39 - BIOCHEMICAL ANALYSIS OF VARIABLES IN A PROOF OF CANOEING

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It is believed, especially in high performance sport, the more specific you're physiological and biochemical assessments in relation to metabolic requirements and tests performed in competitions, the greater the chances of athletes from different modalities achieve success.

For optimum efficiency in sport depends on the development of expertise. However, as important as the specificity of training, are the periodic evaluations. This information helps in controlling the levels of fitness and technique provides a more careful analysis on the effectiveness or otherwise of employee training.

With the bases specific assessments, many researchers (Gobbo, Papst et al., 2002) have tried to investigate, particularly over the last two or three decades, the physical characteristics of elite athletes in an attempt to explain athletic performance, relating it the success and failure within the sport (Parizkova 1987).

Some of these studies have confirmed the close relationship between body type and athletic performance in different modalities (Sadly and Freedson, 1984; Parizkova, 1987). Thus, coaches, trainers and researchers have struggled in trying to adapt the anthropometric profile of athletes to the specific requirements of each modality, in order to bring them to maximum efficiency. The knowledge of the specifics of the activity, the type of physical and physiological responses, allows us to understand decision making in the selection of athletes with sporting potential and the improvement of physical training. In this context some studies (Khosla and McBroom, 1985; Sendecki and Lutoslawski, 1990; Fewtrell, Godfree et al. 1992; Gray, Matheson et al. 1995; Macintyre, Moran et al. 2002; Ackland, Ong et al. , 2003) sought to profile the athlete in the world of canoeing.Studies have been conducted in Brazil (Abramova, Chafanova and Nikitina, 1995; Abramova, Ozolin and Nikitina, 1995; Abramova, Nikitina et al. 2000; Dantas and Fernandes Filho, 2002, John and Fernandes Filho, 2002; Medina, 2002; Castaneda Dantas et al., 2003, Fernandes and Ferreira Filho, 2003 and Silva, 2003; Veiga, Pavel et al., 2003, Ferreira and Fernandes Filho, 2007a; Fonseca, Dantas et al., 2008) to identify the profile of the athlete Brazil, however, few studies have been conducted to identify the type of kayaking.

Some authors (Kemecsey 1971, Pendergast, Bushnell et al. 1989; Budgett, 1995, 1998; Zampari, Capelli et al. 1999; Sources, 2001, Sources, Borges et al. 2002; Gobbo, Papst et al. , 2002; Szanto, 2004, Fernandes and Ferreira Filho, 2005; Souza, Zogaib et al. 2005; Ferreira, Fernandes Filho et al., 2006, Ferreira and Fernandes Filho, 2007b, a), investigated in the form of high boating income, all in search of the specificity of sporting potential in different ways, yet the metabolic processes have not been widely addressed.

Thus to know the changes in concentrations of substrates and metabolites as well with the increase of activities of marker enzymes in plasma that accompanies physical exertion is key to understanding the biochemical procedures of the sport. The influence of intensity and volume of exercise on plasma biomarkers has been examined extensively in the sport of canoeing.

The purpose of this study was to examine the influences of a canoe race on the selected plasma biochemical variables.

METHODOLOGY:

We evaluated 15 canoeists, male, with more than three years experience of high level of expertise. The proof consists of two slalom canoeing descents of approximately 450 meters long the journey of a river and 20 minutes interval. Blood samples were collected prior to antisepsis of the antecubital fossa, 15 minutes before heating and 15 minutes after the end of two descents. The sample (8 mL) was wrapped in a test tube without anticoagulant and centrifuged at 1500 rpm for 15 minutes. The extracted serum was placed in Eppendorf vials for later biochemical analysis of glucose, uric acid, creatinina, protein, and total creatine kinase MB fraction, uric acid, lactate dehydrogenase, alkaline phosphatase, triglycerides, total cholesterol and fractions (HDL, LDL and VLDL), serum iron and ferropéxica capacity (TIBC).

We used the brand Labtest Diagnostic kits and Biotechnical protocols specific to their determination to semi-automated equipment brand Labquest.

