Creatine Kinase and Cortisol Level Among Athletes

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ABSTRACT

The present study was conducted to evaluate the serum creatine kinase and cortisol levels of 45 male athletes of 14-17 age range, 15 each for hockey, wushu and fencing. The results show that the mean values of both creatine kinase (Hockey:200.3 ± 97.29, Fencing:138.3 ± 69.72 & Wushu:159.1 ± 56.62) and cortisol level(Hockey: 169.00 ± 24.22, Fencing: 162.00 ± 20.94 & Wushu: 162.67 ± 34.32) were found higher in the hockey players as compared to the players of fencing and wushu. On applying ANOVA, the obtained F values showed non-significant differences of both the biochemical parameters among the athletes of different sports disciplines.

KEY WORDS

Creatine Kinase, Cortisol, Hockey, Fencing, Wushu

INTRODUCTION

Competitive sports impose substantial energy, mechanical, mental and emotional burden on athletes. This reflects, among other things, on a number of biochemical and hematological properties in blood sample collected at rest (Malczewska et al. 2000; Mayr et al, 2006; Nikolaidis et al. 2003; Tolfrey et al, 2000). Serum concentration of creatine kinase is used widely as an index of skeletal muscle fibre damage in athletes. Cortisol is a steroid hormone, often called the "stress hormone" because its level rises following emotional and physical stress. The highest concentration Creatine kinase can be seen in the muscle and in the brain. The serum Creatine kinase concentration rises when an organ of the enzyme, containing it, is damaged. It is probably the best biochemical marker of muscle fibre damage. Creatine kinase involved in muscle metabolism and it is believed to leak into the plasma from skeletal muscle fibers when they are damaged because of repeated and intense contraction of muscles (Clarkson et al, 1992; Mougios, 2006; Noakes, 1987). The serum concentration of Creatine kinase peaks 1–4 days after exercise and remains elevated for several days. Thus, athletes participating in daily training have higher resting values than non-athletes, although this response to training is mitigated by the so-called repeated-bout effect. That is, the repetition of an exercise after several days or even weeks causes less muscle fibre damage than caused by the previous exercise. The primary functions of control are to increase blood sugar through gluconeogenesis, suppress the immune system, and aid in fat, protein, and carbohydrate metabolism. It also decreases bone formation. High level

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of cortisol can change the body from an anabolic (muscle building) to a catabolic (muscle losing) state. Cortisol release in response to exercise appears to be altered depending on the time of day that exercise takes place (Noakes, 1987).

METHODLOGY

The sample comprised of fortyfive (45) male athletes, fifteen (15) each from Hockey, Wushu and Fencing sports disciplines of 14-17 age range under training at Sports Authority of India training centre, Netaji Subhas National Institute of Sports, Patiala. Fasting (Twelve hours) 3ml blood sample was collected from antecubital vein between 07.00am to 09.00am. Serum separated from whole blood was used to analyze the biochemical parameter creatine kinase and cortisol. Creatine kinase was measured by spectrophotometric method and cortisol was estimated by competitive immune-enzymatic method (ELISA). Creatine kinase catalyzes the reaction between creatine phosphate and adenosine diphosphate (ADP) to form creatine and adenosine tri-phosphate (ATP). The ATP formed along with glucose is catalysed by hexokinase to form glucose-6-phosphate. The glucose-6-phosphate reduces nicotine adenine di-nucleotide phosphate (NADP) to nicotine adenine di-nucleotide hydrogen phosphate (NADPH), in the presence of glucose 6 phosphate dehydrogenase. The rate of reduction of NADP to NADPH is measured as an increase in absorbance which is proportional to the creatine kinase activity in the sample.

Creatine kinase

Creatine Phosphate + ADP ⟶ Creatine +ATP

Hexokinase

Glucose +ATP ⟶ Glucose 6 Phosphate + ADP

Glucose 6 phosphate dehydrogenase

Glucose 6 Phosphate + NADP ⟶ Gluconate 6 phosphate + NADPH + H

Cortisol (antigen) in the sample competes with horseradish peroxidase-Cortisol (enzyme-labelled antigen) for binding onto the limited number of anti-cortisol (antibody) sites on the micro plates (solid phase). After incubation, the bound/free separation is performed by a simple solid-phase washing. The enzyme substrate hydrogen per-oxide (H_2O_2) and the TMB-substrate (TMB) are added. After an appropriate time has elapsed for maximum colour development, the enzyme reaction is stopped and the absorbencies are determined. The colour intensity is inversely proportional to the Cortisol concentration in the sample.

RESULTS & DISCUSSION

Table 1 shows the mean ± SD of creatine kinase level of Hockey (200.3 ± 97.29), Fencing (138.3 ± 69.72), Wushu (159.1 ± 56.62) and the obtained F-value (2.570) shows non-significant difference in the creatine kinase level among the athletes of the three sports discipline. The mean ± SD values of cortisol level of Hockey (169.00 ± 24.22), Fencing (162.00 ± 20.94), Wushu players (162.67 ± 34.32), respectively and the obtained F-value has shown non- significant difference (0.305) in the cortisol level among the athletes of all the three sports disciplines.

TABLE-1 : Mean SD and F-value of creatine kinase and Cortisol level among hooking

VARIABLES	Hockey (N=15) Mean±SD	Fencing (N=15) Mean±SD	Wushu (N=15) Mean±SD	F- Value
Creatine kinase (Units/Litre)	200.3 ± 97.29	138.3 ± 69.72	159.1 ± 56.62	2.570
Cortisol (nanogram /millilitre	169.00 ± 24.22	162.00 ± 20.94	162.67 ± 34.32	0.305

The serum creatine kinase and cortisol concentration serve as an index of both overexertion and adaptation of the muscular system to repeated bouts of exercise. The serum creatine kinase and cortisol activity are used, along with the training cycle, to verify the training load and recovery. Higher serum creatine kinase and cortisol activity are associated with signals and symptoms that suggest the excessive training regime as well as skeletal muscle lesion. Conversely, lower values can signify that training planning do not promote the adaptations. In this investigation, it was noticed that the mean values of creatine kinase and cortisol level of all the three groups are in desirable range. Creatine kinase and cortisol is one of the top choices of athletes and coaches when requesting a biochemical profile, although the interpretation of these parameters is not always straightforward. A particularly important consideration relating to the use and the interpretation of creatine kinase and cortisol values, in the sports sector, is the dependence of this parameter on nature of the stress. Physical training is a form of stress that is applied onto the body. Chronic stress (overtraining) results in an excess of cortisol and creatine kinase, which will cause higher baseline levels (Brancaccio et al, 2007; Peake et al, 2005; Mayhew et al, 2005). The study shows both the variables to be good markers of physical and mental stress on athletes.

CONCLUSION

Within the limits and limitation of the study, it was concluded that athletes of three different sport disciplines have desirable range of enzyme creatine kinase and hormone cortisol which indicated no muscle damage and no stress condition during athletes training. The serum level of creatine kinase and cortisol are good markers for skeletal muscle tissue and varies widely in both pathological and physiological conditions.

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