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AMELIORATIVE EFFECT OF DIFFERENT SOY PROTEIN PRODUCTS COMPARED TO ANIMAL PROTEIN ON RENOPATHIC RATS

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ABSTRACT: *Low protein and soy protein diets are the focal point of medical nutrition therapy for renal health. This work was carried out to study the effect of different types of soy flour (full and low fat) as a protein source versus animal protein (casein and egg) in low protein diets on the health status of renal infected rats. Thirty six Sprague Dawley strain male albino rats weighing about (160±5) g were used and divided into 6 groups; two of them were control; negative and positive, from third to last group was fed on 6% protein from casein, egg protein, full fat and low fat soy flour respectively. All groups except group 1 were prepared for treatment of renopathic injury by injection of gentamicin. The experimental period was 28 days. Biological & biochemical analyses and histopathological examinations were carried out. Results indicated the following: Slowed the disease progress due to substituting dietary soy protein for casein and egg. This was evidenced by lower kidney, liver and heart weights. Soy-based diets reversed the kidney and liver functions. Lipid profile and serum glucose were improved with vegetarian protein diets more than animal protein diets. Patients with renal diseases should be advised and aware with the beneficial health effects of using soy protein instead of animal proteins in their diets.*

Key words: *soy protein - renopathic injury - low protein diet*

INTRODUCTION

Diet is often used to control the progression of life-threatening health problems such as renal disease in diabetes and polycystic kidney disease. Specifically, low protein and soy protein diets are the focal point or medical nutrition therapy for renal health. Recent research indicates that even a moderate incorporation of soy protein into the diet may have significant renal benefits for those at risk for kidney problems (Azadbakht *et al.,* 2003).

Soy protein clearly exerts different effects on renal function parameters compared with animal protein. These effects may be related to one or more of these: Isoflavones; amino acid profile; lipid-lowering effects; antioxidant properties; and anti-inflammatory effects (Stephenson, 2001 and Teixeira *et al.,* 2001). Therefore, soy may be beneficial for treatment as well as prevention in persons with kidney problems or in healthy persons at risk of kidney problems (Anderson *et al.,* 1999). Accordingly it seems that restriction of protein intake and soy protein may be the corner stone for clinical nutrition of renopathy.

AIM OF RESEARCH

This investigation aims to study the effect of soy protein compared to animal protein in low protein diets on renopathic rats.

MATERIALS AND METHODS

This work was carried out in the animal house of the Faculty of Home Economics, Menoufiya University, (2013).

Materials:

Two types of soy flour; full fat (3.6 g fat) and low fat (1.3g fat) were obtained from Agricultural Researches Center, Giza, Egypt.

Preparation of egg powder:

Fresh good quality eggs were obtained from Poultry Farm, in Giza. The eggs were cleaned, washed and allowed to dry, then deshelled. Whole Egg liquid was later homogenized with a metal whisk. The samples were later vacuum oven dried at 44°C for 4 h and allowed to cool. The egg flakes were scooped milled and sifted with a 60 mm meshes and then weighed (Ndife *et al.*, 2010).

Diets:

Basal Diet:

The basal diet was prepared according to Reeves *et al.,* (1993). It was consisted of 11.8% protein (casein), 10% corn oil, 1% vitamin mixture, 3.6% salt mixture and 5% fiber (cellulose). The remainder was corn starch.

Experimental diets:

Experimental diets are shown in Table (1):

Preparation of renopathic rats:

Acute renal injury was induced in normal healthy male albino rats by intraperitoneal injection of gentamicin at 10 mg/kg/day for 10 days.

Experimental design and animal groups:

Thirty six Sprague Dawley strain male albino rats weighing about (160±5) g were used in the study. The animals were obtained from Helwan Experimental Animals Station.

The groups of rats were classified as follows:

Group 1 (control -ve): Control negative group, in which the normal rats fed on basal diet.

Group 2 (control +ve): Renopathic, control positive group, in which the injected rats fed on basal diet.

Group 3 (Diet A): Renopathic rats fed on low protein (casein) diet.

Group 4 (Diet B): Renopathic rats fed on low protein (egg) diet.

Group 5 (Diet C): Renopathic rats fed on low protein (full fat soy flour) diet.