STATISTICAL ANALYSIS:

Data were tested for normality using the Kolmogorov - Smirnoff analysis. Analysis was used for comparison of means by Student's t test for paired samples (parametric data) and Wilcoxon-Mann-Whitney test (nonparametric data) in the statistical package SPSS 13.0, considering $p < 0.05$. The results were expressed as mean and standard error.

RESULTS

Data were tested for normality using the Kolmogorov - Smirnoff analysis. Analysis was used for comparison of means by Student's t test for paired samples (parametric data) and Wilcoxon-Mann-Whitney test (nonparametric data) in the Statistical Package SPSS 13.0, considering $p < 0.05$. The results were expressed the mean and standard error.

Table 1 - Analysis of biochemical parameters of paddlers at rest and 15 minutes after the race slalom canoeing.

	After	Resting	Value of p*
Triglycerides (mg / dL)	75.4 ± 6.3	69.2 ± 3.2	0.04
LDL cholesterol (mg / dL)	144.1 ± 8.4	112 ± 12.7	0.03
HDL cholesterol (mg / dL)	43.1 ± 1.3	46.4 ± 2.7	0.001
Serum uric acid (mg / dL)	4.9 ± 1.7	3.71 ± 1.2	0.005
Serum creatinine (mg / dL)	0.75 + 0.19	1.16 ± 0.19	0.04
Serum total creatine kinase (U / L)	86.4 ± 24.2	96.0 ± 16.9	0.01
Mm serum creatine kinase (U / L)	53.1 ± 19.4	91.4 ± 15.1	0.03
Serum creatine kinase MB (U / L)	29.1 ± 13.1	42.9 ± 16.0	0.04
Relationship creatine kinase (mb / creatine)	38.7 ± 12.5	28.4 ± 9.6	0.02
Serum iron (mg / dL)	20.8 ± 2.3	24.3 ± 2.0	0.02
STI (%)	5.9 ± 1.2	6.9 ± 1.2	0.02

* p <0.05 compared to the rest of the analysis by Student's t test for paired samples. IST-transferrina saturation index. Results are expressed as mean ± standard error.

Table 2 - Analysis of hematological parameters of paddlers at rest and 15 minutes after the race slalom canoeing.

	After	Resting Stress	Value of p*
White blood cell count (cells / uL)	6,100 ± 221.0	11,600 ± 605.0	<0.01
Monocytes (uL)	293.3 ± 58.1	456.2 ± 46.8	0.04
Lymphocytes (%)	30.8 ± 1.9	23.2 ± 2.1	<0.01
Lymphocytes (uL)	2101.2 ± 144.0	2922.0 ± 320.0	0.03
Eosinophils (%)	1.9 ± 0.5	0.92 ± 0.2	0.02
Segmented neutrophils (%)	59.3 ± 3.4	63.9 ± 2.1	0.01
Segmented neutrophils (uL)	3198.3 ± 134	7065.2 ± 452	< 0.01
Rod neutrophil (%)	5.4 ± 0.5	14.3 ± 1.3	< 0.01
Rod neutrophil (uL)	452.1 ± 121.,0	1876.0 ± 198.2	< 0.01
Platelets (uL)	242.1 ± 12.2	287.1 ± 13.1	0.04

* p <0.05 compared to the rest of the analysis by Student's t test for paired samples. IST-transferrina saturation index. Results are expressed as mean ± standard error.

DISCUSSION

Because they require a force greater than that needed excessively, this may cause a strain on muscles and contractile systems can break structure (Siegel, Lewandrowski et al. 1995; Siegel, Shola et al. 1997, Echegaray and Rivera , 2001; Kratz, Lewandrowski et al. 2002; Brites, Verona et al., 2004) Thus it generates a greater infiltration of neutrophils, and consequently the release of cellular proteins into the circulation, for example, creatine kinases.

Thus, the increase in plasma activity of muscle enzymes such as lactate dehydrogenase (LDH), CK and fractions, can be a typical physiological response in the face of strenuous exercise and can usually be used as markers of muscle damage (France, Neto et al., 2006). The peak activity of these enzymes occurs within 12 to 24 hours, however, the focus of this study was to analyze the acute changes that occur over a period of 15 minutes.

