Websites:
http://www.jofamericanscience.org
http://www.sciencepub.net

Emails:
editor@sciencepub.net
sciencepub@gmail.com

Journal of American Science

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Study of the Blood Urea Nitrogen Index of Animal and Plant Protein in Acute Renal Failure in Rats

Ahmed Aly Ameen, Alaa Osama Aboraya, Mennatullah Shady Mahmoud

Department of Nutrition and Food Science, Faculty of Home Economics, University of Helwan, Cairo, Egypt
Email: menna.shady97@gmail.com

Abstract: The quality and quantity of protein are essential factors that determine nutritional significance of a protein. The aim of this study was to compare the effects of several animal and plant proteins on the progression of acute renal failure in rats. Forty adult male albino rats (Sprague-Dawley strain), weighing about (150-180g) were divided randomly into eight main groups as follow: the first group (-ve control= 5 rats) was fed on basal diet. The second group (35 rats) were fed on basal diet and intramuscular injected intraperitoneal 50% glycerol (10 ml/kg B.Wt.) in their hind limbs to induce acute renal failure, then divided into 7 subgroups from group 2 to group 8. Group 2 (+ve control) fed on basal diet supplementing with 150 gm/kg of Casein. Group 3-8 fed on basal diet supplemented with 150 gm/kg of dry Beans powder, dry Soybean powder, dry Cowpeas powder, dry Lamb Meat powder, dry Chicken powder and dry Beef Liver powder. At the end of the experimental period (4 weeks), rats were scarified and serum was collected for biochemical analyses. Body weight gain increased as food intake decreased in all groups other than the positive control group, and the food efficiency ratio paralleled food intake. Rats fed the Lamb Meat protein diet had lower blood urea nitrogen (29.07 mg/dL), uric acid (1.92mg/dL) levels compared with the other groups. There were no significant differences in creatinine levels between rats fed the plant protein (soybean, cowpeas and bean) or the animal protein (Lamb meat and chicken) diets. Also, there were no significant differences in blood urea nitrogen levels between rats fed the animal protein (chicken and beef liver) or the plant protein (soybean, cowpea and bean)
[Ahmed Aly Amee, Alaa Osama Aboray, Mennatullah Shady Mahmou **Study of the Blood Urea Nitrogen Index of Animal and Plant Protein in Acute Renal Failure in Rats.** *Am Sci 2022;18(9):9-17]. ISSN 1545-1003 (print); ISSN 2375-7264 (online).http://www.jofamericanscience.org* 02.doi:10.7537/marsjas180922.02.

Keyword: Animal Protein, Plant Protein, Rats, Acute Renal Failure

1 Introduction

The kidney (renal) has an important role in removing wastes and toxins from the blood circulation (like creatinine and urea), regulating the balance of electrolytes, controlling the fluid balance, blood pressure, and hormone secretions **(Javaid et al., 2012 and Wu et al., 2017)**. Kidney (renal) diseases are considered a worldwide public health issue. They contribute to approximately 850,000 deaths each year **(Al-Shahed et al., 2020)**.

Renal failure, known as end-stage renal disease, is a medical condition in which the kidneys are functioning at less than 15% of normal **(National Institute of Diabetes and Digestive and Kidney Diseases, 2017)**. Renalfailure isclassified as either acute renal failure, which develops rapidly and may resolve; or chronic renal failure, which develops slowly

Acute Renal Failure (ARF) is a common problem in both the inpatient and outpatient setting Traditional methods of identifying ARF, through measurement of blood urea nitrogen and serum creatinine, are problematic in that they are slow to detect decreases in glomerular filtration rate (GFR) and are influenced by a variety of factors that are not related to GFR changes **(Sirota et al., 2011)**. Complications of acute renal failure include uremia, high blood potassium, and volume overload **(Blakeley and Sara, 2010)**.

Nutritional interventions can be viewed as consisting of two phases in renal dysfunction - diet plans that address the underlying causes of kidney disease and slow the progression of kidney failure and those that support and prevent complications arising from advanced kidney disease **(Steiber, 2014)**.The link between dietary protein intake and the risk of kidney dysfunction is always a challenging issue. This study aimed to investigate the relationship between plant protein, and animal protein intake with the risk of acute renal failure.

2 Materials and Methods

2.1. Materials

2.1.1. Plant and animal protein materials:

Lamb meat, chicken, beef liver, soy beans (Yellow Soybean), beans (Fava beans) and cowpeas (black eyed pea) were obtained from the Egyptian local market.

2.1.2. Chemicals:

Glycerol 50%, casein, cellulose, choline chloride, vitamin and mineral constituents were purchased from

El-Gomhoriya Pharmaceutical Company, Cairo, Egypt.Starch, corn oil, and sucrose were obtained from the Egyptian local market.

2.1.3. Rats:

Forty adult male albino rats (Sprague Dawley strain), weighing about (150-180 g) body weight were obtained from the Laboratory Animal Colony, Helwan, Egypt.

2.2. Methods

2.2.1. Preparation of animal and plant protein:

Lamb meat, chicken, beef liver, soy beans, beans and cowpeas were boiled first then driedin Research Center Solar power Unit in El-Doki and laid after being crushed and sifted.

