Muscle Enzyme Markers, Renal and Liver Function Tests during Preparatory and Precompetition Phase of Male Hockey Players

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ABSTRACT

The present study was conducted to evaluate the level of serum muscle enzyme markers, renal and liver function test, during preparatory and pre-competition phases of sports training of male Hockey players. Total twenty (20) male Hockey players, of age group of 14 to 22 years, belonging to SAI training center, undergoing training at Netaji Subhas National Institute of sports, Patiala, participated in the study. The t-test was applied to see the difference between various biochemical variables during preparatory and pre-competition phases of the training cycle.

The results showed that there were significant differences in serum creatine kinase, lactate dehydrogenase, creatinine and blood urea nitrogen levels; whereas, non-significant differences in alanine transaminase, aspartate transaminase and uric acid, between preparatory and pre-competition phases of the training cycle.

Key words

Creatine Kinase, Lactate dehydrogenase, alanine transaminase, aspartate transaminase, creatinine, uric acid and blood urea nitrogen.

INTRODUCTION

The training induced changes observed in various biochemical variables can be attributed to incremental training load. This would enable the coaches to assess the current status of an athlete and the degree of training adaptability and provide an opportunity to modify the training schedule accordingly, to achieve the desired performance (Bompa, 1999).The markers of muscle fibre damage such as creatine kinase and lactate dehydrogenase, liver function test such as alanine transaminase and aspartate transaminase, renal function test such as creatinine, urea, and uric acid, are routinely analyzed to assess the function of these vital organs. Change in serum enzyme activity, after exercise, depends on the magnitude of activity, physical condition of the athlete and the specific characteristics of the enzymes, although heat stress and hemolysis associated with exercise also could play a role. The amount of enzyme efflux from muscle tissue to serum can be influenced by physical exercise (Boros-Hatfaludy et al, 1986).

Serum creatine kinase (CK) and lactate dehydrogenase (LDH) gives an indication of the degree of metabolic adaptation to physical training of skeletal muscles. Both enzymes are involved in muscle metabolism, and their serum concentration is normally very low; but, due to physiological wear and tear of the muscle, they increase considerably after intensive exercise and in muscle pathology (Garry & McShane, 2000). Creatine kinase is believed to leak into the plasma from skeletal muscle fibers when they are

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damaged because of repeated and intense contractions (Clarkson et al, 1992; Mougios, 2006; Noakes, 1987).The serum concentration of creatine kinase is used widely as an index of skeletal muscle fibre damage in sport and exercise. Lactate dehydrogenase (LDH) is an intracellular enzyme which is widely distributed throughout the body and is found at high levels in tissues that utilize glucose for energy; it is therefore not organ specific. Lactate dehydrogenase catalyzes the interconversion of pyruvate and lactate with concomitant interconversion of NADH and NAD+. It converts pyruvate, the final product of glycolysis, to lactate when oxygen is absent or in short supply and it performs the reverse reaction during the Cori cycle in the liver.

Kidneys clean the blood and remove waste products of the metabolic system which would otherwise poison the body. Creatinine is a breakdown product of creatine phosphate in muscle, and is usually produced at a fairly constant rate by the body, depending on muscle mass (Yuegang & Chengjun, 2008). The concentration of creatinine, in serum, the most widely used and commonly accepted measure of renal function. Urea is major nitrogenous end product of protein and amino acid catabolism, produced by liver and distributed throughout intracellular and extracellular fluid. The most frequently determined clinical indices for estimating renal function depends upon concentration of urea in the serum. It is useful in differential diagnosis of acute renal failure and pre renal condition where blood urea nitrogen-creatinine ratio is increased (Mitchell & Kline, 2006). Uric acid is the end product of purine metabolism. High blood concentrations of uric acid can lead to a type of arthritis known as gout. Uric acid is associated with other medical conditions including the formation of ammonium acid urate kidney stones. The liver is a vital organ present in vertebrates and some other animals. It has a wide range of functions, including detoxification and protein synthesis. Alanine transaminase (ALT) is a transaminase enzyme and also called serum glutamic pyruvic transaminase (SGPT). ALT is found in serum and in various bodily tissues, but is most commonly associated with the liver. The difference being; ALT is found predominately in the liver, with clinically negligible quantities found in the kidneys, heart, and skeletal muscle. AST is found in the liver, heart, skeletal muscle, kidneys, brain and red blood cells. As a result ALT is a more specific indicator of liver inflammation than the AST, as AST may also be elevated in diseases affecting other organs, such as the heart or muscles in myocardial infarction, also in acute pancreatitis, acut) hemolytic anemia, severe burns, acute renal disease, musculoskeletal diseases, and trauma.

