Kidney function among male bodybuilders taking protein supplement

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Abstract

The kidneys are the main route by which nitrogenous end products are excreted. The loss of renal function is characterized by the increase of nitrogenous waste products in the blood.
The trend for some athletes to take protein supplements to increase their muscle mass is very popular these days. This trend should be of a great concern because high protein intake will lead to the increase of production of **urea** which must be filtered through the kidneys.
We assumed that a high amount of Urea due to the intake of protein supplement will promote renal damage by chronically increasing the glomerular pressure and hyperfiltration. This research will assess the renal function of those who are taking protein supplement and compare their results with that of a control group of individuals who are on a regular diet.

Studies **by Berner & al** have shown that excessive intake of dietary protein and amino acids may influence the kidney function [1].

Research by **Robertson & al** has also shown that excessive protein intake can produce aciduria and eventually a stone formation in the urinary tract[2]. The status of such effect has not been investigated previously in the UAE. Therefore, the purpose of this research is to evaluate the renal function of individuals who are on protein supplement and compare it with that of a control group. It's well known that the normal diet in the UAE is very rich in protein especially animal protein and that due to the affluent life style in the UAE. This by itself places a great pressure on the kidneys to eliminate the nitrogenous waste products. As for those who are on protein supplements the pressure on their kidneys will be compounded which may result in gradual renal dysfunction and eventual renal failure.

4.KIDNEY FILTRATION

The kidney is made up of units called nephron that are responsible for blood filtration. Each nephron consists of a coil of capillaries called glomerulus surrounded by the Bowman's capsule. The glomerulus has semi-permeable membrane that filters out all of the blood components into the Bowman's capsule. The filtrate has the same plasma consistency except it does not have proteins because proteins are big molecules and they do not get filtered.

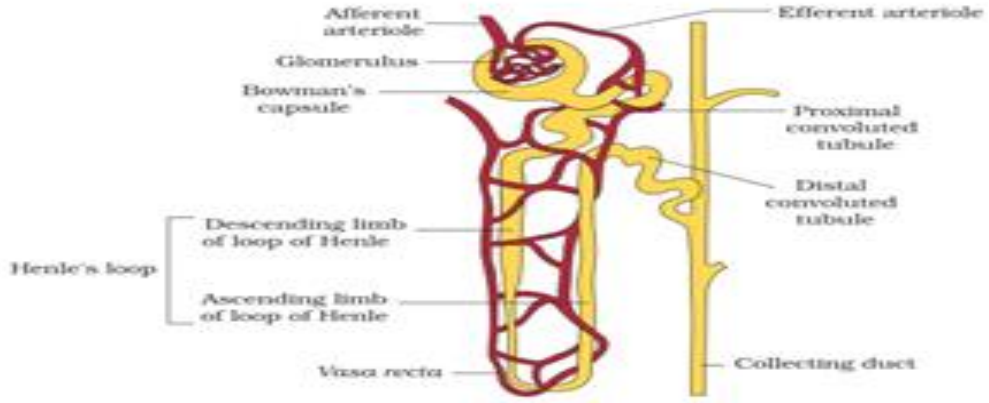

Fig. 1: Nephron

The filtrate leave the capsule into the renal tubules and eventually end up in the collecting ducts and the bladder as urine. As the filtrate passes through the renal tubules some of its components get reabsorbed back to the blood and excess salts and nitrogenous waste ends up in the bladder as urine where it gets excreted.. [4]-[6]

5.UREA METABOLISM

Urea is the major excretory product of protein metabolism, it is formed in the liver from amine groups of amino acids by enzymatically catalyzed process called urea cycle. When protein is broken into its component parts (amino acids) and metabolized it releases nitrogen which converted to urea and excreted as waste product. Following the synthesis in the liver, urea released by the liver into the bloodstream and is carried to the kidneys, where it is filtered by the glomerulus and excreted in the urine. Although some urea is reabsorbed by passive diffusion during passage of the filtrate through the renal tubules.[7]-[8]

6.URIC ACID METABOLISM

Uric acid is derived from the catabolism of purine base, adenine and guanine, in the liver. The liver releases uric acid into the blood to be transported to the kidney where it is filtered by the glomerulus and end up in urine where it is excreted. [8]-[9]