2.2.2. Induction of Acute renal failure:

Rats were be given intramuscular injections of 50% glycerol (10 ml/kg B.Wt.) in their hind limbs **(Midhun et al., 2012)**.

2.2.3. Chemical Composition:

Crude protein, moisture, fat, fiber, and ash contents of each protein source were determined according to methods outlined by the Association of Official Analytical Chemists **A.O.A.C., (2012)**. Carbohydrate content was determined usingstandard analytical procedures for the sake of accuracy.

2.2.4. Preparation of basal diet:

The basal diet (AIN-93M) would been prepared according to **(Reeves et al., 1993)**. It consists of 14% casein (<85%), 5% corn oil, 0.2 % choline chloride, 1% vitamin mixture, 3,5 % salt mixture, 5% cellulose, are corn starch and 10% sucrose.

2.2.5. Experimental Design:

The study was done on 40 rats weighing approximately 150-180 g, Animals were divided into 8 groups (n=5) in each group.Rats were housed in well conditions in Biological Studies Lab of Faculty of Home Economics, Helwan University. They were kept in standard cages at room temperature (25 ± 3°C) with a 12 h dark/light cycle. They were left for seven days as adaptation period and they were allowed to feed standard laboratory food and water. After the period of adaptation, animals were divided into eight main groups of five animals each, as follows: -

First group: Negative control group, rats (n=5) were fed on basal diet only during the experimental period (4 weeks).

The ARF rats were fed on animal or plant diets added instead of casein. After the adaptation period for one week

- Second group (ARF): positive control group, rats (n=5) were fed on basal diet supplementing with 150 gm/kg of Casein.
- Third group (ARF): Rats were fed on basal diet supplemented with 150 gm/kg of dry Beans powder.
- Fourth Group (ARF): Rats were fed on basal diet supplemented with 150 gm/kg of dry soybeans powder.
- Fifth Group (ARF): Rats were fed on basal diet supplemented with 150 gm/kg of dry cowpeas powder.
- Sixth Group (ARF): Rats were fed on basal diet supplemented with 150 gm/kg of dry lamp meat powder.
- Seventh Group (ARF): Rats were fed on basal diet supplemented with 150 gm/kg of dry chicken powder.
- Eighth Group (ARF): Rats were fed on basal diet supplemented with 150 gm/kg of dry beef liver powder.

At the end of experiment (30 days), rats were anesthetized; blood samples were collected from hepatic portal vein in clean centrifuge tubes and serum were separated.

2.3. Biological Evaluation:

During the experimental period, the weights of all rats were determined weekly and recorded. At the end of the experimental period, body weight gained in percentage (BWG %) and Food Efficiency Ratio (FER) was determined as a biological evaluation according to the following formulas **Chapman et al., (1959).**

2.4. Blood Collection and Serum Separation:

At the end of the experimental period (4 weeks), rats were fasted overnight before scarifying and blood samples were collected from each rat and were centrifuged at 3000 rpm for 15 min to obtain the serum for biochemical analysis.

2.5. Biochemical analysis:

Serum creatinine, serum uric acid, and blood urea nitrogen (BUN) levels, were determined using the biochemical methods described by **Young, (2001).**

Additionally, serum Potassium, sodium and phosphors Concentrationwere determined using the methods described by three scientists respectively **(Henry (1964);Henry (1974) and El-Merzabaniet al., (1977)).**

2.6. Statistical analysis: -

All data obtained results were analyzed using Statistical Package for the Social Sciences (SPSS) for Windows, version 20 (SPSS Inc., Chicago, IL, USA). Collected data were presented as mean± standard error (SE). Analysis of Variance (ANOVA) test was used for determining the significances among different groups according to **(Armitage and Berry, 1987)**. All differences were considered significant if P-values were ($P < 0.05$).

3. Results and Discussion:

3.1. Biological Evaluation:

3.1.1. Effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef

Liver and Chicken) on Feed Intake (FI), Body Weight Gain (BWG) and Feed Efficiency Ratio (FER) of Acute Renal Failure Rats:

Data presented in table (1) show the effect of lamb meat, chicken, beef liver, soybean, bean and cowpeas on bodyweight gain (BWG), food intake (FI), and feed efficiencyratio (FER) inacute renal failure rats.

Table (1): Effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) on Feed Intake (FI), Body Weight Gain (BWG) and Feed Efficiency Ratio (FER) of Acute Renal Failure Rats

Parameters / Groups	IBW (g)	FBW (g)	BWG%	FI(g/day/rat)	FER
G1: -ve control	204.20±0.85[a]	342.60±1.75[a]	68.59±1.56[a]	31.50	0.101±0.017a b
G2: +ve control	203.25±0.86[a]	329.70±1.52[b]	61.48±1.28[b]	27.60	0.098±0.018[b]
G3(ARF):Soybeans	206.17±0.73[a]	321.42±1.82[c]	55.92±1.44[c]	24.00	0.106±0.023[a]
G4(ARF): Beans	203.75±1.49[a]	316.75±1.20[c]	55.49±1.13[c]	23.50	0.106±0.015[a]
G5(ARF): Cowpeas	204.15±0.50[a]	316.10±1.20[c]	54.84±0.73[c]	23.50	0.105±0.012[a]
G6(ARF): Meat	205.57±0.98[a]	308.25±2.76[d]	49.97±1.73[d]	22.70	0.100±0.031[ab]
G7(ARF): Chicken	204.70±0.59[a]	303.87±3.60[d]	48.44±1.63[d]	22.00	0.100±0.034[ab]
G8(ARF):Beef liver	205.90±0.76[a]	307.27±1.70[d]	49.23±0.43[d]	22.50	0.100±0.010[ab]