Group 6 (Diet D): Renopathic rats fed on low protein (low fat soy flour) diet.

Biological parameters:

Biological parameters were evaluated by:

1. Body weight gain (BWG).
2. Feed intake (FI).
3. Determination of feed efficiency ratio (FER).

Table (1): The composition of control and experimental diets (g/100 g diet) (on dry weight basis):

Ingredients \ Groups	Control (-ve)	Control (+ve)	(Diet A) Casien	(Diet B) Whole egg	(Diet C) Full fat soy flour	(Diet D) Low fat soy flour
Protein source	13.9g casein =11.8g protein	13.9g casein =11.8g protein	7.1g casein =6.0g protein	12.4g egg =6.0g protein	17.37 g full fat soy =6.0g protein	13.18g low fat soy =6.0g protein
Fat	10 corn oil	10 corn oil	10 corn oil	4.7corn oil +5.3 egg fat	6.4 corn oil +3.6 soy oil	8.8 corn oil +1.2 soy oil
Salt mixture	3.6	3.6	3.7	3.5	3.1	3.4
Vitamin mixture	1	1	1	1	1	1
Cellulose	5	5	5	5	4.2	4.6
D.L methionine	0.3	0.3	0.3	0.3	0.3	0.3
Choline chloride	0.2	0.2	0.2	0.2	0.2	0.2
Corn starch	68.1	68.1	73.8	73.8	73.8	73.8

Animal protein (casein) added to obtain 6 g protein in 100 g diet. Also, dried whole egg, full fat soy flour and low fat soy flour added to obtain 6 g protein / 100 g diet.

Blood sampling and organs:

At the end of the experimental period, the rats were fasted overnight and anesthetized with diethyl ether. Blood samples were collected from the hepatic portal vein into centrifuge tubes. All serum samples were analyzed for determination the following parameters: Hemoglobin, serum glucose according to Trinder (1969), serum sodium, serum potassium, and serum phosphorus according to (Nicoll, Diana *et al.,* 2003), plasma total protein according to Weichselbaum (1964), plasma albumin according to Dournas and Biggs (1971); globulin = (plasma total protein - albumin); glutamic oxaloacetic transaminase (GOT) according to Reitman and Frankel (1957); glutamic pyruvic transaminase (GPT) according to Reitman and Frankel (1957); uric acid according to Fossati (1980); creatinine according to Henry (1974); urea according to Patton (1977), triglyceride (T.G.) according to Trinder (1969), total cholesterol (T.C.) according to Rhichmond (1973); high density lipoprotein (HDL) according to Rhichmond (1973); very low density lipoprotein (VLDL) = (T.G.)/5, low density lipoprotein (LDL) = [T.C – (HDL+VLDL)]. At the same time, the organs (heart, liver, and kidneys) removed, cleaned, weighed and stored in buffered formalin solution (10 %) for histopathological testing according to Drury and Wallington (1980).

Statistical analysis:

The obtained data were statistically analyzed using computerized SPSS (Statistic Program Sigmastat, Statistical Software, SAS Institute Cary, NC). Effects of different treatments were analyzed by one way ANOVA (analysis of variance) test using Duncan's multiple range at $p < 0.05$ to indicate significance between groups (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

In the current study the effect of two different types of soy flour as a protein source versus animal protein in low protein diets on the health status of renal infected rats was investigated.

Due to renopathy, Body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) in rats were decreased. Animal protein diets revealed significantly lower BWG, FI and FER as compared with vegetables protein diets (Table 2). Statistically animal protein diets revealed significantly lower BWG, FI, FER as compared with vegetarian protein diets, it may be referred to quality of the soy protein which was adequate to maintain growth and provide adequate protein nutrient (Aukema *et al.,* 1999).

Soy contains nine essential amino acids in the correct proportion for human health. Soy protein therefore is categorized as high quality, complete protein (Hoogenkamp, 2005).

Slowing of disease progression by substituting dietary soy protein for casein and egg, was evidenced by lower kidney, liver and heart weights (Table 2). The results of decreased kidneys weight in present work is similar to that found by Fair *et al.,* (2004) who demonstrated that dietary soy protein compared with casein delays disease progression in an early stage of chronic kidney disease. Aukema *et al.,* (1999) showed that differences (decreasing) in kidney weights and cyst score due to protein reduction were significant in animals fed soy protein, but not in those fed casein as the protein source. The mechanisms by which soy protein retards kidney enlargement and cyst growth, however are unclear.