7.CREATININE METABOLISM

Creatinine is a waste product produced in muscles from the breakdown of creatine and creatine phosphate. Creatine is synthesized in the liver from arginine, glycine and methionine. After synthesis, creatine is carried to the muscles to be phosphorylated. Creatine phosphate serves as a high-energy source. Each day about 1% of total creatine in the muscle is oxidized into creatinine which is a waste that is filtered out in the kidneys and excreted in urine. [8]

8.ALBUMIN AND TATAL PROTEIN SIGNIFAICANCE IN ASSESSING RENAL FUNCTION

All serum proteins are synthesized in the liver and secreted to the blood except the gamma globulins which are synthesized in the B-lymphocytes. Since proteins are big molecules they do not get filtered by the glomerulus so they are not normally seen in urine. However, as the kidneys start to lose their function proteins start appearing in urine and consequently their concentrations in serum start to decrease

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11.METHODS AND MATERIALS

57 blood samples were collected by the research group from male volunteers who have admitted of taking protein supplements. Another 56 samples was collected from volunteers who are on a regular diet with no protein supplements. All participants were asked to sign a consent form and data were collected using an appropriate questioner (Height, weight, age, time that have been taking the protein supplement and how often) . 5 ml of blood was collected from each subject in a red top tube. Serum was immediately separated from the cells and kept at -20C till all the samples were collected. All samples was tested for Urea, Uric acid, Creatinine, Albumin and Total protein. Samples were ran as duplicate using reagent kits specific for each metabolite and spectrophotometer. Duplicate samples had to agree with 10% of each other, otherwise the sample would be repeated.

8.1. Kits and equipment

-Urea- kit S180 (BioMerieux).
-Uric acid kit (BioMerieux).
-Creatinine kit (BioMerieux).
-Total protein kit (BioMerieux).
-Albumin kit (BioMerieux).
-JENWAY- 6505 UV/Vis. Spectrophotometer
-10,20,100,1000 microliter automated pipettes.
-1 ml plastic cuvette.
-Plastic tips.
-5 ml evacuated red top tubes (Becton Dickinson).
-21 G multi-sample needles from (Sterile, EO).
-Vortex mixer (stuart scientific).

9.DATA ANALYSIS

Data is analyzed using SPSS statistical method. Mean and Standard deviation for each group are calculated and

T test is done to see whether the differences in Means between the subject groups and control group are statistically significant or not. A P value of < 0.05 will be considered significant.

The table below clearly indicates that not only there are significance statistical differences between the control group and the study groups but also between those who have been taken protein supplement for less than one year those who have been on the supplement for more than one year.

Table

	Urea (mg/dl)	Uric Acid (mg/dl)	Creatinine (mg/dl)	T.protein (g/dl)	Albumin (g/dl)
Mean of Control Group	31.38	6.3	1.03	8.28	5.126
SD of Control Group	7.91	1.44	0.26	1.09	0.31
Mean of Study Group (<1 year of usage)	39.31	6.85	1.05	7.64	4.92
SD of Study Group (< 1 year of usage)	9.84	1.28	0.16	0.79	0.26
Mean of Study Group (> 1 year of usage)	45.2	6.31	1.17	7.44	4.92
SD Study Group (> 1 year of usage	11.751	1.14	0.31	1.07	0.52
Mean of Both Study groups	42.93	6.52	1.12	7.5	4.92
SD of both Study groups	11.33	1.21	0.27	0.97	0.44
Significance Difference (Control group Vs all S. group)	$7.2x10^{-9}$	0.38	0.05	0.0001	0.006
	Ext. Sigf	**Not Sigf**	**Sigf**	**Ext. Sigf**	**Ext. Sigf**
Significance Difference (Control group Vs > 1 y S. group)	$1.0x10^{-9}$	0.96	0.02	0.0006	0.02
	Ext. Sigf	**Not Sigf**	**Sigf**	**V.Sigf**	**Sigf**
Significance Difference (Control group Vs < 1 y S.group)	0.0003	0.12	0.64	0.01	0.01
	Ext. Sigf	**Not Sigf**	**Not Sigf**	**sigf**	**sigf**
Significance Difference (>1 y Vs < 1 y S. groups)	0.05	0.1	0.13	0.46	0.98
	Sigf	**Not Sigf**	**Not Sigf**	**Not Sigf**	**Not Sigf**