The total CK enzyme activity in serum is considered an important marker of muscle damage, however, its value is relative isolation as a marker because it is a parameter rather indirect and unspecific. In addition, variations in the activity of CK differ in marking in accordance with the conditions of volume and training intensity (Bounds, Grandjean et al., 2000).

The muscle damage by exercise is characterized by decreased production of muscle strength, increased serum CK activity, muscle fiber disruption, inflammation, and increased activity of proteolytic enzymes. If by workload is repeated over time, this muscle damage is reduced and the athlete develops an adaptation in skeletal muscle, characterized by a reduction in the release of CK.

The statistical analysis of the activity of CK-MM showed a significant increase after 15 minutes. The release of CK-MM to the bloodstream is more specific muscle overload when compared to total CK (Siegel, Shola et al. 1997; Bounds, Grandjean et al. 2000; Kratz, Lewandrowski et al. 2002; Brites , Verona et al., 2004). The analysis of the activity of CK-MB showed a significant increase in activity. The increase in serum CK-MB may be due to atypical forms of CK, for example, the macro-CK, which is a complex consisting of CK-BB linked to immunoglobulin (IgA, IgG), whose presence in serum athletes can cause an apparent rise in CK-MB. The elevation of CK may be related to an adaptive microtrauma. In highly trained athletes, the adaptive microtrauma may be a constant response, able to accelerate the turnover of muscle fibers.

Several hypotheses have been established to explain the adaptive microtrauma, among them, one assumes the occurrence of a metabolic overload in which the need for ATP would become higher than its rate of production, another theory proposes that muscle injury can be caused by mechanical forces, such as those present in the eccentric contraction, can disrupt the muscle architecture, and another proposes the elevation of mediators of inflammation and oxidative stress (Siegel, Shola et al. 1997; Bounds, Grandjean et al. 2000; Kratz, Lewandrowski et al. 2002; Brites, Verona et al., 2004).

In this sense the literature shows that the analysis of biochemical markers of injury, inflammation and athletic performance should be investigated in the light of a clinical context of the athlete and their performance after competition or training session. A careful interpretation should be applied in order to avoid erroneous conclusions about a typical condition of effort, compared to a pathological condition.

Countless times of trial canoeing are characterized by an increase in the intensity of muscle contraction and speed, requiring a greater recruitment of type II muscle fibers, and muscle fiber type I. Thus, by strategy, if at any time there is a sprint, there will need to obtain energy from the fast twitch fiber by the type II. As a result, there may be a mobilization of the reserves of phosphocreatine to ATP regeneration, resulting in an elevation of serum creatinine.

Data from erythrogram (eritrometria, hematocrit, hemoglobin, MCV, MCH, MCHC) showed no significant difference. Resistance training can cause a volume expansion, which would justify a drop in hemoglobin concentration in athletes. In such cases, a phenomenon called reactive and transient dilutional pseudo anemia (Hansen, Bjerre-Knudsen et al. 1982; Noakes, 1987; Brahm, Piehl-Aulin et al., 1997). The analysis of the concentration of serum iron and transferrin saturation index showed a significant increase after the race. The hyperactivity of the electron transport chain (rich in cytochromes), along with a variable degree of hemolysis, can promote a leakage of protein rich in iron.

Individuals with hemoglobin values within the normal range, with progressive reduction of serum iron (less than 60 mg / dL), elevated serum transferrin and reducing the percentage of transferrin saturation (below 16%), may be in the first phase a process anemic (Mateo and Lainez, 2000). The next phase characterized by reductions in hemoglobin, hematocrit and eritrometria. This suggests that even with normal levels of hemoglobin. Athletes have already analyzed a negative iron balance, featuring an athlete's anemia and not a part of hemodilution. This deficit may impair the transport of oxygen, triggering a loss of athletic performance in individuals analyzed.

The increased altitude promotes a greater release of erythropoietin, which in turn raises RBC and consequently hemoglobin. Samples were collected at 600 m from sea level. You can not say that this factor has directly influenced the results, however, may have contributed to enhance the framework hipoferremia. Thus, it is necessary to carry out new studies in which these results can be compared to other tests conducted at the level of the sea. Regardless it is clear the need for an adequate nutritional prescription for trained professionals to meet the increased needs of the population analyzed.