*Mean values are expressed as means ± SE.
*Mean values at the same column with the same superscript letters are not statistically significant at P<0.05.
*ARF=Acute Renal Failure, *IBW=Initial Body Weight, *FBW=Final Body Weight, *BWG=Body Weight Gain.
*FI=Feed Intake, *g=gram, *%=preceding

Results showed that the FI was decreased in the positive control group, with mean value of 27.60g/d compared to the negative control group, with a mean value of 31.50 g/d. Data revealed that, rats fed on diet containing plant protein (Beans, Soybeans and Cowpeas) and animal protein (Lamb Meat, Beef Liver and Chicken) decreased in FI, with a mean values soybeans 24.00g/d ,beans 23.50g/d, cowpeas 23.50g/d, lamb meat 22.70g/d, chicken 22.00g/d and beef liver 22.50g/d respectively compared to positive control group.

Regarding BWG, it was significantly lowered (P< 0.05) in the positive control group compared to the negative control group (61.48±1.28and 68.59±1.5, respectively). On the other hand, group 3(soybeans), group 4(beans) group 5(cowpeas) showed non-significant increase compared to positive control group (55.92±92, 55.49±1.13 and 54.84±0.73, respectively). In addition to, group 6(lamb meat), group 7(chicken) and group 8(beef liver) showed non-significant increase compared to positive control group (49.97±1.73 ,48.44±1.63 and 49.23±0.43 respectively).

Results also revealed that, FER for positive control group was significantly decreased (P< 0.05) compared to negative control group (0.098±0.018 and 0.101±0.017, respectively). It was also showed that all treated groups with group 3(soybeans), group 4(beans) group 5(cowpeas), group 6(lamb meat), group 7(chicken) and group 8(beef liver) significantly increased (P< 0.05) for FER compared with positive control group(0.106±0.023, 0.106±0.015 ,0.105±0.012, 0.100±0.031 ,0.100±0.034 ,0.100±0.010 and 0.098±0.01 respectively) also observed that there were no significant differences in FER for all treated groups with group 3(soybeans), group 4(beans) group 5(cowpeas), group 6(lamb meat) ,group 7(chicken) and group 8(beef liver) compared to negative control group(0.106±0.023, 0.106±0.015 ,0.105±0.012, 0.100±0.031 ,0.100±0.034 ,0.100±0.010 and 0.101±0.017 respectively) .

Results in Table 1 revealed that, groups fed on plant protein (Beans, Soybeans and Cowpeas) and animal protein (Lamb Meat, Beef Liver and Chicken) decreased in FI compared to positive control group

(24.00 ,23.50 ,23.50 22.70, 22.00,22.50 and 27.60 respectively). This decrease may be attributed to the taste of Animal Protein and Plant protein that used, it is known that Animal Protein and Plant protein that used powder have bitter smell and taste so it affects the rat's appetite.

Results in Table 1 showed that glycerol administration significantly decreased body weight of rats in positive control group, group three(soybeans), group four(beans), group five(cowpeas), group six (lamb meat), group seven(chicken) and group eight (beef liver) compared to negative control group, these result agreement with **Wirtshafter and Davis (1977)**. They reported that subcutaneous glycerol administration in male rats produced reductions in both body weight and food intake that actually agree with result of FI in Table 1 showed that administration significantly decreased feed intake of rats in all groups compared to negative control group, also **Lin et al., (1976),** agreement with these results.

3.1.2. Effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) on Serum Urea, Creatinine and Uric Acid of Acute Renal Failure Rats

Data presented in table (2) show the effect of lamb meat, chicken, beef liver, soybean, bean and cowpeas on Serum Urea, Creatinine and Uric Acid of Acute Renal Failure Rats

Table (2): Effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) on Serum Urea, Uric Acid and creatine of Acute Renal Failure Rats

Parameters / Groups	**Uric acid**	**Creatinine**	**Urea**
(mg/dL)			
G1: -ve control	$1.50{\pm}0.08^{f}$	$0.46{\pm}0.06^{c}$	$25.62{\pm}1.34^{d}$
G2: +ve control	$5.97{\pm}0.26^{a}$	$1.60{\pm}0.22^{a}$	$62.50{\pm}2.95^{a}$
G3(ARF): Soybeans	$3.27{\pm}0.13^{b}$	$0.83{\pm}0.05^{b}$	$52.00{\pm}2.27^{b}$
G4(ARF): Beans	$2.50{\pm}0.10^{cd}$	$0.92{\pm}0.02^{b}$	$52.90{\pm}1.94^{b}$
G5(ARF): Cowpeas	$2.62{\pm}0.16^{c}$	$0.84{\pm}0.05^{b}$	$49.75{\pm}2.95^{b}$
G6(ARF): lamb meat	$1.92{\pm}0.11^{e}$	$0.49{\pm}0.04^{c}$	$29.07{\pm}0.56^{d}$
G7(ARF): Chicken	$2.02{\pm}0.11^{e}$	$0.55{\pm}0.06^{c}$	$35.72{\pm}0.66^{c}$
G8(ARF): Beef liver	$2.12{\pm}0.10^{de}$	$0.90{\pm}0.05^{b}$	$38.50{\pm}0.33^{c}$

Data revealed that serum urea, uric acid and creatinine levels of the positive control group were significantly increased ($P<0.05$) compared to the negative control group.

