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Effects of a high protein intake on kidney function and acid excretion in bodybuilders

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Abstract

Body builder often prefer a high protein diet to achieve maximum skeletal muscle hypertrophy. In this study the effect of high protein diet on renal function test and urine pH was studied. The renal deteriorate activity of the high protein intake was determined by assessing biochemical parameters. Serum creatinine and urea were significantly elevated in bodybuilders with high protein intake While, the urine pH was decreased significantly compared with control group.

Key words: Bodybuilders, Protein, Urea, Creatinine, Urine-pH.

Introduction

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proteins are an essential macronutrient needed by the human body for growth and maintenance (1). As replacing normal diet with a diet rich in protein enhances nitrogen retention and increases muscle mass, it has become a popular dietary supplements among athletes and physically-active individuals. A growing body of research has examined the role of protein in prevention protein catabolism during prolonged exercise and promotes muscle glycogen resynthesize following exercise. Furthermore, protein increases synthesis of hemoglobin, myoglobin, oxidative enzymes and mitochondria which prevent sports anaemia during aerobic training (2).

Observational data from epidemiological studies provide evidence that excessive dietary protein intake is a principal

factor for the CKD progression. Protein catabolism furthermore is an important source of the daily renal acid load, primarily by the production of sulfate (3). Studies have showed an increased frequency of kidney stone disease among body builders with high protein intake. The association between an excessive intake of protein and the kidney stone formation can be explained by the observation that high protein intake is associated with a higher renal acid excretion, and acid loads, and this effect has shown to be buffered in part by bone which releases calcium to be excreted by the kidney. This protein-induced hypercalciuria could lead to the formation of calcium kidney stones (4). Additionally, animal protein is also the major dietary source of purines, the precursors of uric acid. Excessive intake of animal protein is therefore associated with hyper uricosuria, a condition present in some uric acid stone formers (5).

In this study the effect of high protein intake on renal function and renal acid excretion was studied comparing dietary intake in bodybuilders and young male adult.

Materials and method:

Ten bodybuilders aged between 20-40 years on high protein intake were investigated clinically. They provided a 2 months weighed diet. Another Ten body builders aged between 20-40 years on normal diet were studied. Ten healthy young male adults aged between 20-40 years old on a normal diet served as control.

Group 1: control

Group ll: Bodybuilder

Group lll: Bodybuilder+ protein

Samples collection

Collection of blood and urine samples

Resting blood samples taken between 8 and 9 am. After an overnight fast and 24- hour urine from previous day were obtained on 30 day of the study to measure pH and estimate kidney function.

Biochemical determination

Determination of serum creatinine

Serum creatinine level was determined by spectrophotometer Creatinine kit (Biolab, France). Creatinine in alkaline solution reacts with picrate to form a coloured complex; the intensity of the colour is proportional to the concentration of the creatinine in the serum and urine. The absorbance was measured at 500 nm using spectrophotometer.

Determination of serum urea

Serum urea was determined by using colorometric test kit and the absorbance was measured at 600 nm using spectrophotometer (Biolab,France).

Statistical analysis

Analysis of data was performed by using {statistical package for social science (SPSS) version 11.5}. Results are expressed as mean ± standard error (mean ± SE). Statistical differences were determined by Ducan's test for multiple comparisons after analysis of variance (ANOVA).

Result

Renal function test parameters

Serum creatinine

A significant increase ($p<0.05$) in serum creatinine level was recorded in high protein diet bodybuilders (1.10±0.20 mg/dL) when compared to control (0.75± 0.10 mg/dL), group, while, serum creatinine level does not change significantly in bodybuilders (0.81±0.20 mg/dL) when compared with control group (Figure 1, a).

Serum urea level

Statistical analysis shows that serum urea level increased (30.78± 0.90 mg/dL) significantly ($p<0.05$) in the bodybuilders with high protein diet compared with control (21.1± 0.7 mg/dL). On the other hand, serum urea level showed no significant change ($P <0.05$) in bodybuilder group (22.65 ± 0.80 mg/dL) compared with control group (figure 1, B).