CONCLUSION

The completion of this study, the test event promoted an increase in the activity of enzyme markers of muscle damage after 15 minutes and can be applied with good reliability. The increase suggests a microtrauma found silent originating from a variable degree of disruption of muscle fibers.

Furthermore, despite normal hemoglobin, the athletes indicates hipoferremia presented by the installation of an anemic process that can evolve to a decrease inerythrocytic values with subsequent loss of income resulting from an athletic muscle oxygenation unsatisfactory.

However, the results shown here should be looked at in a clinical setting and never as figures and as reference values.

REFERÊNCIAS

ABRAMOVA, T. F.; NIKITINA, T. M.; CHAFANOVA, E. I. Impressões Dermatoglíficas - Marcas genéticas na seleção nos tipos de esportes // Atualidades na preparação de atletas nos esportes cíclicos. . **Coletânea de artigos científicos Volvograd, v. 2**, p. 86-91, 1995.

ABRAMOVA, T. F.; NIKITINA, T. M.; IZAAK, S. I.; KOCHETKOVA, N. I. [Asymmetry of signs of finger dermatoglyphics, physical potential and physical qualities of a man]. **Morfologiia,** v. 118, n. 5, p. 56-9, 2000.

ABRAMOVA, T. F.; NIKITINA, T. M.; OZOLIN, N. N. Possibilidade de utilização das Impressões Dermatoglíficas na seleção desportiva. **Teoria e prática da cultura física,** v. 3, p. 10-15, 1995.

ACKLAND, T. R.; ONG, K. B.; KERR, D. A.; RIDGE, B. Morphological characteristics of Olympic sprint canoe and kayak paddlers. **J Sci Med Sport,** v. 6, n. 3, p. 285-94, Sep 2003. ISSN 1440-2440 (Print).

BOUNDS, R.; GRANDJEAN, P.; O'BRIEN, B.; INMAN, C.; CROUSE, S. Diet and short term plasma lipoprotein-lipid changes after exercise in trained Men. **Int J Sport Nutr Exerc Metab**, v. 10, n. 2, p. 114-27, 2000.

BRAHM, H.; PIEHL-AULIN, K.; LJUNGHALL, S. Bone metabolism during exercise and recovery: the influence of plasma volume and physical fitness. **Cal Tissue Int, v. 61**, n. 3, p. 192-8, 1997

BRITES, F.; VERONA, J.; DE GEITERE, C.; FRUCHART, J.; CASTRO, G.; WIKINSKI, R. Enhanced cholesterol efflux promotion in well-trained soccer players. **Metabolism,** v. 53, n. 10, p. 1262-7, 2004.

BUDGETT, R. The overtrainning syndrome. **Coahing Focus**, v. 28, p. 4-6, 1995.

BUDGETT, R. **Fatige and underperformance in athletes: the overtraining syndrome.** BJM, v. 32, p. 107-110, 1998

CASTANHEDE, A. L. K.; DANTAS, P. M. S.; FERNANDES FILHO, J. Perfil dermatoglifico e somatotipico de atletas de futebol de campo masculino de alto rendimento no Rio de Janeiro - Brasil. **fitness & performance journal, v. 2**, n. 4, p. 234-9, 2003.

DANTAS, P. M. S.; FERNANDES FILHO, J. Identificação dos perfis genéticos, aptidão física e somatotipico que caracterizam atletas masculinos, de alto rendimento participantes do futsal adulto, no Brasil. **fitness & performance journal,** v. 1, n. 1, p. 28-36, 2002.

ECHEGARAY, M.; RIVERA, M. Role of creatine kinase isoenzymes on muscular and cardiorespiratory endurance. Genetic and molecular evidence. **Sports Med, v. 31,** n. 13, p. 919-34, 2001.

FERREIRA, A. A. M.; FERNANDES FILHO, J. Corrida de Orientação: Caracterização dermatoglífica e somatotípica de alto rendimento da região sul do Brasil. **Fitness & Performance Journal**, v. 2, n. 3, p. 145-150, 2003.