Nephritis caused an increase of serum glucose, while feeding renopathic rats on diets containing vegetarian (soy) protein lowered the serum glucose as compared with the animal protein diets (Table 3). These results may be due to what was reported by Akiyama *et al.,* (1987), Abler *et al.,* (1992), Mishra *et al.,* (2000), and Dang *et al.,* (2003) that soy antioxidant (genistein and other isoflavones) have many in-vitro effects that could affect renal function; including variety of effects on insulin sensitivity.

Table (2): Effect of different sources and levels of proteins on body weight gain (BWG) & Feed intake & Feed Efficiency Ratio (FER) and organs weight of renopathic rats

Groups	BWG (g/28 days) Mean±SD	Feed intake (g/day) Mean±SD	FER Mean±SD	Kidney wt. (g) Mean±SD	Liver wt. (g) Mean±SD	Heart wt. (g) Mean±SD
Control (-) Casein 11.8%	30.00±0.05[a]	20.24±1.99[a]	0.053±0.02[a]	0.85±0.04[d]	4.30±0.13[f]	0.44±0.05[d]
Control (+) Casein 11.8%	7.20±0.03[e]	17.39±1.70[d]	0.015±0.01[d]	1.05±0.04[a]	5.38±0.25[a]	0.66±0.04[a]
(Diet A) Casein 6%	10.80±0.03[d]	18.68±1.88[c]	0.020±0.01[c]	0.95±0.04[b]	4.80±0.43[d]	0.58±0.03[b]
(Diet B) Whole egg /6% protein	10.40±0.09[d]	18.84±1.63[c]	0.020±0.02[c]	0.97±0.06[b]	4.94±0.43[c]	0.60±0.04[b]
(Diet C) Full fat soy flour/protein 6%	11.60±0.06[c]	19.29±2.80[b]	0.021±0.01[c]	1.03±0.03[a]	5.08±0.18[b]	0.61±0.03[b]
(Diet D) Low fat soy flour/ protein 6%	12.20±0.03[b]	19.64±2.00[b]	0.032±0.01[b]	0.89±0.06[c]	4.68±0.17[e]	0.51±0.05[c]

Values denote arithmetic means ± standard deviation of the mean. Means with different letters (a ,b, c, d, e and f) in the same column differ significantly at $p \leq 0.05$ using one way ANOVA test, while those with similar letters are nonsignificantly different.

Table (3): Effect of different sources and levels of proteins on lipid profile and serum glucose of renopathic rats

Groups	TC(mg/dl) Mean±SD	TG(mg/dl) Mean±SD	HDL(mg/dl) Mean±SD	LDL(mg/dl) Mean±SD	VLDL(mg/dl) Mean±SD	AI ratio Mean±SD	Serum glucose (mg/dl) Mean±SD
Control (-) Casein 11.8%	170.00±2.45[e]	90.00±2.16[f]	48.00±2.16[a]	104.00±1.84[e]	18.00±0.43[d]	2.54±0.13[f]	80.25±0.96[d]
Control (+) Casein 11.8%	250.00±4.40[a]	180.00±1.83[a]	34.00±4.56[d]	180.00±3.29[a]	36.00±0.91[a]	6.35±0.26[a]	160.50±2.08[a]
(Diet A) Casein 6%	195.00±3.74[b]	110.00±2.16[c]	38.00±4.69[c]	135.00±1.49[b]	22.00±0.94[b]	4.13±0.13[b]	85.00±1.41[c]
(Diet B) Whole egg / 6% protein	200.00±9.13[b]	121.00±1.83[b]	40.00±4.24[c]	135.80±8.39[b]	24.20±0.94[b]	4.00±0.17[c]	150.00±2.22[b]
(Diet C) Full fat soy flour/6%protein	188.00±4.24[c]	103.00±2.16[d]	43.00±3.92[b]	124.40±1.66[c]	20.60±0.78[c]	3.37±0.08[d]	78.00±1.83[d]
(Diet D) Low fat soy flour / 6% protein	180.00±2.58[d]	94.00±1.83[e]	45.00±3.37[b]	116.20±0.23[d]	18.80±0.67[d]	3.00±0.06[e]	75.25±3.20[e]

Values denote arithmetic means ± standard deviation of the mean. Means with different letters (a, b, c, d, e and f) in the same column differ significantly at $p \leq 0.05$ using one way ANOVA test, while those with similar letters are nonsignificantly different.