Regarding serum uric acid level, results demonstrated a significant ($P< 0.05$) decrease in serum uric acid level of six groups plant protein (Beans, Soybeans and Cowpeas) and animal protein (Lamb Meat, Beef Liver and Chicken) compared to the positive control group. Rats were fed on beans and soybeans had non -significant for serum uric acid level. There are non-significant differences between three groups lamb meat, chicken and beef liver on serum uric acid level. In addition to, there was the nearest result to negative control group.

Serum creatinine level, results showed a significant ($P< 0.05$) decrease in serum creatinine level for groups treated with plant protein (Beans, Soybeans and Cowpeas) and animal protein (Lamb Meat, Beef Liver and Chicken) compared with the positive control group. It was also observed that the nearest result to negative control group was the two groups that treated with lamb meat and chicken, significantly. There are non-significant differences between four groups beans, soybeans, cowpeas and beef liver. Rats were fed on lamb meat had the best result for reducing serum urea level and it considered the nearest result to negativecontrol group.

It was clear that, there was significant ($P< 0.05$) decrease in serum urea for all groups of plant protein (Beans, Soybeans and Cowpeas) and animal protein (lamb meat, beef liver and chicken) with compared to the positive control group. There are non-significant differences between three groups beans, soybeans, cowpeas, In addition to, two groups chicken and beef liver. Rats were fed on lamb meat had the best result for reducing serum urea level and it considered the nearest result to negative control group.

Creatinine that is produced in muscles is removed from the body as excretory nontoxic waste product by the kidneys. The production and excretion of creatinine by the kidneys help to equilibrate its concentration in the blood **(Nisha et al., 2017)**.

Urea is an organic compound excreted as waste product of dietary protein and needed in the metabolism of nitrogen containing molecules. Blood urea concentration increases in kidney failure. Though urea and creatinine are metabolic waste products but are not directly toxic as they are only used to measure kidney function **(Rock et al., 1987)**.

Uric Acid is the end product of purine metabolism, largely derived from endogenous synthesis, but a minor part also arises from exogenous sources such as foods with purine content, alcohol, and fructose drinks. UA is synthesized mainly in the liver and intestines but is also synthesized in other tissues, such as muscles, kidneys, and the vascular endothelium **(MacFarlane and Kim, 2014 and El Ridi and Tallima, 2017)**.

Results of kidney function Table (2) were in the same line with **Al Asmari et al, (2017)**, who showed a significant increase in, Serum Urea, Serum Creatinine and Serum Uric Acid in nephrotoxic rats (positive control groups) compared with their respective levels in the negative control confirming renal failure. also, **Konda et al., (2016) and Uchendu et al., (2017)** confirmed these results, they reported the renal biochemical parameters, which include serum creatinine, blood urea nitrogen (BUN), were elevated in the group administered with glycerol alone (affected group) 24 hrs. after glycerol administration, in this study. From the result, it was observed that BUN and serum creatinine levels were elevated when compared to normal group.

The results of SCR of soybean group in the same line with that found by **Zhang, et al., (2014)** they reported that a significant efficacy of soy protein consumption in improving Serum Creatinine. Compared with animal protein, the consumption of soy protein significantly reduced Serum creatinine in renal failure patients. And In the 1990s, instead of reducing protein intake, some interest was directed toward manipulating the quality of dietary protein, specifically by replacing animal protein with soy protein **(Velasquez and Bhathena., 2001)** indicated a significant efficacy of soy protein consumption in improving Serum creatinine. Also,**Siefker and DiSilvestro (2006)** confirming this result.

Anderson et al., (1994) proposed the soy protein hypothesis, which stated that substituting animal protein for soy protein resulted in reduced hyperfiltration and glomerular hypertension, with resultant protection from diabetic nephropathy. Soy protein was shown to improve kidney function in animal models of polycystic kidney disease and in the rat remnant kidney model **(Tomobe et al., 1998 and Fair et al., 2004).**

A review on epidemiologic and intervention studies indicated that soy did not increase Serum uric acid levels in response to quantities comparable to customary Asian consumption **Messina et al., (2011**), that agreeing with the result of serum uric acid of soybean in group there compared with positive control group Table (2).

The results of serum urea for group three of soybeans (Table 2) agreed with the results of **Uchendu et al., (2017)**, They showed that the group that received glycerol and subsequently administration of soy protein had a significant reduction in the BUN and serum creatinine. This result shows a protective or an ameliorating effect by soy protein, which correlates with the statement by **Anderson., (2008)**, who states that soy, has protective effects in animal models of kidney disease. This renal-protection, could be as a result of reported properties of the phytochemicals in soy, such as; the effect on gene expression of enzymes that enhance antioxidant defenses by isoflavones; scavenging of hydroxyl and free oxygen radicals by soyasaponins, sapogenins, phenols and lignin's; and the anti-inflammatory activity of the triterpenes and phytosterols **(Corry et al., 2008; Heckman et al., 2010 and Rabadi et al., 2012)**.