METHODOLOGY

The study was conducted on male STC Hockey players. A prior written consent was taken that the subjects are voluntarily ready for the participation in the present study. Total twenty (20) male Hockey players, of age group of 14 to 22 years, belonging to SAI training center undergoing training at Netaji Subhas National Institute of Sports, Patiala, participated in the study. All the subjects were healthy, neither taking any medication, nor suffering from any disease and were not regular smoker or alcohol drinkers. In the morning (between 7:00 AM to 8:00 AM), fasting 5 ml blood sample was collected from antecubital vein. Blood sampling was carried out twice; one during preparatory phase and another during pre-competition phase, of the training cycle. Serum was separated from the whole blood and following methods were used for quantitative estimation of biochemical variables:

- Serum Creatine Kinase (Mod. IFCC kinetic method: DGKC, 1977; Di & C Tren, 1982).
- Serum Lactate dehydrogenase (UV kinetic method: Thomas, 1998; Moss et aL, 1999).
- Serum Alanine transaminase (IFCC kinetic method: Bradley, etal; 1972; Wolf et al, 1972; Wroblewski & ladue, 1956).
- Serum Aspartate transaminase (IFCC kinetic method: Tietz, 1986; Bradley et al, 1972; Wolfet et al, 1972; Rej et al, 1973).
- Serum Creatinine (Jaffe' method: Bowers, 1980; Bartel, 1972; Slot, 1965; Young, 1975).
- Serum uric acid (Enzymatic method: Thefeld ,1973 ; Fossati, 1980).
- Blood urea nitrogen (GLDH- Urease method :Take et al, 1965; Tiffany et al, 1972; Young, 1990).

RESULTS & DISCUSSION

The data obtained on muscle enzyme marker (CK, LDH), renal function test (Creatinine, Uric acid, BUN) and liver function test (ALT, AST),during preparatory and pre-competition phases of training cycle of male Hockey players, has been analyzed by applying mean, standard deviation and 't'-test,using SPSS version 9.0. The following results were obtained.

Table-1: Mean, SD and 't' - value of Serum Creatine Kinase and Lactate Dehydrogenase during Preparatory and Pre-competition Phase.

	Training Phase	Mean±SD	't'- Value
Creatine kinase (U/L)	Preparatory phase (N=20)	184.75±42.99	2.10*
	Pre-Preparatory phase (N=20)	228.03±72.72	
Lactate dehydrogenase (U/L)	Preparatory phase (N=20)	325.28±57.55	1.82*
	Pre-Preparatory phase (N=20)	356.77±47.83	

Significant ar 5% level (1.685)

Table1 shows the mean±SD and t-value of creatine kinase and lactate dehydrogenase of male Hockey players, during preparatory and pre-competition phases of the training cycle. The mean±SD of creatine kinase, during preparatory and pre-competition phases,has been observed 184.75±42.99 and 228.03±72.72, respectively; and the mean±SD of LDH, during preparatory and pre-competition phases,has been observed 325.28±57.55 and 356.77±47.83 respectively. 't'-test was applied and the obtained 't' - value (2.10) for creatine kinase shows that there was significant difference whereas, the obtained, 't' - value (1.82) for lactate dehydrogenase shows that there was also significant difference between preparatory and pre-competition phases of the training cycle.

Table 2 shows mean±SD and t-value of alanine transaminase and aspartate transaminase of male Hockey players, during preparatory and pre-competition phase of training cycle. The mean±SD of

Table-2: Mean, SD and 't' -test value of Alanine Transaminase and Aspartate Transaminase during Preparatory and Pre-Competition Phase

	Training Phase	Mean±SD	't'- Value
Alanine transaminase (IU/L)	Preparatory phase (N=20)	23.64±6.52	1.29
	Pre-Preparatory phase (N=20)	27.15±9.24	
Aspartate transaminase (IU/L)	Preparatory phase (N=20)	27.05±7.57	1.56
	Pre-Preparatory phase (N=20)	31.62±8.46	

*Significant ar 5% level (1.685)

alanine transaminase, during preparatory and pre-competition phase, has been observed 23.64±6.52 and 27.15±9.24, respectively; and the mean ± SD of aspartate transaminase; during preparatory and pre-competition phase has been observed 27.05±7.57 and 31.62±8.46, respectively .'t'-test was applied and the obtained 't' - value (1.29) for alanine transaminase shows that there was no significant difference; whereas, obtained 't' - value (1.56) for aspartate transaminase shows that there was no significant difference between preparatory and pre-competition phase of the training cycle.

