THE CHANGES ON CREATINE KINASE IN RESPONSE TO AEROBIC EXERCISE AMONG NOVICE AND TRAINED SOCCER PLAYERS OF DIFFERENT AGES

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Abstract: The study was intended to evaluate the creatine kinase responses to exercise among novice and trained soccer players of different ages. Sixty male adolescent soccer players aged 14 and 16 years were selected as participants, of whom thirty of them were trained soccer players and the rest were novice to the sport. The participants were segregated into four groups of fifteen each, namely: junior novice soccer players, senior novice soccer players, junior trained soccer players, and senior trained soccer players. The independent variable confined to this study is aerobic exercise stress testing using Bruce treadmill protocol to evaluate its influence on creatine kinase. The data on creatine kinase was measured at rest and after exercise condition. The data thus collected from novice and trained soccer players of different ages at rest and after exercise condition have been analyzed by three way factorial ANOVA. The finding of the study concludes that there is a statistically significant difference between novice and trained soccer players of different ages at rest and after exercise on creatine kinase.

Keywords: *Creatine kinase, soccer, aerobic exercise*

Introduction

Human beings acclimatize in a variety of ways depending upon the stresses to which it is exposed. Reactions to excessive stresses are modified by the individual attributes of each person. The length of exposure to stresses modifies the nature of changes and the resiliency of those changes. Thus, upon exposure to an active stress, the body undergoes a hierarchy of responsive changes, the physiological and biochemical changes to increase oxygen supply to body tissues are noticeable in those body systems that are directly related to oxygen delivery, but the changes probably occur in all organ systems.

In physiological response to acute exercise, there are several components that dictate what will be the magnitude and direction of the physiological response. The key components of "acute exercise" are the intensity at which the exercise is performed and the duration of the individual exercise bout [12]. Typically the greater the intensity of exercise, the greater the degree of stress placed upon the physiological system. Relative to duration, typically extending the length of time of an exercise bout at any given intensity tends to amplify the physiological response; that is, as a person exercises longer and longer, one can see a gradual and further increase in the physiological and biochemical levels [3]. Age and maturation can also be influential factors. The very young and older mature individuals have certain physiological responses to exercise that vary from those exhibited by the young to middle-aged adults which usually are used in many exercise studies [4].

Exercise, a common active stress, can elicit cardiovascular abnormalities not present at rest. Dynamic exercise is preferred for testing because it puts a volume stress rather than a pressure load on the heart and because it can be graduated. When dynamic exercise is begun or increased, oxygen uptake by the lungs quickly increases. After the second minute, oxygen uptake usually remains relatively stable at each intensity of exercise. During steady state of exercise, heart rate, cardiac output, blood pressure, and pulmonary ventilation are maintained at reasonably constant levels [5].

The body"s response to dynamic exercise consists of a complex series of cardiovascular adjustments to provide active muscles with the blood supply appropriate for their metabolic needs, to dissipate the heat generated by active muscles, and to maintain the blood supply to the brain and the heart.

Further, it is evident that a number of biochemical and haematological properties, which display significant differences between athletes and non-athletes in blood samples collected at rest [6, 7]. Most prominent among these properties is creatine kinase, which is believed to leak into the plasma from skeletal muscle fibres when they are damaged because of repeated and intense contractions [8-11].

A relationship between sedentary behaviour and deleterious health consequences was noted as early as the 17th century by occupational physician Bernadino Ramazzini [12]. The importance of understanding the creatine kinase levels and that distinguishes the capability of novice and trained soccer players in enduring physical exertion and competitive performance is much needed.

The subjects in this study were described as novice or trained soccer players, based on their years of experiences with regular physical activity routine specific to soccer sports. Regularly exercising may attenuate physiological adaptations and protect against exercise muscle disruption and subsequent damage. It would be of interest to explore the effects of habitual

training in different age groups and its effect on serum creatine kinase levels. To date, there has been a lack of research in identifying the biochemical conditions and the role of being habitually trained on the biochemical responses to exercise among soccer players of different ages. Hence, the investigator is provoked to determine whether creatine kinase responses to aerobic exercise varies between novice and trained soccer players, and furthermore to examine creatine kinase responses to aerobic exercise among players of different ages. The present paper was proposed to evaluate the creatine kinase responses to exercise among novice and trained soccer players of different ages.