Gentamicin injection increased serum TC, TG, LDL & VLDL, but decreased serum HDL. Table (3) showed that rats fed on full fat soy flour (group C) and low fat soy flour (group D) showed the best treatment for lowering TC, TG, LDL & VLDL, AI and increasing HDL. Such results can be explained as Anderson *et al.,* (1995) who found that most of the hypocholesterolemic effects were attributed to isoflavones. While Hori *et al.,* (2001); Wang and de Mejia ,(2005); Anderson (2008) indicated that various peptides may have the predominant role in many of the physiologic effects of the soy protein package, Since it is difficult to separate the effects of intact protein (or its amino acids) from the effects of isoflavones or peptides.

D'Amico and Gentile (1993) and Teixeira *et al.,* (2004) reported that soy protein diets decreased serum lipids and albuminuria in patients with chronic renal disease.

Renopathy affected kidney functions by: limiting urine volume, decreasing serum proteins concentrations, increasing serum uric acid & urea, accumulating minerals in serum, lowering excreting them in urine, increasing creatinine in serum while lowering it in urine and so creatinine clearance is reduced (Tables 4- a, b, c).

A decline in renal function alters the composition of blood and urine. The kidneys become unable to regulate the levels of electrolytes, acid, and nitrogenous wastes in the blood. This was also reported by El-Gamal (2012) showing that nephropathy lowered serum total protein and albumin as well as albumin / globulin ratio, while raised the level of serum globulin, changed N& K concentrations in serum and urine. Feeding rats on the pumpkin seeds reversed such changes improving the serum protein profile. Also from the present work, results of vegetarian protein diets were better than that of the animal protein (including casein & egg protein).

Table (4-a) indicated that the best serum albumin was recorded for group D (low fat soy flour / 6% protein) when compared to control (+) group. Also the best treatment was showed by group D (low fat soy flour / 6% protein) for globulin showing the same value of the healthy control (-) rats. Albumin / Globulin ratio revealed that Diet D was the best. The better serum uric acid was observed for diet D group (renopathic rats fed on low fat soy flour) when compared to control (+) rats. Soy-based diets (groups C and D) reversed the action of accumulating sodium & potassium and phosphorus, and corrected their concentration in serum and so enhanced its secretion them in urine (Table 4-b).

This was also found by Khider (2006) that acute renal failure in rats resulted in the increase of serum K and P. Feeding of renopathic rats on diets containing brown algae or mixture of algae (thrown on shores after a storm) corrected the increase of minerals in serum of nephritic rats. Obstruction of urine may be the reason for minerals rising in the serum.

El-Moslemany (2012) came to same conclusion and added that the reverse would be noticed when low protein diets, in particular that of vegetables origin consumed.

Data present in table (4-c) showed that soy-based diets (groups C and D) were associated with preservation of renal function as indicated by high serum creatinine and creatinine clearance rates. Results indicated that urine creatinine of diet D rats was even more than that recorded for the control (-) group indicating the value of this diet. These changes also found by Soroka *et al.,* (1998) compared the effect of a soya-based vegetarian low-protein diet (VPD) and an animal-based low-protein diet (APD) in 15 patients with chronic renal failure, and found that serum creatinine and phosphate were lower on the VPD than on the APD. Ogborn *et al.,* (2010) reported that soy-based diets were associated with preservation of renal function as indicated by serum creatinine.