FERREIRA, H. F.; FERNANDES FILHO, J. Diagnóstico das qualidades físicas básicas e somatotipia da Seleção Brasileira de Canoagem Slalom. **FIEP Bulletin**, v. 21, p. 190-199, 2005

FERREIRA, H. F.; FERNANDES FILHO, J. Diagnostico da predominância do tipo de fibra muscular da seleção brasileira de canoagem slalom através da Dermatoglifia. **FIEP Bulletin, v. 77,** p. 273-275, 2007a.

FERREIRA, H. F.; FERNANDES FILHO, J. Diagnóstico da via metabolica predominante da seleção brasileira de canoagem slalom através da dermatoglifia. **Revista Brasileira de Ciência e Movimento, v. 30**, n. especial, 10/2007 2007b.

FERREIRA, H. F.; FERNANDES FILHO, J.; ROQUETTI, P. F. Diagnóstico do Potencial Genético da Seleção Brasileira de Canoagem Slalom através da Dermatoglifia. **FIEP Bulletin, v. 76,** p. 110-114, 2006.

FEWTRELL, L.; GODFREE, A. F.; JONES, F.; KAY, D.; SALMON, R. L.; WYER, M. D. Health effects of white-water canoeing. **Lancet, v. 339,** n. 8809, p. 1587-9, Jun 27 1992.

FONSECA, C. L. T.; DANTAS, P. M. S.; FERNANDES, P. R.; FERNANDES FILHO, J. **Perfi l dermatoglífico, somatotípico e da força explosiva de atletas da seleção brasileira de voleibol feminino. fitness & performance journal, v. 7,** n. 1, p. 35-40, 2008.

FONTES, E. B. Análise dos resultados da canoagem de velocidade nas Olimpíadas de Sidney' 2000 (Final K1 1000m Masculino). **Anais do XXIV Simpósio Internacional de Ciências do Esporte, p. 128**, 2001.

FONTES, E. B.; BORGES, T. O.; ALTIMARI, L. R.; MELO, J. C.; OKANO, A. H.; CYRINO, E. S. Influência do número de coordenadas e da seleção de distâncias na determinação da velocidade crítica na canoagem de velocidade. **Revista Brasileira de Ciência e Movimento,** v. 10, p. 161, 2002.

FRANÇA, S.; NETO, T.; AGRESTA, M.; LOTUFO, R.; KATER, C. Resposta divergente da testosterona e do cortisol séricos em atletas masculinos após uma corrida de maratona. **Arq Bras Endocrinol Metabol,** v. 50, n. 6, p. 1082-6, 2006.

GOBBO, L. A.; PAPST, R. P.; CARVALHO, F. O.; SOUZA, C. F.; CUATTRIN, S. A.; CYRINO, E. S. Perfil antropométrico da Seleção Brasileira de Canoagem. **Revista Brasileira de Ciência e Movimento,** v. 10, p. 7-12, 2002.

GRAY, G. L.; MATHESON, G. O.; MCKENZIE, D. C. The metabolic cost of two kayaking techniques**. Int J Sports Med, v. 16, n. 4,** p. 250-4, May 1995. ISSN 0172-4622 (Print)

HANSEN, K.; BJERRE-KNUDSEN, J.; BRODTHAGEN, U.; JORDAL, R.; PAULEV, P. Muscle cell leakage due to long distance running. **Eur J Appl Physiol Occup Physiol,** v. 48, n. 2, p. 177-88, 1982.

JOÃO, A.; FERNANDES FILHO, J. Identificação do perfil genético, somatotípico e psicoloógico das atletas brasileiras de ginástica olímpica feminina de alta qualificação esportiva. **fitness & performance journal, v. 1, n. 2,** p. 12-20, 2002.

KEMECSEY, G. Sprint kayak technique. **Journal Applie Physiology, v. 31,** n. 6, p. 834-838, 1971.

KHOSLA, T.; MCBROOM, V. C. Age, height and weight of female Olympic finalists. Br J Sports Med, v. 19, n. 2, p. 96-9, Jun 1985.

KRATZ, A.; LEWANDROWSKI, K.; SIEGEL, A.; CHUN, K.; FLOOD, J.; COTT, E. Effect of marathon running on hematologic and biochemical laboratory parameters, including cardiac markers. **Am J Clin Pathol, v. 118, n. 6,** p. 856-63, 2002.

