine supplementation in humans. Amer Journ Physiol 1996; 271: 821–826.
23. Theodorou A, Cooke C, King R, Duckette R. The effect of combined carbohydrate and creatine ingestion on anaerobic performance. Med Sci Sports Exerc 1998; 30: 272 (abstract).
24. Theodorou AS, Havenetidis K, Zanker CL, O'Hara JP, King RF, Paradidis G, Cooke CB. Effects of acute creatine loading with or without carbohydrate on repeated bouts of maximal swimming in high-performance swimmers. Journ Strength Cond Res 2005; 19(2): 265–9.
25. Peyrebrune MC, Stokes K, Hall GM, Nevill ME. Effect of creatine supplementation on training for competition in elite swimmers. Med Sci Sport Exerc 2005; 37(12): 2140–7.
26. Norton K, Olds T. Anthropometrica. UNSW Press, Sydney, 1996.
27. Earnest C, Almada A, Mitchell T. High-performance capillary electrophoresis-pure creatine monohydrate reduced blood lipids in men and women. Clinical Sci 1996; 91: 113–18.
28. Watanabe A, Kato N, Kato T. Effects of creatine on mental fatigue and cerebral hemoglobin oxygenation. Neurosci Res 2002; 42(4): 279–85.
29. Kreider R. Creatine supplementation: Analysis of ergogenic value, medical safety, and concerns. Journ Exerc Physiol 1998; 1: 7–18.
30. Juhn M, Tarnopolsky M. Oral creatine supplementation and athletic performance: A critical review. Clinical Journ Sport Med 1998; 8: 286–297.
31. Finn JP, Ebert TR, Carey MF, Mackay M, Philips JW, Febbraio MA Effcet of creatine supplementation metabolism and performance in humans during intermittent sprint cycling. Eur Appl Physiol 2001; 84(3), 238–43.
32. Milašius K, Pečiukonienė M, Švedas E. Creatine food supplements in the nutrition of endurance-training sportsmen. Acta Kinesiologiae, Univer Tartuensis 2002; 7: 139–43.
33. Janssen G, Degenaar C, Menheere P, Habets H, Geurten P. Plasma urine, creatinine, uric acid, albumin, and total protein concentrations before and after 15-, 25- and 42-km contests. Int Journ Sports Med 1989; 10: 132–38.

Kazys Milašius, Rūta Dadelienė,
Eglė Kemerytė-Riaubienė

MAISTO PAPILDO KREATINO IR JO KOMPLEKSO SU VITAMINU MULTIVITA$^+$ POVEIKIS SPORTININKŲ ORGANIZMO ADAPTACIJAI ESANT FIZINIAM KRŪVIUI

Santrauka

Sportininkų mityboje vis plačiau yra vartojami didesnės biologinės vertės bei ergogeniniai produktai. Jie gali būti taikomi skubiam maisto raciono subalansavimui, maitinimuisi varžybų metu, kaip atsigavimo priemonė po intensyvių treniruočių arba varžybų dienomis. Ypač paplitęs maisto papildas kreatinas, suteikiantis daugiau fizinių jėgų, žvalumo, didinantis darbingumą trumpai trunkančio darbo metu.

Tačiau dar nėra pakankamai duomenų, kaip kreatinas veikia ištvermę lavinančių sportininkų organizmo adaptaciją esant fiziniam krūviui, jų raumenų galingumą, aerobinį pajėgumą, kraujo morfologinę ir biocheminę sudėtį, taip pat pasigendame duomenų apie kreatino poveikį vartojant jį kompleksiškai kartu su įvairiais vitaminais.

Darbo tikslas – įvertinti kreatino monohidrato ir jo komplekso su vitaminu MULTIVITA$^+$ poveikį sportininkų kraujo ir šlapimo morfologinei ir biocheminei sudėčiai.

Tyrimuose dalyvavo 20 sportininkų, kurių amžius buvo 20–24 metai. Po pirmojo tyrimo, kurio metu visiems buvo nustatyti kraujo morfologinės ir biocheminės sudėties rodikliai, tiriamieji suskirstyti į dvi grupes (E_1 ir E_2) po 10 sportininkų kiekvienoje. E_1 grupės sportininkai 5 dienas vartojo kreatino monohidratą po 0,3 g 1 kg kūno raumenų masės ir 15 dienų – po 0,1 g 1 kg kūno raumenų masės. E_2 grupės sportininkai 5 dienas vartojo kreatino monohidratą po 0,3 g 1 kg kūno raumenų masės, o 15 dienų – po 0,1 g 1 kg kūno raumenų masės ir kartu po vieną vitaminų MILTIVITA$^+$ (MULTIPOWER) kapsulę visas 20 dienų. Kraujo bei šlapimo morfologiniai ir biocheminiai tyrimai buvo atlikti tris kartus: prieš kreatino vartojimą, po 5 dienų pavartojus didesnę papildo dozę ir dar po 15 dienų pavartojus mažesnę papildo dozę. Tiriamųjų grupes sudarė ištvermės šakų sportininkai (bėgikai, slidininkai, biatlonininkai).

Atlikus tyrimus paaiškėjo, kad raudonųjų kraujo kūnelių skaičius, hemoglobino koncentracija abiejų tiriamųjų grupių narių kraujyje eksperimento metu didėjo, tačiau kraujo klampumas nekito. Tai rodo didelį teigiamą vartojamo maisto papildo poveikį kraujodaros sistemai. ENG sumažėjimas vartojant kreatiną leidžia daryti prielaidą, kad šis maisto papildas pasižymi priešuždegiminiu poveikiu.

Didesnis leukocitų skaičius užfiksuotas E_2 grupėje, vartojusioje kreatiną su multivitaminu. Padidėjimas buvo statistiškai patikimas. Eksperimento metu statistiškai reikšmingai padidėjo abiejų tiriamųjų grupių kreatino koncentracija šlapime. Tai rodo, kad organizme gerai vyko kreatino metabolizmas, nesukėlęs šlapimo rūgštingumo ar kitokių jo sudėties pokyčių. Tiriamosiose grupėse pastebėta kraetinkinazės fermento kraujyje didėjimo tendencija.

Raktažodžiai: maisto papildas kreatinas, multivitaminai, sportininkai, kraujo biocheminė sudėtis