The result of groups treated with beans Table (2) agreement with **Naber and Purohit, (2021)**, That they reported beans is a source of fiber, both water-soluble or insoluble that reduced serum urea and creatine in renal failure. Also, the result of serum uric acid of treated group with bean in the same line with that found by **Rumagitet al., (2012)**. They reported that beans didn't increase the uric acid. Serum uric acid levels are determined by both the quality and quantity of protein intake **(Fellstrom et al., 1983)**.

Results in Table (4) also, showed that treated groups with cowpeas decreased significantly in serum urea and creatinine levels compared to nephrotoxic group (+ve), these results agreed with **Eiyaand Obika, (2016)** who found that intake of a high plant protein (cowpeas) does not affect the general functions of the kidney (urea and creatinine). Also,

The results of serum urea, uric acid and creatinine in treated groups with lamb meat and chicken (Table 4) agreed with the results of **Al-Amoudi, (2013)**, they demonstrated that serum urea, uric acid and creatinine levels in treated groups with meat and chicken showed a significant decrease compared with the positive control group.

3.1.3. Effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) on Serum Minerals of Acute Renal Failure Rats:

Table (3) showed the effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) on Serum Minerals of Acute Renal Failure Rats.

Table (3): Effect of Plant Protein (Beans, Soybeans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) on Serum Minerals of Acute Renal Failure Rats

Parameters / Groups	P	Na	K^+
	(Mmol/L)		
G1: -ve control	4.77±0.20^d	112.55±2.06^e	3.12±0.11^d
G2: +ve control	8.67±0.16^a	164.50±2.39^a	5.70±0.17^a
G3(ARF): Soybeans	7.17±0.20^b	143.27±2.31^c	4.65±0.06^b
G4(ARF): Beans	7.00±0.30^b	148.50±0.86b^c	4.35±0.06^b
G5(ARF): Cowpeas	6.85±0.39^b	146.40±2.19b^c	4.65±0.15^b
G6(ARF): lamb meat	5.75±0.15^c	128.22±3.08^d	3.82±0.22^c
G7(ARF): Chicken	5.50±0.17^c	131.50±2.83^d	3.84±0.08^c
G8(ARF): Beef liver	6.62±0.19^b	150.97±1.62^b	4.50±0.12^b

*Mean values are expressed as means ± SE.
*Mean values at the same column with the same superscript letters are not statistically significant at P<0.05.
*ARF=Acute Renal Failure.
*G=group, *P= Phosphorus, *Na=Sodium. *K=Potassium.

Data revealed that serum Na, P and K were significantly (P< 0.05) increased in the positive control group compared with the negative control group.

Results showed that all groups that were treated with Plant Protein (B (Soybeans, beans and Cowpeas) significantly decreased (P<0.05) in serum phosphorus compared to the positive control group which were 7.17±0.20, 7.00±0.30 ,6.85±0.39 and 8.67±0.16, respectively. There are non-significant differences between groups beans, soybeans and cowpeas on serum phosphorus level.

Concerning serum phosphorus concentration, results showed a significant reduce (P<0.05) for all treated groups with animal protein (lamb meat, chicken and beef liver) in serum phosphorus compared to the positive control group which were 5.75±0.15, 5.50±0.17, 6.62±0.19 and 8.67±0.16, respectively.

Rats were fed on lamb meat and chicken had the best result for reducing serum phosphorus level and it considered the nearest result to the negative control group which were 5.75±0.15, 5.50±0.17and 4.77±0.20, respectively. There are non-significant differences between groups lamb meat and chicken on serum phosphorus level which were 5.75±0.15, 5.50±0.17, respectively.

Results showed that serum sodium was significantly increased (P< 0.05) in the positive control group compared with the negative control group which were 112.55±2.06 and 164.50±2.39, respectively.

Furthermore, results showed a significant (P< 0.05) reduce in serum sodium level for all groups treated with Plant Protein (Soybeans, Beans and Cowpeas) and Animal Protein (Lamb Meat, Beef Liver and Chicken) compared with the positive control group which were 143.27±2.31, 148.50±0.86, 146.40±2.19, 128.22±3.08, 131.50±2.83, 150.97±1.62 and 164.50±2.39, respectively.

There are non-significant differences between groups soybeans, beans and cowpeas 143.27±2.31, 148.50±0.86 and 146.40±2.19, respectively. Also, there are non-significant differences between groups lamb meat and chicken on serum sodium level which were 128.22±3.08 and 131.50±2.83, respectively. It was also observed that the nearest result to the negative control group was the two groups that treated with lamb meat and chicken, significantly which were 112.55±2.06, 128.22±3.08 and131.50±2.83, respectively.

Serum potassium level, results showed that all groups treated with Plant Protein (soybeans, beans and Cowpeas) and Animal Protein (Lamb Meat, Chicken and Beef Liver) significantly decreased (P< 0.05) compared to the positive control group which were 4.65±0.06, 4.35±0.06, 4.65±0.15, 3.82±0.22, 3.84±0.08, 4.50±0.12 and5.70±0.17, respectively.