LUTOSLAWSKA, G.; SENDECKI, W. Plasma biochemical variables in response to 42-km kayak and canoe races**. J Sports Med Phys Fitness,** v. 30, n. 4, p. 406-11, Dec 1990. ISSN 0022-4707.

MACINTYRE, T.; MORAN, A.; JENNINGS, D. J. **Is controllability of imagery related to canoe-slalom performance? Percept Mot Skills,** v. 94, n. 3 Pt 2, p. 1245-50, Jun 2002. ISSN 0031-5125 (Print)

MATEO, R.; LAÍNEZ, M. Anemia do atleta: fisiopatologia do ferro. **Rev Bras Med Esporte, v. 6, n. 3**, p. 108-14, 2000.

MEDINA, M. F. Identificação dos perfis genético e somatotípico que caracterizam atletas de voleibol masculino adulto de alto rendimento no Brasil. **Fitness & Performance Journal,** v. 1, n. 4, p. 12-20, mar-abr 2002.

NOAKES, T. Effect of exercise on serum enzyme activities in human**. Sports Med, v. 4,** n. 4, p. 245-67, 1987.

PARIZKOVA, J. Body composition, aerobic capacity, ventilatory threshold and food intake in different sports. **Annals of Sports Medicine,** v. 3, p. 171-187, 1987.

PENDERGAST, D. R.; BUSHNELL, D.; WILSON, D. W.; CERRETELLI, P. Energetics of kayaking. **European Journal Applie Physiology Occupcional** v. 59, p. 342-350, 1989.

SADLY, S. P.; FREEDSON, P. S. Body composition and structural comparisons of female and male athletes. **Clinical Sports Medicine,** v. 3, n. 755-757, 1984.

SIEGEL, A.; LEWANDROWSKI, K.; STRAUSS, H.; FISCHMAN, A.; YASUDA, T. Normal post-race antimyosin myocardial scintigraphy in asymp- tomatic marathon runners with elevated serum creatine kinase MB isoenzyme and troponin T levels. Evidence against silent myocardial cell necrosis. **Cardiology, v. 86,** n. 6, p. 451-6, 1995.

SIEGEL, A.; SHOLAR, M.; YANG, J.; DHANAK, E.; LEWANDROWSKI, K. **Elevated serum cardiac markers in asymptomatic marathon runners after competition: is the myocardium stunned? Cardiology, v. 88, n. 8**, p. 487-91, 1997.

SILVA, R. F. Perfil dermatoglífico e somatotípico da equipe brasileira de pentatlo militar participante do 51º campeonato mundial de pentatlo militar do CISM 2003. E**dição Especial da Revista Brasileira de Ciência e Movimento, p. 222, 2003.**

SOUZA, R. S.; ZOGAIB, F. G.; FERNANDES FILHO, J.; FERNANDES, P. R.; DANTAS, P. M. S. Perfil dermatoglífico e somatotípico dos atletas da Seleção Brasileira de Rafting Competitivo. **Ação & Movimento, v. 2, n. 5,** p. 256, setembro/outubro 2005.

SZANTO, C. Racing Canoeing**. International Canoe Federation,** v. 2, p. 1-264, 2004.

VEIGA, M. A. A.; PÁVEL, D. A. C.; FERNANDES FILHO, J. **Perfil dos nadadores juvenis brasileiros de 100m livre com as caracteristicas dermatoglificas, somatotipicas e as qualidades físicas básicas.** Congresso Ibérico - Associação Portuguesa de técnicos de natação, v. 1, n. 1, p. 1-5, 2003.

ZAMPARO, P.; CAPELLI, C.; GUERRINI, G. Energetics of kayaking at submaximal and maximal speeds. **European Journal Applie Physiology Occupcional,** v. 80, p. 542-548, 1999.