Table (4-a): Effect of different sources and levels of proteins on kidney function of renopathic rats

Groups	S. Total proteins (g/dl) Mean±SD	S. Albumin (g/dl) Mean±SD	S. Globulin (g/dl) Mean±SD	Albumin/ globulin Ratio(g/dl) Mean±SD	S. uric acid (mg/dl) Mean±SD	S.urea (mg/dl) Mean±SD
Control (-) Casein 11.8%	7.50±0.12[a]	5.50±0.08[a]	2.00±0.08[c]	2.75±0.02[a]	3.50±0.14[d]	25.00±1.83[f]
Control (+) Casein 11.8%	5.00±0.08[e]	2.40±0.08[e]	2.60±0.14[a]	0.93±0.01[f]	6.50±0.08[a]	79.00±1.22[a]
(Diet A) Casein 6%	5.90±0.08[c]	3.40±0.08[d]	2.50±0.10[a]	1.36±0.01[e]	4.30±0.14[c]	45.00±1.41[c]
(Diet B) Whole egg /6% protein	5.60±0.08[d]	3.50±0.08[d]	2.10±0.14[b]	1.67±0.02[d]	5.10±0.08[b]	51.00±1.83[b]
(Diet C) Full fat soy flour /6% protein	5.90±0.41[c]	3.80±0.12[c]	2.10±0.29[b]	1.81±0.01[c]	4.90±0.18[b]	40.00±1.63[d]
(Diet D) Low fat soy flour / 6% protein	6.50±0.29[b]	4.50±0.16[b]	2.00±0.08[c]	2.25±0.01[b]	4.10±0.22[c]	36.00±1.83[e]

Values denote arithmetic means ± standard deviation of the mean. Means with different letters (a ,b, c, d, e and f) in the same column differ significantly at $p \leq 0.05$ using one way ANOVA test, while those with similar letters are nonsignificantly different.

Table (4-b): Effect of different sources and levels of proteins on kidney function of renopathic rats

Groups	S. Sodium (mmol/L) Mean±SD	S. Potassium (mmol/L) Mean±SD	S. Phosphorus (mmol/L) Mean±SD	U. volume (ml/24hr) Mean±SD	U. sodium m.eq/l Mean±SD	U. potassium m.eq/l Mean±SD
Control (-) Casein 11.8%	137.00±1.85[e]	3.95±0.13[e]	1.40± 0.12[e]	0.83±0.21[a]	163.00±2.16[a]	153.00±2.58[a]
Control (+) Casein 11.8%	150.00±1.80[a]	6.00±0.08[a]	2.20± 0.08[a]	0.38±0.02[e]	120.00±2.08[f]	132.50±3.65[e]
(Diet A) Casein 6%	145.50±1.83[c]	4.73±0.10[c]	1.95± 0.07[b]	0.50±0.08[c]	135.00±2.58[e]	143.00±2.65[c]
(Diet B) Whole egg / 6%protein	147.00±2.80[b]	5.00±0.18[b]	2.00± 0.08[b]	0.48±0.07[d]	142.00±5.51[d]	136.00±3.65[d]
(Diet C) Full fat soy flour / 6% protein	144.00±2.94[c]	4.45±0.13[d]	1.85± 0.18[c]	0.62±0.13[b]	150.75±4.80[c]	140.00±3.70[c]
(Diet D) Low fat soy flour/ 6%protein	142.00±4.55[d]	4.40±0.24[d]	1.65± 0.11[d]	0.66±0.16[b]	158.50±3.86[b]	148.00±4.24[b]

Values denote arithmetic means ± standard deviation of the mean. Means with different letters (a ,b, c, d, e and f) in the same column differ significantly at $p \leq 0.05$ using one way ANOVA test, while those with similar letters are non-significantly different.

Table (4-c): Kidney function of renopathic rats as affected by sources & levels of protein

Groups	S. Creatinine mg/dl Mean±SD	U. Creatinine mg/dl Mean±SD	Cr. Clearance ml/min Mean±SD
Control (-ve) Casein 11.8%	0.80±0.10[d]	2744±32.62[c]	1.98±0.04[a]
Control (+ve) Casein 11.8%	2.00±0.08[a]	2390±65.88[d]	0.31±0.01[e]
(Diet A) Casein 6%	1.60±0.16[b]	2710±72.63[c]	0.59±0.02[d]
(Diet B) Whole egg / 6% protein	1.80±0.12[b]	2980±50.73[b]	0.55±0.02[d]
(Diet C) Full fat soy flour / %protein	1.10±0.12[c]	2991±31.75[b]	1.18±0.02[c]
(Diet D) Low fat soy flour / 6% protein	0.90±0.14[d]	3101.25±60.04[a]	1.58±0.03[b]

Values denote arithmetic means ± standard deviation of the mean. Means with different letters (a ,b, c, d and e) in the same column differ significantly at $p \le 0.05$ using one way ANOVA test, while those with similar letters are non-significantly different.