Urine pH

Urine pH decreased (5.95± 0.9) significantly ($p<0.05$) in high protein intake bodybuilders when compared with control (6.72± 0.70) group. While, urine pH showed no significant changes (6.89 ± 0.80) in bodybuilders group when compared with control group (Figure 2).

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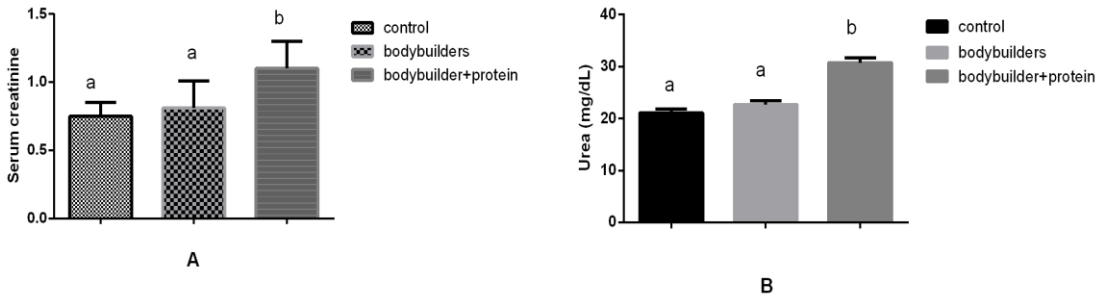

Figure (1): Effects of high protein intake on kidney function (A) serum creatinine and (B) serum urea in budybuilders.The bodybuilder and budybuilders+ protein groups were compared with control group.

The different letters on bars mean significant difference and the same letters on bars mean no significant difference. The data represented mean ± SEM P<0.05 considered a significant difference according to 1-way ANOVA followed by Duncan post hoc test.

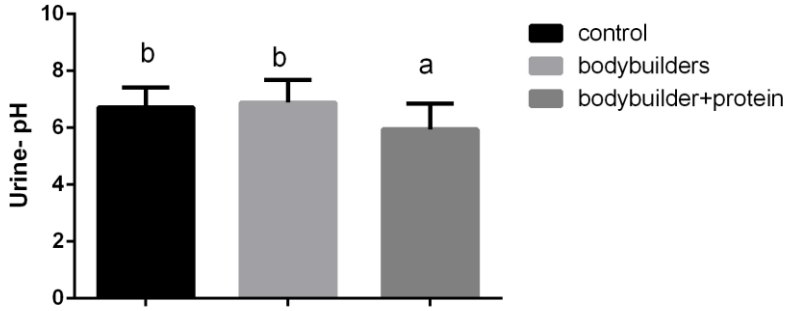

Figure (2): Effects of high protein intake on urine pH in budybuilders.The bodybuilder and budybuilders+ protein groups were compared with control group.

The different letters on bars mean significant difference and the same letters on bars mean no significant difference. The data represented mean ± SEM P<0.05 considered a significant difference according to 1-way ANOVA followed by Duncan post hoc test.

Discussion

Our results show that high protein intake in bodybuilders produced a significant increase in serum urea and creatinine. It well known that urea the primary end product of nitrogen and amino acid metabolism, is produced by the liver in larger

amounts than is eliminated in the urine (6). However, the kinetics of urea production, excretion, and hydrolysis have been widely investigated in humans, during physical activity (7) and protein intake. On the other hand, (8) demonstrated that dietary protein intake has important effects on renal ammonia metabolism. In general, high-protein diets, particularly if high in sulfur-containing amino acids, increase endogenous acid production, causing a parallel increase in ammonia excretion.

Studies show that mammals fed acute and chronic high protein diets exhibit increases in GFR and renal blood flow (9). The common mechanism underlying increased creatinine level was eventually attributed to changes in GFR (10) and (11) demonstrated that renal blood flow was the basis for GFR mediated changes in serum creatinine in response to increased protein intake.

The results of the present study showed that high protein diet bodybuilders had lower urine pH compared with control group. The increased renal acid excretion on a high protein diet is the result of an increased urinary excretion of anionic end products from protein catabolism (12). A high-protein intake was also found to increase in a mild metabolic acidosis. Which in turn increases renal acid excretion (13).

Conclusion: from the present study we concluded that dietary protein intake changed same renal function test parameters in bodybuilders.

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