BIOCHEMICAL ANALYSIS OF VARIABLES IN A PROOF OF CANOEING

ABSTRACT

Objective: The objective of this study was to analyze biochemical markers of athletic performance in the light of a clinical context and athletic. Methods: We collected peripheral blood samples (8 mL) of 15 paddlers at rest and 15 minutes after a race official. Then, there were blood count, analysis of biochemical markers, muscle damage and lipid profile. Results: Statistical analysis of results showed a significant increase ($p < 0.05$) in serum activities of CK, CK-MM, CK-MB and LDH, the serum creatinine concentration and serum iron. On the other hand, triglycerides, VLDL and serum uric acid showed a significant decrease. Conclusion: This study shows that athletes have analyzed changes in the biochemical parameters of blood after an official proof of this type, which demonstrates the importance of laboratory tests as diagnostic biochemical disturbances silent.

Keyword: Injuries. Canoeing. Chemical analysis of blood.

RÉSUMÉ

Objectif: L'objectif de cette étude était d'analyser les marqueurs biochimiques de la performance sportive à la lumière d'un contexte clinique et sportive. Méthodes: Nous avons recueilli des échantillons de sang périphérique (8 ml) de 15 pagayeurs, au repos et 15 minutes après un officiel de course. Puis, il y avait numération formule sanguine, analyse des marqueurs biochimiques, des lésions musculaires et le profil lipidique. Résultats: L'analyse statistique des résultats a montré une augmentationsignificative ($p < 0,05$) dans les activités sériques de CK, CK-MM, CK-MB et la LDH,la concentration de créatinine sérique et du fer sérique. D'autre part, des triglycérides, des VLDL et l'acide urique sérique ont montré une diminutionsignificative. Conclusion: Cette étude montre que les athlètes ont analysé les changements dans les paramètres biochimiques de sang après une preuve officiellede ce type, ce qui démontre l'importance des tests de laboratoire comme undiagnostic biochimique des troubles silencieux.

MOT-CLÉ: Blessures. Canoë-kayak. L'analyse chimique du sang.

RESUMEN

Objetivo: El objetivo de este estudio fue analizar los marcadores bioquímicos del rendimiento deportivo a la luz de un contexto clínico y deportivo. Material y métodos: Se recogieron muestras de sangre periférica (8 ml), de 15 remeros en reposo y 15 minutos después de que un oficial de la carrera. Entonces, había hemograma, análisis de marcadores bioquímicos, daño muscular y el perfil lipídico. Resultados: El análisis estadístico de los resultados mostraron un aumento significativo ($p < 0,05$) en la actividad sérica de CK y CK-MM, CK-MB y LDH, la concentración de creatinina sérica y el hierro sérico. Por otro lado, los triglicéridos, VLDL y del ácido úrico en suero mostró una disminución significativa. Conclusión: Este estudio de muestra que los atletas han analizado los cambios en los parámetros bioquímicos de sangre después de una prueba oficial de este tipo, lo que demuestra la importancia de las pruebas de laboratorio como un diagnóstico de alteraciones bioquímicas en silencio.

PALABRA CLAVE: Lesiones. Canoa. Análisis químico de la sangre.

ANÁLISES DE VARIÁVEIS BIOQUÍMICAS EM UMA PROVA DE CANOAGEM

RESUMO

Objetivo: O objetivo do presente estudo foi analisar marcadores bioquímicos de desempenho atlético, à luz de um contexto clínico e atlético. Métodos: Foram coletadas amostras de sangue periférico (8 mL) de 15 canoístas em repouso e 15 minutos após uma prova oficial. Em seguida, realizaram-se hemograma, análise de marcadores bioquímicos, lesão muscular e lipidograma. Resultados: A análise estatística dos resultados mostrou um aumento significativo ($p < 0,05$) na atividade sérica das enzimas CK, CK-MM, CK-MB e LDH; na concentração sérica de creatinina e ferro sérico. Por outro lado, triglicérides, VLDL e ácido úrico sérico apresentaram um decréscimo significativo. Conclusão: O presente estudo mostra que os atletas analisados apresentam alterações nos parâmetros bioquímicos de sangue após uma prova oficial dessa modalidade, o que demonstra a importância da realização de exames laboratoriais como forma de diagnóstico de distúrbios bioquímicos silenciosos.

PALAVRA-CHAVE: Lesões. Canoagem. Análise química do sangue.