The Relationship between Creatine Kinase and Cortisol Level of Young Indian Male Athletes

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Abstract

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. Forty five (45) male athletes of three different sports disciplines namely Hockey, Wushu and Fencing having age between 14 to 17 yrs, were divided equally into three groups. The results show that no correlation exists between the creatine kinase and cortisol level of male Indian athletes of three different sports discipline.

Key words: Creatine kinase, Cortisol, Muscle fibre damage, Stress hormone

Introduction

Competitive sports impose substantial energy, mechanical, mental and emotional burdens on the athletes. This reflects, among other things, on a number of biochemical and hematological properties in blood sample collected at rest *(Lang & Wurzburg, 1982; Clarkson et al, 1992; Malczewska et al, 2000; Mayr et al, 2006).* Creatine kinase is an enzyme and present in almost all tissues but is highest in the muscle and in the brain. Creatine kinase exists in three different isoenzymes. Each Isoenzyme is a dimer composed of two protomer 'M' for muscle and 'B' for brain *(Nanji, 1983; Noakes, 1987; Nikolaidis et al, 2003).* The serum concentration of creatine kinase is used widely as an index of skeletal muscle fibre damage in sport and exercise. The serum Creatine Kinase concentration rises when an organ that contains the enzyme is damaged. The serum Creatine Kinase concentration 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 these are damaged because of repeated and intense contraction of muscles *(Wevers et al, 1977; Tolfrey et al, 2000).* 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 that caused by the previous exercise. Cortisol is a steroid hormone, often called the "stress hormone" because its level rises following emotional and physical stress. Its primary functions are to increase blood

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sugar through gluconeogenesis, suppress the immune system, and aid in fat, protein, and carbohydrate metabolism. It also decreases bone formation. High level 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 (10).

The aim of the present study is to evaluate the level of serum Creatine Kinase and cortisol and find out the correlation between serum Creatine Kinase and cortisol level in Indian male athletes.

Materials & Methods

A total of forty five (N=45) male athletes, fifteen (15), each from Hockey, Wushu and Fencing sports disciplines having age between 14 to 17 years of Sports Authority of India training centre, Netaji Subhas National Institute of Sports, Patiala were the subjects of the present study. Fasting (Twelve hours) 3ml blood sample was collected from antecubital vein between 07.00am to 09.00am. Creatine kinase catalyzes the reaction between creatine phosphate and ADP to form creatine and ATP. The ATP formed along with glucose is catalysed by hexokinase to form glucose 6 phosphate. The glucose 6 phosphate reduces NADP to 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

$$\text{Creatine Phosphate} + \text{ADP} \xrightarrow{creatine\ kinase} creatine + \text{ATP}$$

$$\text{Glucose} + \text{ATP} \xrightarrow{Hexokinase} Glucose\ 6\ Phosphate + \text{ADP}$$

$$Glucose\ 6\ Phosphate + \text{NADP} \xrightarrow{G\ 6P\ dehydrogenase} Gluconate\ 6\ Phosphate + \text{NADPH+H}^{+}$$

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

Results & Discussion

Table 1: Mean standard deviation and r- value of creatine kinase and cortisol level of young Indian male athletes of three different sports disciplines

Groups (Sports Disciplines)	Creatine kinase (U/L), Mean±SD	Cortisol (ng/ml), Mean±SD	r-Value
Hockey (N=15)	200.3±97.29	169.00±24.22	0.129
Fencing (N=15)	138.3±69.72	162.00±20.94	0.098
Wushu (N=15)	159.1±56.62	162.67±34.32	0.281

As shown in the table no. 1 the mean value of creatine kinase (200.3 ± 97.29) & cortisol (169.00±24.22) level was observed to be highest in the athletes of Hockey group and the lowest in the Fencing group. No significant correlation was found between the two variables in the three different sports disciplines (groups).

The serum creatine kinase and cortisol activity observed can serve to verify if the training protocol is adequate. Higher serum creatine kinase and cortisol activity

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is believed to be associated with other clinical signals and symptoms suggestive of excessive training load and skeletal muscle lesion. Conversely, lower values may point inadequate training load not promoting the adaptations. In the present study, the mean values of creatine kinase and cortisol level of all the three groups are in the desirable range. But we have found that some athletes in each sports discipline have higher level of creatine kinase while the level of cortisol of all the athletes is found to be within a reference range. The serum creatine kinase and cortisol concentration serves as an index of both overexertion and adaptation of the muscular system to repeated bouts of exercise. As such, creatine kinase and cortisol is one of the top choices of athletes and coaches when requesting a biochemical profile, although the interpretation of these parameter's values 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.

This is for the first time that the study was carried out to find out the relationship between creatine kinase and cortisol level of athletes. Three groups of young Indian male athletes belong to Hockey, Fencing and Wushu were analyzed for creatine kinase and cortisol level. As mentioned that both the variables are good markers of physical and mental stress on athletes. In order to find out the relationship between the two variables, Karl Pearson's coefficient of correlation method was used. After applying correlation between the two variables of the three groups of athletes, we found that there is no correlation exists between creatine kinase and cortisol level of Indian male athletes.

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