There are non-significant differences between four groups soybeans, beans, cowpeas and beef liver on serum potassium level which were 4.65±0.06, 4.35±0.06, 4.65±0.15 and4.50±0.12, respectively.

Rats were fed on lamb meat and chicken had the best result for reducing serum potassium level.

Potassium measurements are used to monitor electrolyte balance in the diagnosis and treatment of hypokalemia, hyperkalemia, and diseases involving electrolyte imbalance. Hypokalemia with normal total body potassium, by definition, is due to a shift of potassium into the cell. Hyperkalemia with increase in total body potassium is almost always caused by a decrease in renal excretion of potassium. Hypokalemia associated with low total body potassium is either due to poor dietary intake or increased potassium loss from the body **(Appel et al.,2006; Adroguéet al.,1981 and Saltzman et al.,2001)**

The kidney helps control the amount of phosphate in the blood extra phosphate is filtered by the kidneys and passes out of the body in the urine. Phosphate measurements are used to monitor electrolyte balance in the diagnosis and treatment of hypophosphatemia, hypophosphatemia, and diseases involving electrolyte imbalance. Hypophosphatemia is usually secondary to the inability of the kidney to excrete phosphate as it occurs in renal failure **(Azevedo et al., 2003 and Morris,1996).**

The result of serum $K^{+, Na}$ and P **Table (3)** agreed with **Uchenduet al.,(2017)**,they reported that the level of K+, Na and P were also shown to be increased significantly, in the affected group (glycerol alone) compared with normal group , this was as a result of the damage to the proximal convoluted tubule **(Joanna et al.,2012).**

The results of serum phosphorus concentrations **(Table 3)** agreed with the results of **Zhang, et al., (2014),** they investigated that soy protein significantly reduced levels of serum phosphorus in renal failure compared with the positive control group, also **Sorokaet al. (1998),** confirmed this results, they indicated a significant efficacy of soy protein consumption in improving serum phosphorus concentrations in pre-dialysis CKD patients compared with animal protein consumption. And they found a significant reduction in serum phosphorus concentrations, which may have important clinical implications, since hyperphosphatemia is an often-intractable problem in pre-dialysis CKD patients. The decrease is likely due to a combination of the reduced phosphate intake and reduced intestinal absorption. Phosphorus from animal proteins is well absorbed by humans, whereas that from plant sources is less well absorbed because much of the phosphorus is in the form of phytic acid, which is not well absorbed. If a significant reduction in phosphate intake and absorption can be achieved by the simple.

The results of Serum potassium and sodium of soybean group in the same line with that found by **Uchendu, et al., (2017)** they reported that a significant decreased, in the group that was given an administration of soy protein after glycerol injection, which might be as a result of the antioxidant and anti-inflammatory properties of the phytochemical constituents of soy as stated earlier **(Lehnhardtet al.,2012)**.

Serum potassium and phosphorus of beans group result for the present study in **Table (3)** agreement with **NKF, (2022)**, reported the phosphorus and potassium from beans are not absorbed as well as the phosphorus and potassium from animal sources or phosphate and potassium additives. Also, the result of serum sodium agreement with Guenther**et al., (2006) and Brick, (2006)** they reported that beans are very low in sodium.

The results of Na and K (**Table 3**) agreed with the results of **Balaiel, (2014)**, who investigated that Na and K were significantly ($P \leq 0.05$) decreased with increasing level of cowpea seeds in diets. also,**Oberleaset al., (1981)** confirmed these results, who reported that the absorption of Kand Na may be unavailable in feed containing high level of phytate.

The results of serum Na and k in treated groups with lamb meat and chicken (**Table 3**) agreed with the results of **Al-Amoudi , (2013)**, they demonstrated that serum Na and K levels in treated groups with meat and chicken showed a significant decrease compared with the positive control group .also, the result of serum P **Table 3** in the same line with **NKF,(2022)**, they showed lamb meat and chicken Lower phosphorus alternatives .

References

[1]. **A.O.A.C. (2012):** Association of Official Analytical Chemistry (A.O.A.C.) International, 19th ed., Gaithersburg, Maryland,USA.

[2]. **Adrogué, H.J. and Madias ,N.E. (1981):**Changes in plasma potassium concentration during acute acid-base disturbances. Am J Med .,71:456-67.

[3]. **Al Asmari, A., Al Sadoon, K., Obaid, A., Yesunayagam, D., and Tariq, M. (2017):** Protective effect of quinacrine against glycerol-induced acute kidney injury in rats. BMC nephrology, 18(1), 1-10.

[4]. **Al-Amoudi, N. S. (2013):** Effects of dietary protein sources on the progression of renal failure without dialysis in rats. Journal of Food and Nutrition Sciences., 1(3), 23-32.

[5]. **Al-Shahed, F., Mohammed, E., Abdel-Aal, F., and El-Bhairy, E.M. (2020):**The Impact of Black Seeds and Sidr Honey on paracetamol Induced Nephropathy in Adult Male Albino Rats,

a Histological, Immunohistochemical & Ultrastructural study.

[6]. **Anderson, J.W., Blake, J.E., Turner, J. and Smith, B.M. (1994):**Effects of soy protein on renal function and proteinuria in patients with type 2 diabetes. Am J Clin Nutr., 68,S1347–S1353.

