ACUTE CHANGES IN SERUM UREA, URIC ACID AND CREATININE IN HEALTHY YOUNG ADULTS AFTER MODERATE EXERCISE

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ABSTRACT

BACKGROUND

Effects of exercise on lipid profile of blood have been studied in many studies but studies to evaluate the exercise on blood indicators of renal functions are few.

The aim of this study was to investigate the acute changes in serum urea, uric acid and creatinine in young healthy adults after single bout of moderate exercise.

MATERIALS AND METHODS

This uncontrolled clinical trial study was cleared by ethical committee of institution and total 79 untrained subjects (51 males, 28 females) of age group 18 to 35 yrs., participated in the study. Subjects were explained about study and gave written informed consent. Detailed information regarding dietary habits, any addiction, illness, medication was taken. After physical examination, blood samples were collected before exercise. Single bout of exercise by cyclometer for 30 minutes was done, and blood samples were taken after exercise along with physical examination. Serum levels of urea, uric acid and creatinine were analysed by auto analyser VITA LAB SELECTRA E. Data was collected and assessed by student 't' test and p-value < 0.05 was taken as significant.

RESULTS

Pre and post exercise levels of urea (29.13 ± 4.73 , 31.17 ± 4.75 mg/dl), uric acid (5.04 ± 0.94 , 5.40 ± 1.01 mg/dl) and creatinine (0.82 ± 0.05 , 0.84 ± 0.12) were measured. Statistical significance was observed between pre and post exercise levels of serum urea, uric acid and creatinine in males though no significant difference was noted in female subjects.

CONCLUSION

Further studies are needed to investigate the exercise induced changes in biochemical parameters of renal functions in larger groups.

KEY WORDS

Blood, Creatinine, Urea, Uric Acid, Exercise.

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BACKGROUND

Physical activity is essential for good health, prevention of diseases and good quality of life. Benefits of exercise training also lies in improving blood biochemistry and various parameters of cardiac activity. Epidemiological studies have suggested that regular physical activities are associated with reduced incidence of coronary heart disease and cerebrovascular accidents.

It is postulated that during exercise blood pressure rises and its flow falls¹ which leads to disruption in glomerular filtration and reabsorption.

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This might be reflected in blood urea nitrogen compounds concentration suggesting physiological changes in kidneys. There are other factors that affect serum creatinine concentration particularly muscle mass, consumption of cooked meat. Similarly exercise has been suggested as factor for protein catabolism to raise the urea production and creatinine level.²

There are various studies about exercise induced protein hematuria, proteinuria and acute renal failure following marathon,^{3,4} but studies investigating the effect of sub maximal exercise on indicator of renal function are few. This study was done to evaluate this aspect of sport physiology by measuring serum levels of creatinine, urea, uric acid after single bout of moderate exercise in healthy young adults.

MATERIALS AND METHODS

This Uncontrolled clinical trial study was done in G.S.V.M. Medical College Kanpur and was cleared by ethical committee of college. Individuals with history of any illness or any cause leading to alteration in biochemical parameters were excluded in random selection. Subjects with routine exercise activities were also not included. Total 79 young healthy adults in age group of 18 to 35 years (51 males and 28 females) were

selected. They were explained about study and informed written consent was taken.

Detailed information was collected through careful history taking regarding age, gender, any addiction, medication etc. Height, weight were taken for calculation of BMI (Weight in Kg / height in meter²) was done and subjects were classified in categories of underweight (<18.5 kg/m²) normal (18.5 – 24.5 kg/m²), overweight (25-30 kg/m²), and obese (> 30 kg/m²). Respiratory rate, pulse rate were recorded. Blood pressures were measured by auscultatory method with sphygmomanometer. Blood samples were taken from antecubital vein. Biochemical parameters serum urea, uric acid, creatinine were measured before introducing exercise. All biochemical estimations were done by Biochemical Autoanalyser VIT A LAB SELECTRA E in department of biochemistry and pathology.

Participants were instructed about the exercise. Single bout of acute exercise of moderate grade (Heart rate 100-125 beats/ minutes) by cycle ergometer was done for period of 30 minutes under supervision. After stoppage of exercise physical parameters such as pulse rate, respiratory rate and B.P. were reassessed. Blood samples were recollected and analysis was done for previously mentioned parameters.

Statistical Analysis

Statistical analysis was done using the software SPSS version 21. Mean of Pre-test scores and Post-test scores for all the parameters were compared using Paired samples t-test. Cognitive gain was calculated as Post-test score minus Pre-test score. For all statistical evaluations, probability of value <0.05 was considered significant.

RESULTS

BMI (kg/m ²)	Male		Female		Total	
	No	%	No	%	No	%
< 18.5	10	7	17	8.86	17	21.51
18.5- ≤24.5	25	14	39	17.72	39	49.36
>24.5- 30	10	4	14	5.06	14	17.72
>30	6	3	9	3.79	9	11.39
Total	51	64.55	28	34.45	79	100

Table 1. Distribution of Subjects According to Gender and BMI (kg/m²)

Approximately 50% of participants had BMI of normal range while 21.51 % were underweight. About 29% of subjects were either overweight or obese according to their BMI.