Fair *et al.,* (2004) demonstrated that dietary soy protein compared with casein delays disease progression in an early stage of chronic kidney disease. Slowing of disease progression by substituting dietary soy protein for casein also was evidenced by higher creatinine clearance rates.

Anderson *et al.,* (1998) reported that proteinuria, morphologic damage to the kidney, blood urea concentrations, and early death were all significantly greater in casein-fed than in soy-protein-fed animals.

In several low protein diets regardless of its source improved the renal function, meanwhile, best results obtained with the low vegetarian protein diet, especially that of the soy flour.

The overall improvement in kidney function of renopathic rats (fed on soy flour) may be due to what was reported by Hodgson *et al.,* (1996), Aoki *et al.,* (2002), and Gibbs *et al.,* (2004) that soy peptides, as well as isoflavones, also have antioxidant activities that may have renoprotective effects.

Inflicting with renopathy was raising the activities of liver enzymes (AST and ALT) (Table 5). When feeding reopathic rats with low protein diets, levels of liver enzymes were reduced. The maximum improvement of AST & ALT and the ratio between them was recorded for group D (low fat soy flour). These results is similar to that found by Nkosi *et al.,* (2005) indicating that pumpkin seeds protein isolate showed benefit effects on liver health in carbon intoxicated showing decreases of AST& ALT& ALP.

This study demonstrated that dietary intervention using soy protein compared with animal protein alters disease progression. Best results of histopathological examination of kidney were recorded for groups C and D (full and low fat soy flour). Moreover, best results of histopathological examination of liver were also recorded for group D (low fat soy flour) (Photos 1, 2, 3). Histopathological examinations cleared that low protein diet especially from vegetarian source (low fat soy) corrected the damage occurred in kidney and liver tissues by feeding rats on high protein diet especially of the animal source (casein and egg), provided that low protein diet from eggs was of better results than control (+) group. Similar results were reported by Aukema *et al.,* (1999) who found that in all animals fed diets containing soy protein isolate as the protein source, kidney weights were 28% lower than in all animals consuming diets containing casein as the protein source. In addition to having less enlarged kidneys, the area of the kidney occupied by cysts was 19% lower in animals fed soy protein compared with casein. Overall, cyst score was 37% lower in animals fed diets containing soy protein compared with casein. However, there was a significant interaction between protein level and protein source. Also Fair *et al.,* (2004) showed that soy-fed rats had less renal fibrosis after as little as 1 week of feeding, whereas the effect on cyst growth was not observed until after 3 weeks of feeding soy protein. Slowing of disease progression by substituting dietary soy protein for casein also was evidenced by lower kidney weight relative to body weights and by higher creatinine clearance rates. It is then obvious that low fat diet corrected the histopathological changes due to renopathy.

Table (5): Effect of different sources and levels of proteins on AST & ALT enzymes of renopathic rats

Groups	AST (U/L) Mean±SD	ALT(U/L) Mean±SD	AST/ALT Ratio (U/L) Mean±SD
Control (-ve) Casein 11.8%	30.00±1.83[f]	18.75±1.71[f]	1.60±0.17[b]
Control (+ve) Casein 11.8%	85.00±2.94[a]	50.00±1.83[a]	1.70±0.16[a]
(Diet A) Casein 6%	40.00±2.58[c]	23.00±0.71[d]	1.70±0.36[a]
(Diet B) Whole egg / 6% protein	42.00±1.83[b]	35.00±1.29[b]	1.20±0.14[c]
(Diet C) Full fat soy flour / 6% protein	35.00±1.83[d]	32.00±1.41[c]	1.10±0.20[d]
(Diet D) Low fat soy flour / 6% protein	18.00±2.45[e]	20.00±2.65[e]	0.90±0.09[e]

Values denote arithmetic means ± standard deviation of the mean. Means with different letters (a ,b, c, d, e and f) in the same column differ significantly at p ≤ 0.05 using one way ANOVA test, while those with similar letters are non-significantly different.