Methods

Subject and variables

Sixty male adolescent soccer players aged 14 (*juniors*) and 16 (*seniors*) years were selected as participants, of whom thirty of them were trained soccer players and the rest were novice to the sport. The selected participants were the inhabitants of Malappuram district, Kerala state, India. The participants were segregated into four groups of fifteen each, namely: junior novice soccer players, senior novice soccer players, junior trained soccer players, and senior trained soccer players.

The independent variable confined to this study is aerobic exercise stress testing using Bruce treadmill protocol to evaluate its influence on serum creatine kinase levels. The study was restricted to the criterion variable namely: creatine kinase. The data on creatine kinase were measured at rest and after exercise condition. The standardized testing procedures and instruments used to collect the data on creatine kinase was as presented in the table-1.

Table – 1: Dependent variable and the respective test

Variables	Instruments/methods	Unit of Measurement
Creatine Kinase	Reckon Diagnostics ENZOPAK CK-NAC	IU/L

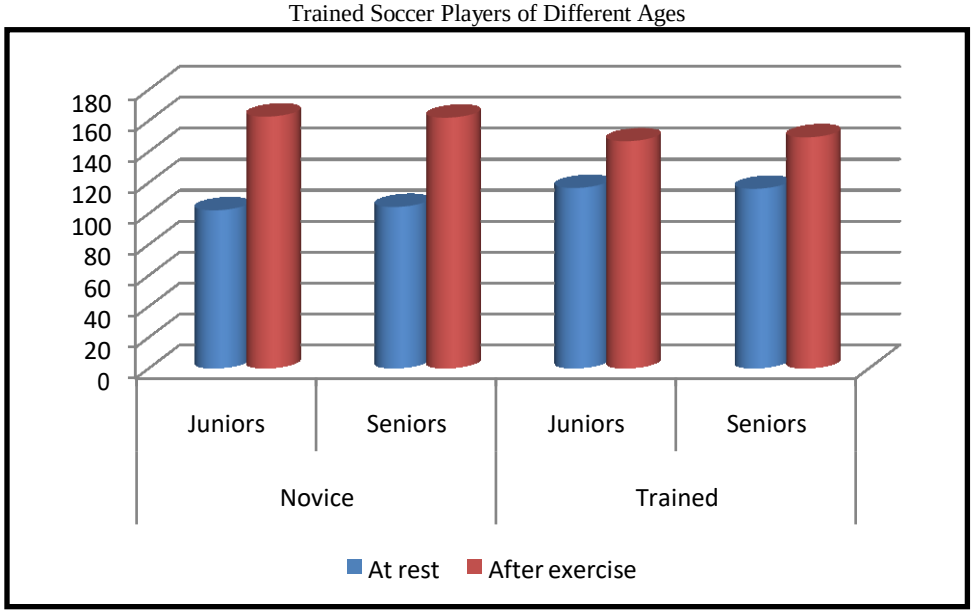
Experimental Design and Statistical Techniques

The experimental design used in this study was stratified random group design involving sixty subjects, who were divided at into four groups of fifteen each. The data thus collected from novice and trained soccer players of different ages at rest and after exercise condition have been analyzed by three way factorial ANOVA. In all the cases level of confidence was fixed at 0.05 for significance.

Results

The mean values on creatine kinase at rest and after exercise among novice and trained soccer players of different ages are graphically illustrated in figure-1.

Figure 1: Graphical Representation of the Mean Values on Creatine Kinase at Rest and After Exercise among Novice and Trained Soccer Players of Different Ages



The data on heart rate have been analyzed by three-way factorial ANOVA (2x2x2) and the obtained results are presented in table-2.

Table – 2: Three Way Factorial ANOVA on Creatine Kinase

Source	Sum of Squares	df	Mean Square	F	Sig.
Group	10.651	1	10.651	3.569	.061
Age category	22.317	1	22.317	7.478	.007
Test	61936.992	1	61936.992	20752.722	.000
Group * Age category	.438	1	.438	.147	.702
Group * Test	5620.430	1	5620.430	1883.191	.000
Age category * Test	.088	1	.088	.029	.864
Group * Age category * Test	64.167	1	64.167	21.500	.000
Error	334.267	112	2.985		

It is observed from table-2 that no significant differences exist between groups (*sedentary and active*) irrespective of age category and testing conditions on creatine kinase. Per se, significant differences exist between age categories (*14 years and 16 years*) irrespective of groups and testing conditions, and also between testing conditions (*at rest and after exercise*) irrespective of groups and age category on creatine kinase.