Male			
Parameter		Mean ± SD	P Value
Heart rate beats/minute	Pre exercise	77.19 ± 9.45	p>0.05
	Post exercise	128 ± 8.56	
Respiratory rate /min	Pre exercise	15.21 ± 3.34	p>0.05
	Post exercise	26.88 ± 5.23	
Systolic BP(mmHg)	Pre exercise	117.8 ± 7.67	p>0.05
	Post exercise	132.6 ± 8.72	
Diastolic BP (mmHg)	Pre exercise	78.8 ± 7.50	p>0.05
	Post exercise	103.2 ± 12.72	

Table 2. Mean of Heart Rate, Respiratory Rate, and Blood Pressure in Males

Female			
Parameter		Mean ± SD	P Value
Heart rate beats/minute	Pre exercise	80.13 ± 8.23	p>0.05
	Post exercise	130.45 ± 7.67	
Respiratory rate /min	Pre exercise	14.85 ± 5.87	p>0.05
	Post exercise	23.64 ± 5.46	
Systolic BP(mmHg)	Pre exercise	115.8 ± 8.76	p>0.05
	Post exercise	136.6 ± 7.97	
Diastolic BP (mmHg)	Pre exercise	76.8 ± 7.43	p>0.05
	Post exercise	108.4 ± 10.84	

Table 3. Mean of Heart Rate, Respiratory Rate, and Blood Pressure in Females

Table 2 and 3 are showing variations in heart rates, respiratory rates and blood pressure in males and females before and after exercise. Changes were statistically insignificant in both the groups.

Male			
Parameter		Mean ± SD	P Value
Serum Urea (mg/dl)	Pre exercise	29.13 ± 4.73	<0.001
	Post exercise	31.17 ± 4.75	
Serum Creatinine (mg/dl)	Pre exercise	0.82 ± 0.05	>0.05
	Post exercise	0.84 ± 0.12	
Serum Uric acid (mg/dl)	Pre exercise	5.04 ± 0.94	<0.001
	Post exercise	5.40 ± 1.01	

Table 4. Comparison of Biochemical Parameters in Pre and Post Exercise Group Among Males

Highly statistically significant (p<0.001) difference were observed between pre and post exercise blood urea and uric acid levels of the males. No statistically significant difference was noted in serum creatinine level in males.

Female			
Parameter		Mean ± SD	P Value
Serum Urea (mg/dl)	Pre exercise	28.83 ± 4.78	>0.05
	Post exercise	30.48 ± 4.69	
Serum Creatinine (mg/dl)	Pre exercise	0.80 ± 0.05	>0.05
	Post exercise	0.82 ± 0.07	
Serum Uric acid (mg/dl)	Pre exercise	3.92 ± 0.45	>0.05
	Post exercise	4.02 ± 0.53	

Table 5. Comparison of Biochemical Parameters in Pre and Post Exercise Group Among Females

No statistically significant (p>0.05) difference were observed between pre and post exercise blood urea, creatinine and uric acid levels of females.

DISCUSSION

The positive effects of exercise on long term are known to lower the incidence of coronary artery disease, obesity, hypertension etc. For good health and better life quality changes in sedentary life style and exercise is recommended by physicians. Depending upon intensity and duration of exercise variations in physical parameters as well as biochemical results are expected.³

In 1996 Hubner-Wozniak et al reported changes in the blood nitrogen compounds concentrations in physical exercise.⁵ Jansen et al (1989) documented that enhanced protein catabolism is seen in prolonged strenuous exercise.⁶ Dudzinska et al (2001) have explained in their study how progressive hypoxia results in impairment of the oxidative resynthesis of ATP and increased degradation of purine

nucleotides exercise with increasing intensity leads to increased concentration of uric acid.⁷ Alina Gailiūnienė reported exercise-induced statistically insignificant ($p > 0.05$) increases in the blood parameters of nitrogen compounds (Creatinine, urea, total protein and uric acid) and suggested that it could be due to the common phenomenon of the physical stress and catecholamine effects.⁸ In this present study there is significant difference between urea and uric acid level in pre and post exercise conditions in males although in females no significant alteration seen in pre and post exercise levels. Significant change in levels of uric acid after exercise program in middle age females is reported by Bijeh N et al.⁹ Some of the studies,^{10,11,12} also reported increase in uric acid where as other studies¹¹ have opposite observations.

Vanita Lal et al observed increase in creatinine level due to aerobic exercises in absence of renal damage.¹³ On the contrary Lippi G et al reported decreased concentration of serum creatinine in post exercise samples of endurance athletes.¹⁴ Slightly raised levels of creatinine were observed in this study but difference was insignificant in both males and females.

CONCLUSION

During physical activity, haemodynamic changes occur in kidneys and these changes might be reflected in blood content of nitrogen compounds. While doing interpretation of lab results, physiological effects of exercise should be taken in account. Physicians should take into account the effects of exercise of different intensities in patients especially of renal disorders. Further studies are needed to study the effects of exercise on blood chemical composition and kidney functions in a larger sample.

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