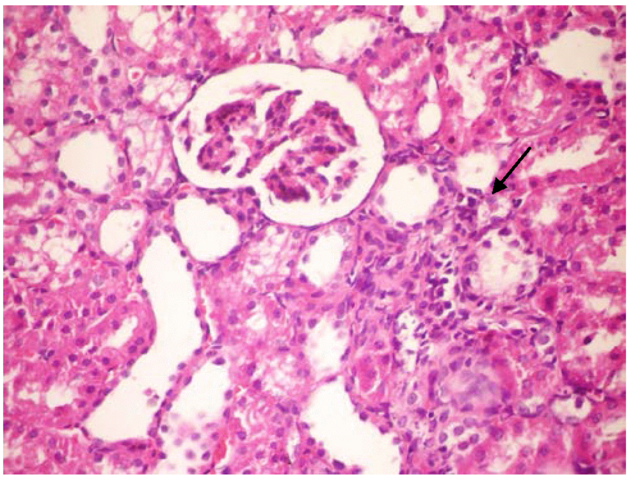

Photo (1): Kidney of rat from control (+) group showing focal tubular necrosis associated with leucocytic cells infiltration (H and E X400)

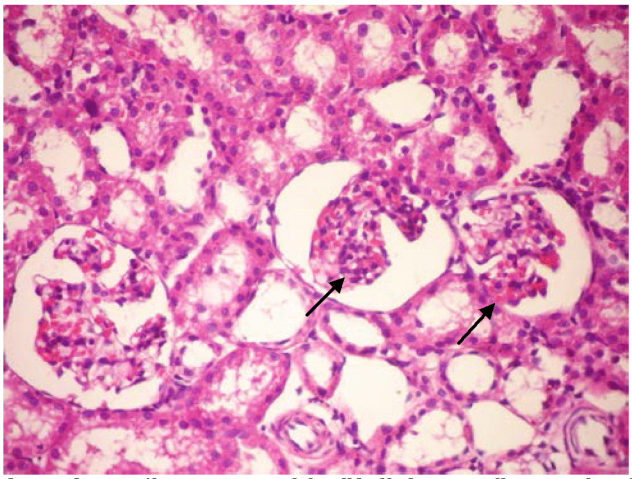

Photo (2): Kidney of rat from (low vegetable "full fat soy" protein diet) group showing vacuolations and congestion of glomerular tufts (H and E X 400)

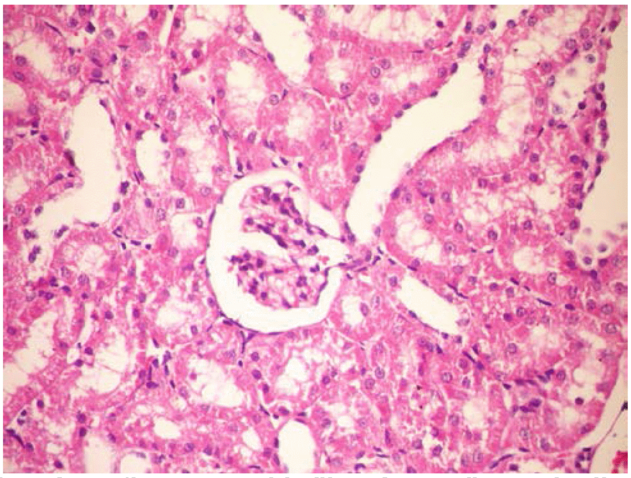

Photo (3): Kidney of rat from (low vegetable "low fat soy" protein diet) group showing no histopathogical changes (H and E X400)