Though, the interaction of groups and age categories irrespective of testing conditions, and the interaction of age categories and testing conditions irrespective of groups reveals the non-existence of significant difference on creatine kinase. The interaction of groups and testing conditions irrespective of age categories shows the existence of significant difference on creatine kinase. Furthermore, the finding of the study establishes the existences of significant differences in the three way interaction of groups, age categories and testing conditions on creatine kinase. Since, the interaction effect is significant, the simple effect test has been applied as follow up test and it is presented in table-3.

Table-3 exhibits that there is a significant difference between novice and trained junior soccer players on creatine kinase levels at resting state. Similarly, there is a significant difference between novice and trained senior soccer players on creatine kinase levels at resting state.

Likewise, there is a significant difference between novice and trained junior and senior soccer players on creatine kinase levels in exercise condition.

Table-3 also displays that there is a significant difference between junior and senior novice soccer players on creatine kinase levels at resting state. While, no significant difference exists between junior and senior novice soccer players on creatine kinase levels in exercise condition.

Table - 3
The Simple Effect Scores of Novice and Trained Soccer Players of Different Ages on Creatine Kinase at Rest and after Exercise

Source of Variance	Sum of Squares	df	Mean Squares	"F" ratio
Groups at rest of juniors	1562.401	1	1562.401	523.418*
Groups after exercise of juniors	1888.117	1	1888.117	632.535*
Groups at rest of seniors	1035.469	1	1035.469	346.891*
Groups after exercise of seniors	1209.675	1	1209.675	405.251*
Novice players of different ages at rest	34.669	1	34.669	11.614*
Novice players of different ages after exercise	3.333	1	3.333	1.116
Trained players of different ages at rest	2.133	1	2.133	0.715
Trained players of different ages after exercise	46.875	1	46.875	15.704*
Tests of junior novice players	27482.1	1	27482.1	9206.735*
Tests of senior novice players	24984.13	1	24984.13	8369.893*
Tests of junior trained players	6855.439	1	6855.439	2296.629*
Tests of senior trained players	8300.05	1	8300.05	2780.586*
Error	334.267	112	2.985	

**Significant at .05 level of confidence*
(Table values required for significance at .05 level with df 1 & 112 is 3.93)

Further, it reveals that no significant difference exists between junior and senior trained soccer players on creatine kinase levels at resting state. Conversely, there is a significant difference between junior and senior trained soccer players on creatine kinase levels in exercise condition.

Furthermore, the findings of the study make obvious that there is a significant elevation on creatine kinase in response to exercise among novice and trained soccer players of different ages.

Discussions

The serum CK concentration serves as an index of both overexertion and adaptation of the muscular system to repeated bouts of exercise. As such, CK is one of the top choices of athletes and coaches when requesting a biochemical profile, although the interpretation of CK values is not always straightforward. Given the fact that serum CK remains elevated for several days post-exercise, the values used in this analysis should be considered as the cumulative effect of recent training sessions in conjunction with the repeated-bout effect [13].

Strenuous exercise that damages skeletal muscle cell structure at the level of sarcolemma and Z-disks [14], results in an increase in total CK [15]. In athletes, the study of CK at rest and after exercise could be an important tool for coaches and clinicians. Athletes have higher resting CK when compared with untrained subjects [16], probably because of the greater muscle mass and the daily training performed. However, after exercise, CK serum activity depends on the level of training: although athletes experience greater muscle soreness when compared with untrained subjects, their peak serum activity is lower [17]. Also, the most marked increase in CK occurs in the less-trained subjects [18]. In addition, CK values show great variability, and athletes with chronically low CK serum levels (*low responders*) have low variability when compared with those who have higher values (*high responders*). Therefore, the diagnosis of overtraining becomes possible only if a large increase is observed in combination with reduced exercise tolerance [19].

Age difference did not seem to have an effect on the CK in athletes considerably. This is in agreement with the statement that age does not appear to influence the degree to which serum enzyme concentrations increase with exercise.

Researchers have observed that dramatic increases in physiological variables and biochemical properties during exercise bout. The extent of the increase in physiological variables and biochemical properties is dependent on the time and intensity of the exercise bout, and the amount of muscle mass involved.

Conclusions

It was found that the creatine kinase at resting conditions of the trained soccer players is higher than that of novice soccer players, consequently the creatine kinase in response to exercise is less for the trained soccer players compared to novice soccer players. This finding ensures the fact that regularly exercising may attenuate physiological adaptations and protect against exercise muscle disruption. Based on the findings of the study it was concluded that there is a statistically significant difference between novice and trained soccer players of different ages at rest and after exercise on creatine kinase.

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