[7]. **Anderson, J. (2008):**W.Beneficial Effects of Soy Protein Consumption for Renal Function, Asia Pacific Journal of Clinical Nutrition., 17(1), 324-328.

[8]. **Appel, L.J., Brands, M.W., Daniels, S.R., Karanja, N., Elmer, P.J., Sacks, F.M., et al.(2006):** Dietary approaches to prevent and treat hypertension: A scientific statement from the American heart association. Hypertension. 47:296-308. 25.

[9]. **Artimage, G.Y. and W.G. Berry, (1987):** Statistical Methods 7th Ed. Ames, Iowa Stata University Press, 39-63.

[10]. **Azevedo, L., Gomes, J.C., Stringheta, P.C., Gontijo, A.M., Padovani, C.R., Ribeiro, L.R., et al.(2003):** Black bean (Phaseolus vulgaris L.) as a protective agent against DNA damage in mice. Food Chem Toxicol .,41:1671-6

[11]. **Blaine ,J., Chonchol, M. and Levi, M. (2014):**Renal control of calcium, phosphate, and magnesium homeostasis.Clin J Am Soc Nephrol. CJN.09750913. doi: 10.2215/CJN.09750913 .http://cjasn.asnjournals.org/content/early /CJN.09750913.full .

[12]. **Blakeley and Sara. (2010):** Renal Failure and Replacement Therapies. Springer Science & Business Media. p. 19.

[13]. **Chapman D.G.,Gastilla ,R. and Campbell, J. A. (1959) :** Evaluation of protein in foods : 1-A Method for the determination of protein efficiency ratio . can J Phys ; 37 ;679-86.

[14]. **Corry, D.B., Eslami, P., Yamamoto, K., NY by ,M.D., Makino, H. and Tuck ,M.L.(2008):** Uric acid stimulates vascular smooth muscle cell proliferation and oxidative stress via the vascular renin– angiotensin system. J Hypertens. ,26:269-75.

[15]. **Eiya, B. and Obika, L. O. F. (2016):** Effect of high plant protein cowpeas (Vigna unguculata) and animal protein (casein) on renal function in rats. Annals of Biomedical Sciences, 15(2), 31-41.

[16]. **El Ridi, R. and Tallima,H.(2017):** Physiological functions and pathogenic potential of uric acid: A review. J. Adv. Res.,8:487–493. doi: 10.1016/j.jare.2017.03.003.

[17]. **El-Merzabani,M.,El-Aaser ,A. and Zakhary, N.(1977):**Anew method for determination of inorganic phosphorus in serum without deprotinization.J Clin Chem Clin Biochem;15:715-718.

[18]. **Fair ,D., Ogborn, M., Weiler, H., Bankovic-Calic ,N., Nitschmann, E., Fitzpatrick-Wong ,S.C. et al.(2004):** Dietary soy protein attenuates renal disease progression after 1 and 3 weeks in Han: SPRD-cy Weanling rats. J Nutr ., 134: 1504–1507.

[19]. **Fellstrom ,B., Danielson, B.G., Karlstrom, B., et al. (1983):**The influence of a high dietary intake of purine-rich animal protein on urinary urate excretion and supersaturation in renal stone disease. Clin Sci .,64: 399-405.

[20]. **Heckman ,M.A., Weil, J., Mejia ,D. and Gonzalez, E. (2010):**Caffeine (1, 3, 7-trimethylxanthine) in foods: a comprehensive review on consumption, functionality, safety, and regulatory matters. J Food Sci. 75:R77-87.

[21]. **Henry M.,(1964):**colorimertric method of total protein,J.of total protein .J.of Clinical Chemistry Haper,Row Publishers ,New York.P.181.

[22]. **Henry R.J(1974):**Clinical Chemistry Principles and Techniques Harper and Publishers,NewYork.Philadelphia.c.

[23]. **Javaid ,R., Aslam, M. and Nizami, Q., 2012 :**Role of antioxidant herbal drugs in renal disorders: An overview. Free Radicals and Antioxidants 2: 2-5. https://doi.org/10.5530/ax.2012.2.2

[24]. **Konda, V. R., Arunachalam, R., Eerike, M., Radhakrishnan, A. K., Raghuraman, L. P., Meti, V., and Devi, S. (2016):** Nephroprotective effect of ethanolic extract of Azimatetracantha root in glycerol induced acute renal failure in Wistar albino rats. Journal of traditional and complementary medicine., 6(4), 347-354.

[25]. **Lin, M., Romsos ,D.andLeveille ,G.(1976):** Effect of glycerol on lipogenic enzyme activities and on fatty acid synthesis in the the continuous recording of solid food ingestion. Physiol. Berat and chicken. J. Nurr. 106: 16611677.

[26]. **MacFarlane ,L.A. and Kim ,S.C.((2014):** a review of nonmodifiable and modifiable risk factors. Rheum. Dis. Clin. N. Am.,40:581–604. doi: 10.1016/j.rdc.2014.07.002.

[27]. **Messina ,M., Messina, VL. and Chan, P.(2011):** Soyfoods, hyperuricemia and gout(a review of the epidemiologic and clinical data. Asia Pac J Clin Nutr. 20:347.