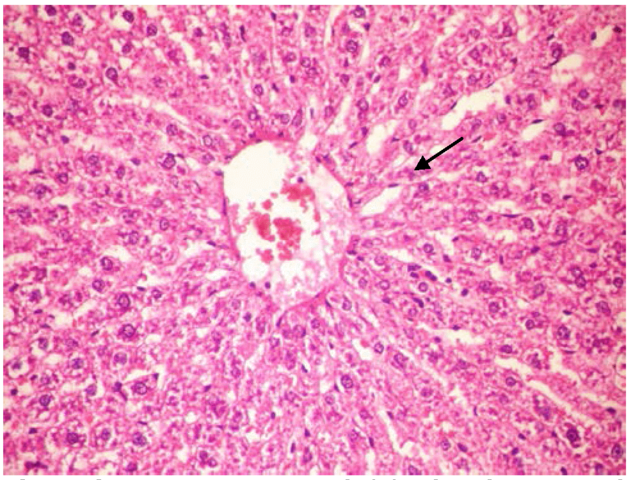

Photo (4): Liver of rat from group control (+) showing granular degeneration of hepatocytes (H and E X400)

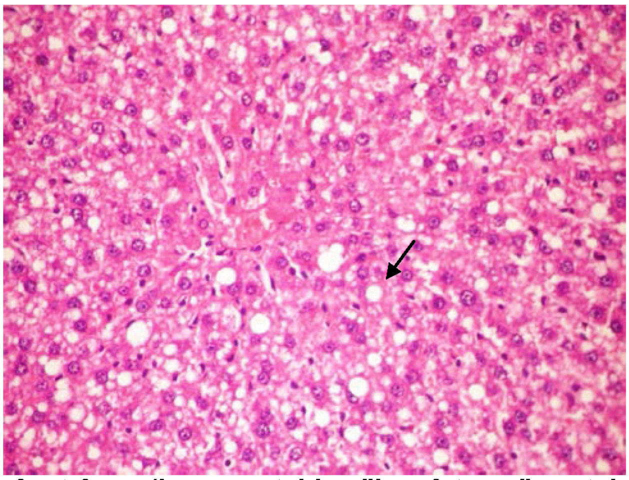

Photo (5): Liver of rat from (low vegetables "low fat soy" protein diet) group showing fatty degeneration of hepatocytes (H and E X400)

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التأثير الملطف لمنتجات مختلفة من بروتين الصويا مقارنة بالبروتين الحيوانى فى الفئران المصابة فى الكلى

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المخلص العربى

الأنظمة الغذائية المنخفضة البروتين وكذلك الأنظمة النباتية المعتمدة على بروتين الصويا هي نقطة محورية في التغذية العلاجية لصحة الكلى. هذا البحث يهدف الى دراسة تأثير نوعين مختلفين من دقيق الصويا كمصدر للبروتين فى مقابل البروتين الحيوانى فى الأنظمة الغذائية القليلة المحتوى من البروتين على الحالة الصحية للفئران المصابة بمرض الكلى. أجريت التجربة على 36 فأر أبيض بالغ يصل وزنها الى 160± 5 جرام وقسمت الى المجموعات التالية: مجموعتين ضابطتين أحدهما سالبة (غير مصابة) و الأخرى موجبة (مصابة بالكلى), المجموعة الثالثة تغذت على الكازين (6% بروتين), المجموعة الرابعة تغذت على البيض كمصدر للبروتين (6% بروتين), المجموعة الخامسة تغذت على دقيق فول الصويا كامل الدسم كمصدر للبروتين (6% بروتين), المجموعة السادسة تغذت على دقيق فول الصويا قليل الدسم كمصدر للبروتين (6% بروتين). مدة التجربة 28 يوم. تم عمل التحاليل البيوكيميائية والبيولوجية والفحوص التشريحية للأنسجة. أوضحت النتائج ما يلى: ابطاء تقدم المرض من خلال استبدال البروتين الحيوانى ببروتين الصويا فى الوجبات ويتضح ذلك من انخفاض وزن الكلى, الكبد, القلب. اللأنظمة الغذائية النباتية المعتمدة على دقيق فول الصويا تعمل على استعادة وظائف الكلى والكبد للفئران المصابة بالكلى, تحسن صورة دهون الدم وجلوكوز الدم من خلال الأنظمة الغذائية المعتمدة على البروتين النباتى بدرجة أكبر من الأنظمة المعتمدة على البروتين الحيوانى, ولذلك يجب توعية مرضى الكلى بالتأثيرات الصحية المفيدة لاستخدام بروتين الصويا بدلا من البروتين الحيوانى فى تغذيتهم.