Fig.5: Urea levels

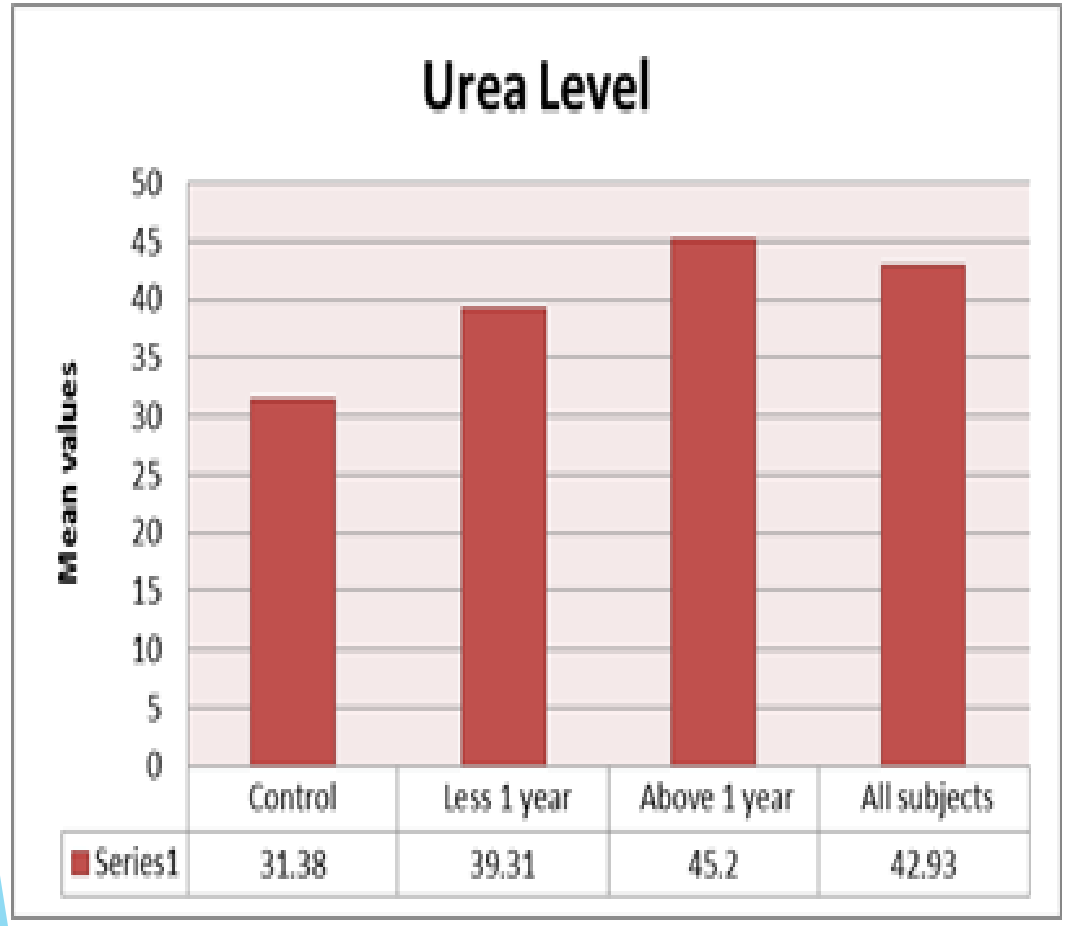


Fig.6: uric acid levels

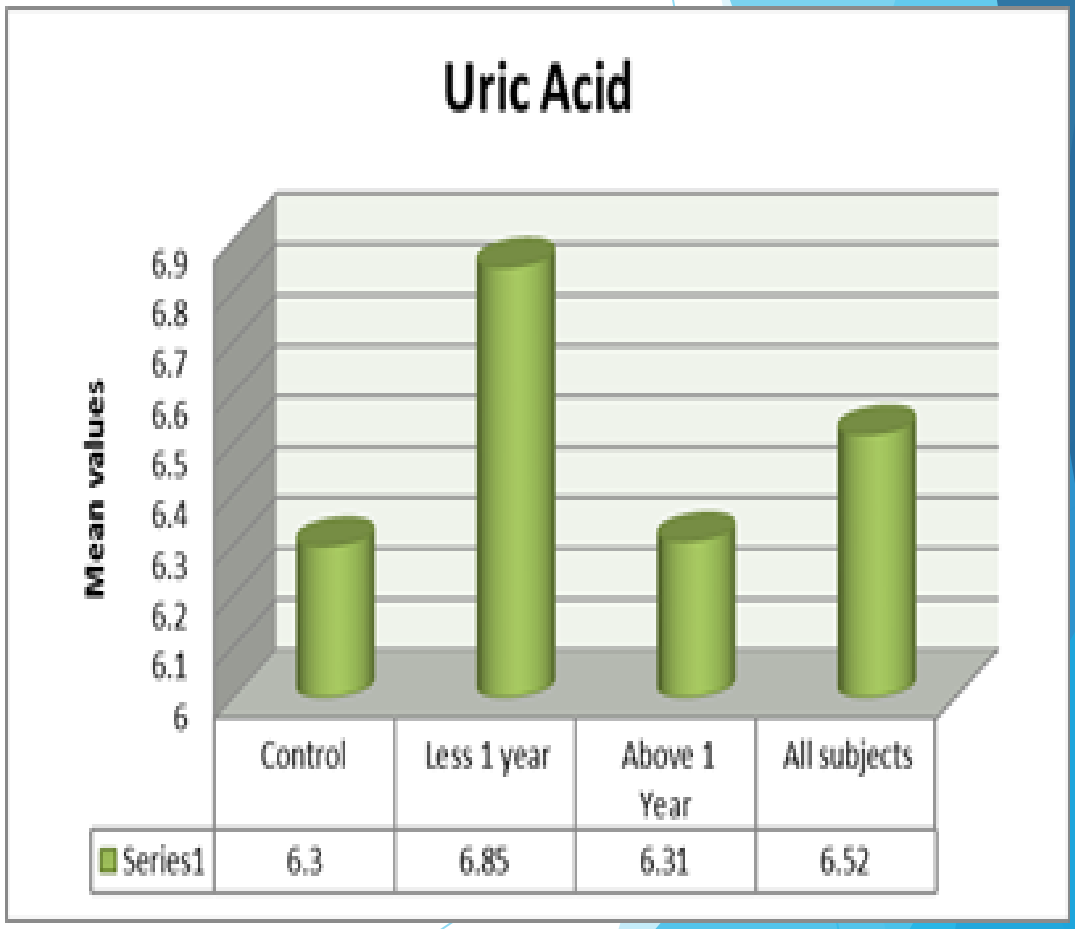


Fig.7: Creatinine levels

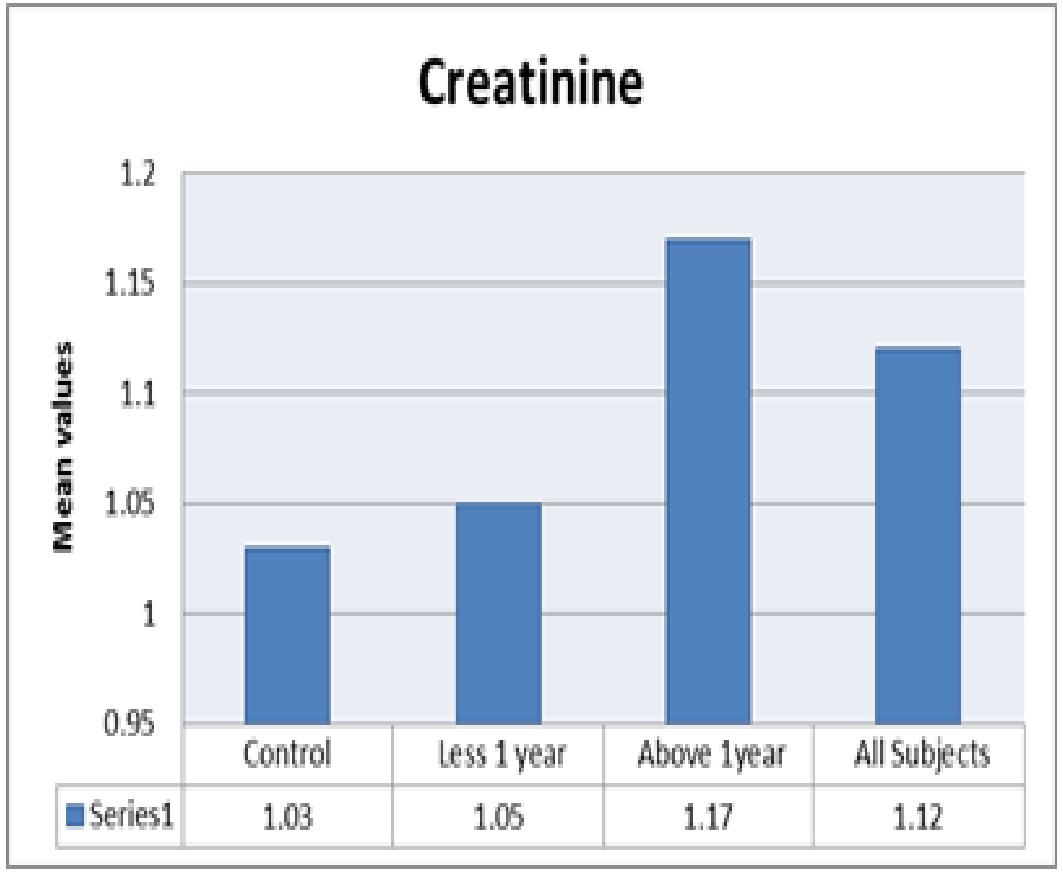


Fig.8: Total protein levels

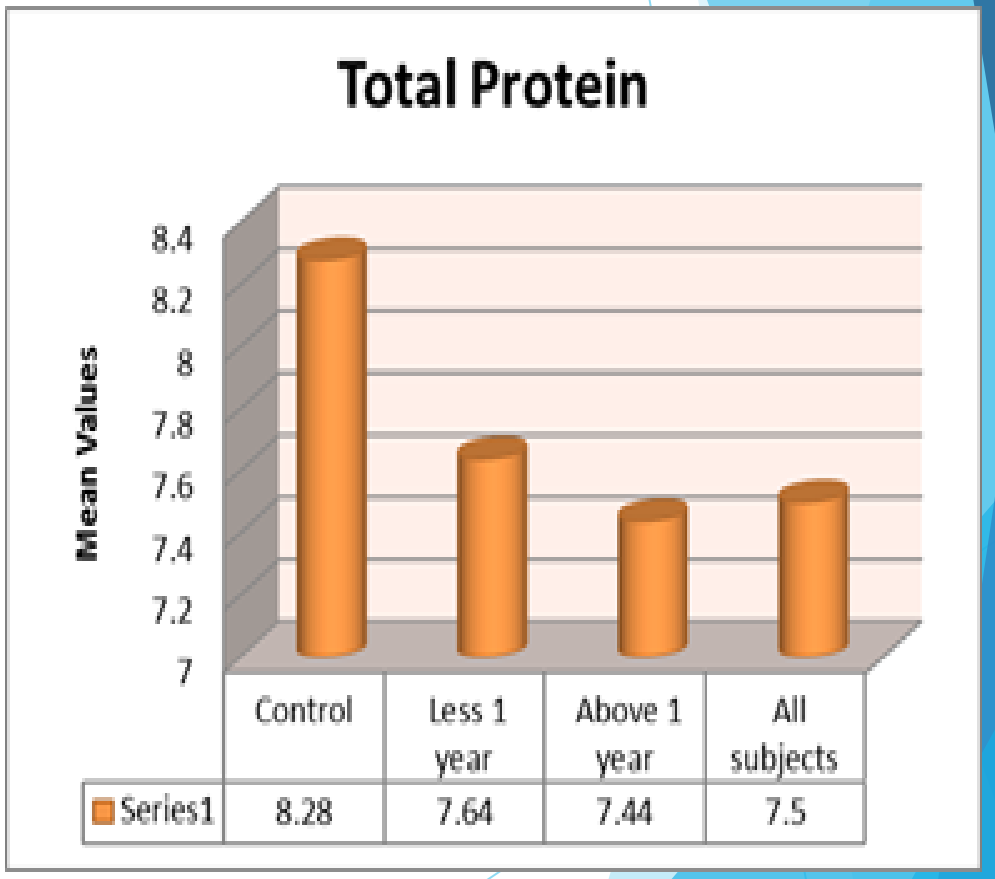
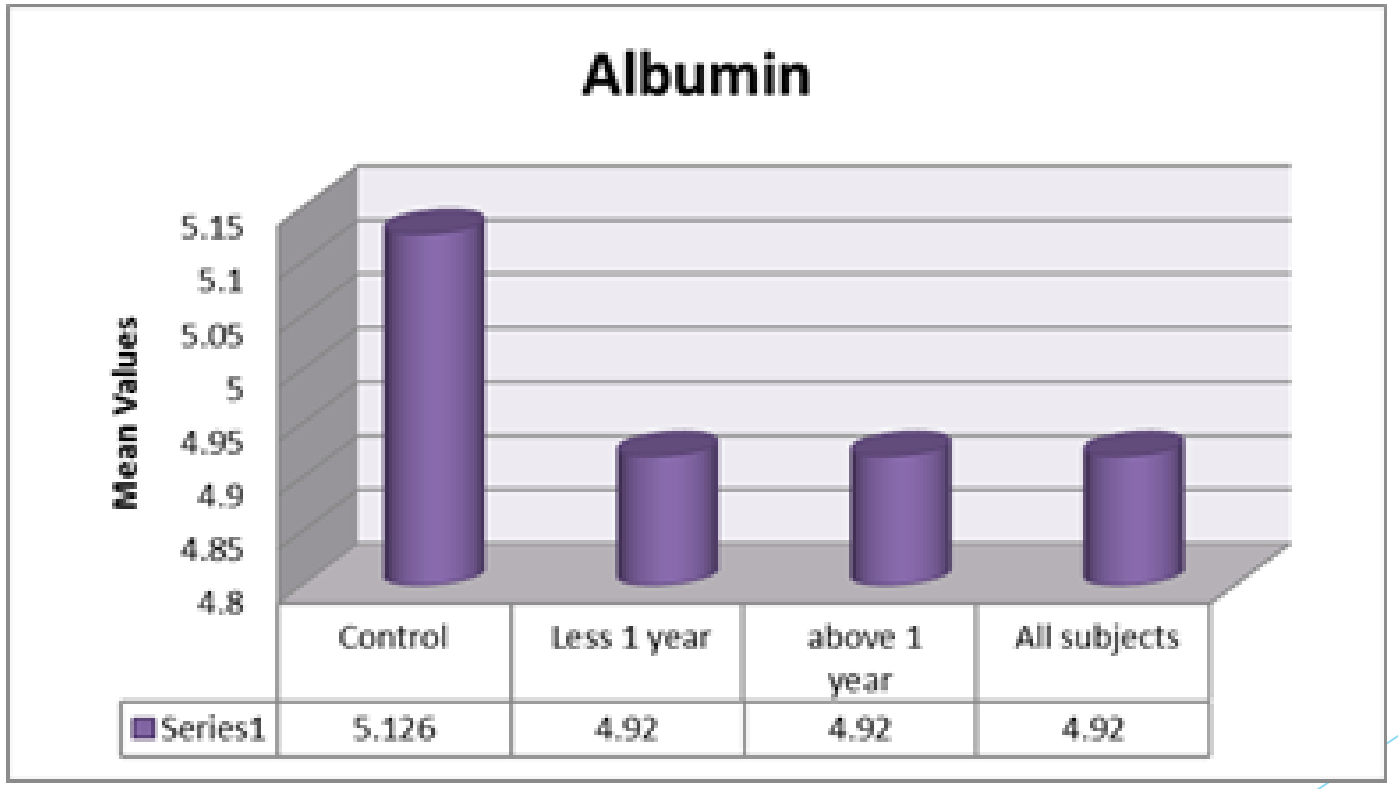


Fig.9: Albumin **levels**



CONCLUSION AND RECOMMENDATIONS:

This study clearly shows that protein supplement causes an extremely significant increase in the plasma urea level. It also shows a significant increase of creatinine level and a significant decrease plasma albumin and total proteins. This is an indication that protein supplement has a negative effect on the kidneys of the users.

As for the slight increase of uric acid this is due, in our opinion, to the fact that the uric acid precursors are the purine bases, Guanine and adenine. Uric acid increases during cell destruction and our subjects are body builders so it is normal for their uric acid not to increase.

We recommend the following:

1- Limit or prohibit the usage of protein supplement for body building
2- If the supplement is not prohibited, a warning label should be place on the products warning users of possible renal damage
3- A comprehensive study should be conducted that include higher number of subjects
4- Most of subjects of this study are college students who have been using for less than 2 years. The new study should include subjects who have been using for more than 2 years
5- Urinalysis should be included in the study to determine presence or absence of protein in urine which will be a definite proof renal damage.

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