Table 3 shows the mean±SD and t-value of creatinine, uric acid and blood urea nitrogen of male Hockey players, during preparatory and pre-competition phases .of the training cycle. The mean±SD of creatinine, during preparatory and pre-competition phase, has been observed

Table-3: Mean, SD and 't'-test value of Serum Cratinine, Uric acid and Blood Urea Nitrogen during Preparatory and Pre-Competition Phase

	Training Phase	Mean±SD	't'- Value
Creatinine (mg/dl)	Preparatory phase (N=20)	1.30±0.07	4.09*
	Pre-Preparatory phase (N=20)	1.42± 0.12	
Uric acid (mg/dl)	Preparatory phase (N=20)	4.97±0.85	0.78
	Pre-Preparatory phase (N=20)	4.69± 0.80	
Blood urea nitrogen (mg/dl)	Preparatory phase (N=20)	25.31± 3.77	4.18*
	Pre-Preparatory phase (N=20)	30.37±4.55	

*Significant ar 5% level (1.685)

1.30±0.07 and 1.42±0.12,respectively; the mean±SD of uric acid, during preparatory and pre-competition, phase has been observed 4.97±0.85 and 4.69±0.80, respectively, and the mean±SD of Blood urea nitrogen, during preparatory and pre-competition phase, has been observed 25.31±3.77 and 30.37±4.55, respectively. 't'- test was applied and the obtained t- value (4.09) for creatinine and obtained t- value (4.18) for blood urea nitrogen shows that was significant difference between the preparatory and pre-competition phase. Whereas, the obtained 't'-value for uric acid (0.78) shows that there was no significant difference between preparatory and pre-competition phase of training cycle.

The serum level of skeletal muscle enzymes are the markers of the functional status of muscle tissue and vary widely in both pathological and physiological conditions (Brancaccio et al, 2007). In the present study, the level of creatine kinase and lactate dehydrogenase increased significantly from preparatory to pre-competition phase of the training cycle. The exercise lead to a substantial increase in muscle enzyme markers i.e. CK and LDH; but, the increase can vary according to the intensity and duration of the exercise during training phase. Munjal et al, 1983; Ohkuwa et al, 1984; Klapcinska et al, 2001; Szabo et aL, 2003; Brancaccio et al, 2007). Davies et al, (2008) evaluated the effect of exercise intensity on the Coenzyme activity. It was reported that low and moderate intensity exercises didn't change the serum CK enzyme activity; but, high intensity exercises caused high levels of serum CK activity; Similarly, in our study we found increased level of both CK and LDH during pre compitition phase ,when the intensity of the training is more, as compared to the preparatory phase of the training cycle.

The level of serum liver function markers i.e. alanine transaminase and aspartate transaminase were found high during pre-competition phase, as compared to-the preparatory phase; but, there was no significant difference observed. Moreover, the levels of both the enzymes were found within desirable range, during preparatory and pre-competition phase of the training cycle. Apple & McGue (1983) has shown that some well athletes have ALT and AST activities 20% above the upper limit of normal population studies, during training. They observed that the activities of ALT and AST of the Thai boxers were significantly higher than those of the sedentary controls. This may be attributed to the training effect. Further increases in these enzymes, after competition, suggest that damage to the liver may have occurred. But, in the present study, we observed that the levels of both the enzymes are within desirable range, during both the phases of the training cycle.

The renal function markers viz. serum creatinine and blood urea nitrogen were significantly increased in pre compitition phase as compared to preparatory phase; whereas, there was no significant difference observed in the uric acid level,between the two phases of the training cycle. Babij et al, (1983) proposed that during aerobic exercises, amino acid oxidation increases with the intensity of the exercise. Urea and uric acid levels increase in the endurance type exercise (Fry et al, 1991; Kaya et al, 2006).In our study, we found that increase level of serum creatinine and blood urea nitrogen, during pre-competition phase, which may be due to increase in amino acid oxidation with the intensity of exercise.

CONCLUSION

The markers of muscle, renal and liver functions are widely used to monitor training load, recovery and status of the vital organs of the athlete's body. In the present study, we observed that all the biochemical markers increased from preparatory to pre-competition phase of the training cycle. This may be due to high training load during pre-competition phase; particularly,the intensity

of the training, increased protein catabolism, less fluid intake and other dietary relate factors. Therefore, monitoring of biochemical variables, during different phases of the training , is very useful for understanding athlete's body responses which is in turn helpful for coaches and trainers to prepare/modify their training programme accordingly.Such types of findings are also useful for other sport scientists, nutritionist and doctors, in providing support to the athletes

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