[28]. **Midhun ,k. ,Brooke, s . and rick, s. (2012) :** Recovery from Glycerol – Induced Acute kidney Injury is accelerated by suramin journal of pharmacology and experimental therapeutics 341 (1): 126-36.

[29]. **Morris ,E.(1996):** Hill A. Inositol phosphate content of selected dry beans, peas, and lentils, raw and cooked. J Food Compos Anal .,9:2-12.

[30]. **Naber ,T. and Purohit ,S.(2021):** Chronic Kidney Disease: Role of Diet for a Reduction in the Severity of the Disease. Nutrients. ,13(9):3277. https://doi.org/10.3390/nu13093277.

[31]. **National Institute of Diabetes and Digestive and Kidney Diseases,2017**

[32]. **National Kidney Foundation,(2022)**

[33]. **Nisha, R., Srinivasa, K.S.R., Thanga, M.K. and Jagatha, P. (2017):** Biochemical evaluation of creatinine and urea in patients with renal failure undergoing hemodialysis. Journal of Clinical Pathology and Laboratory Medicine 1(2):1-5.

[34]. **Oberleas, D. and Harland ,B,F. (1981):**Phytate content of foods: Effect on dietary Zinc bioavailability. J. Amer. Dietet. Associ., 79: (4), 433-436.

[35]. **Rabadi, M.M., Kuo ,M.C., Ghaly ,T., Rabadi S,.M., Weber ,M., Goligorsky ,M.S., et al.(2012):** Interaction between uric acid and HMGB1 translocation and release from endothelial cells. Am J Physiol Renal Physiol. ,302:F730-F41.

[36]. **Rock, E. P., Marsh, K., Saul, A. J., Wellems, T. E., Taylor, D. W., Maloy, W. L., and Howard, R. J. (1987):** Comparative analysis of the Plasmodium falciparum histidine-rich proteins HRP-I, HRP-II and HRP-III in malaria parasites of diverse origin. Parasitology, 95(2), 209-227.

[37]. **Rumagit, B. I. ,Wullur, A. C. and Kalonio, D. E. (2012):** "The effect of red bean (Vigna angularis [Willd] Ohwi& Ohashi) porridge on total cholesterol and uric acid levels of white rat (R. norvegicus) [in Indonesian]," RisetPembinaan Tenaga Kesehatan (Risbinakes), Politeknik Kesehatan Kemenkes Manado.

[38]. **Sirota, J.,Klawitter,J. and Edelstein,C,. (2011):** Biomarkers of Acute Kidney Injury. Journal of Toxicology, 1–10. doi:10.1155/328120 .

[39]. **Soroka, N., Silverberg ,D.S., Greemland, M., Birk ,Y., Blum ,M. and Peer, G.(1998):** Comparison of a vegetable-based (soya) and an animal-based low-protein diet in predialysis chronic renal failure patients. Nephron ., 79, 173–180.

[40]. **Steiber ,A.L.(2014):** Chronic kidney disease: considerations for nutrition interventions. JPEN J Parenter Enteral Nutr., 38:418–426.

[41]. **Tomobe,K., Philbrick ,D., Ogborn ,M., Takahashi ,H. and Holub, B.(1998):** Effect of dietary soy protein and genistein on disease progression in mice with polycystic kidney disease. Am J Kidney Dis., 31: 55–61.

[42]. **Uchendu, I. K., Orji, O. C. and Agu, C. E. (2017):**Attenuation of glycerol-induced acute renal failure in albino rats by soy beans (Glycine max). International Journal of ChemTech Research, 10(12), 165-172.

[43]. **Uchendu, I. K., Orji, O. C. and Agu, C. E. (2017):**Attenuation of glycerol-induced acute renal failure in albino rats by soy beans (Glycine max). International Journal of ChemTech Research, 10(12), 165-172.

[44]. **Uchendu, I. K., Orji, O. C. and Agu, C. E. (2017):**Attenuation of glycerol-induced acute renal failure in albino rats by soy beans (Glycine max). International Journal of ChemTech Research, 10(12), 165-172.

[45]. **Velasquez ,M.T. and Bhathena ,S.J.(2001):** Dietary phytoestrogens: a possible role in renal disease protection. Am J Kidney Dis ., 37: 1056–1068.

[46]. **Wirtshafter, D. and Davis ,J. (1977):** Body weight: Reduction by long-term glycerol treatment. Science 198: 1271-1274.

[47]. **Wu, P., Liu, S., Su, J.,Chen, J., Li, L., Zhang, R. and Chen, T(2017):**Apoptosis triggered by isoquercitrin in bladder cancer cells by activating the AMPK-activated protein kinase pathway. Food Funct.

[48]. **Young.D.(2001):**Effect of disease on clinical lab Tests,4th ed.AACCpress.

[49]. **Zhang, J., Liu, J., Su, J., and Tian, F. (2014):** The effects of soy protein on chronic kidney disease: a meta-analysis of randomized controlled trials. European journal of clinical nutrition, 68(9), 987-993.

[50]. **Zhang, J., Liu, J., Su, J., and Tian, F. (2014):** The effects of soy protein on chronic kidney disease: a meta-analysis of randomized controlled trials. European journal of clinical nutrition, 68(9), 987-993.

9/21/2022