Effect of Treatment with Arabic Gum on Rats Suffering from Chronic Renal Failure
Experimental Biology

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Abstract

The present work was conducted to study the effect of diets containing different levels from protein with or without oral administration of gum Arabic on rats suffering from chronic renal failure. Two main experimental groups were established. Group 1 (n=7 rats) used as a negative control group fed on basal diet (B.D). The other group (n = 49 rats) fed two weeks on diet containing 2% arginine (W/W) to induce renal failure, then this group was divided into seven subgroups (7 rats each). The first subgroup fed on diet containing 2% arginine (arginine diet), as a control positive group. Subgroups (2, 3 and 4) fed on arginine diets containing 5%, 10% and 20% protein, respectively. Subgroups (5, 6 and 7) fed on arginine diets containing the above levels of protein and treated daily with (10% gum Arabic w/v) in the drinking water. Feeding rats on arginine diet decreased the mean value of food intake, body weight gain %, serum HDL-c and serum sodium, while organs weight/body weight %, serum (cholesterol, triglycerides, LDL-c, VLDL-c, uric acid, urea nitrogen, creatinine, potassium, AST and ALT) increased significantly, as compared to the negative control group fed on basal diet. Treating rats which suffer from chronic renal failure with medium and low levels from protein improved these parameters, especially with low level. On the other hand, treating rats which were suffering from chronic renal failure daily with (10% gum Arabic w/v) in the drinking water recorded more effects in improving these parameters, especially when used gum Arabic with low level from protein. The present study suggested that, using the gum Arabic with low protein diet must be implemented for chronic renal failure patients. In the same time nutritional and health educational programs should be organized and directed for public to protect themselves from this disease.

Key words: Arabic Gum; Albino Rats; Arginine; Chronic Renal Failure, Lipid Profile; Kidney Functions – Liver Enzymes.

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INTRODUCTION:

Acacia gum (gum Arabic) is the dried gummy exudate of the stem and branches of acacia trees (Senegal family, leguminosae). It consists mainly of a calcium salt of polyarabic acid, but also contains magnesium and potassium ions. It is a high-molecular weight polysaccharide, which on hydrolysis yields hexoses, arabinose, galactose, rhamnose, and glucaronic acid. Acacia gum is generally recognized as safe by the United States Food and Drug Administration. It is widely used in the production of foods, such as puddings, frostings, candy, chewing gum, and beverages. It has demulcent properties and is often added to medicines (Phillips, 1998).

Ali et al., (2010) reported that, oral administration of gum Arabic could conceivably alleviate adverse effects of chronic renal failure (CRF). Gum Arabic (GA) is a complex polysaccharide used as suspending agent. It has been widely used by eastern folk medicine practitioners as a restorative agent and is thought to be an excellent curative for renal failure patients.

Abdulhakeem et al., (2002) reported that, Arabic gum (AG) protected the rats from gentamicin (GM)-induced nephrotoxicity, possibly, at least in part through inhibition of the production of oxygen free radicals that cause lipid peroxidation. Gum Arabic is a non-digestible food ingredient that has found many applications in the food and pharmaceutical industries. The gums claimed therapeutic usefulness in hepatic and renal failure awaits further verification in animal models and humans. No significant adverse or toxic actions have been associated with the use of gum Arabic.

High protein diet has been proposed to increase exogenous acid load and to result in a chronic low – grade metabolic acidosis. Nitrogen must be separated from the protein molecule and processed by the liver. The kidney must then filter the excess nitrogen out of the body. The more protein eats the harder liver and kidneys must work to accomplish this task (Locatelli,
2004). Reducing protein intake in patients with chronic renal failure reduces the occurrence of renal death by about 40%, as compared with larger or unrestricted protein intake Denis et al., (2000). The present work was conducted to study the effect of diets containing different levels from protein with or without oral administration of gum Arabic on rats suffering from chronic renal failure.

MATERIALS AND METHODS:

Materials:
- Acacia gum was obtained from Agriculture Research Center, Cairo, Egypt.
- Casein, vitamins, minerals, cellulose, choline chloride and arginine were purchased from El-Gomhorya Company, Cairo Egypt.
- Fifty six male albino rats of Sprague Dawley strain weighting an average body weight (200 ±10g) were obtained from Laboratory of Animal Colony, Helwan, Egypt.

Methods:

Preparation of samples:

Acacia gum was soaked in boiling water (100°C) for 15 min. and prepared to be drinking water (10% Arabic Gum w/v) at 20-25°C and kept in glass bottle for biological evaluation.

Biological assay:

Fifty six male albino rats of Sprague Dawely strain weighting an average 200±10g body weight were housed in well aerated cages under hygienic laboratory conditions in the animal house of Faculty of Home Economics, Helwan University, the rats were fed on basal diet for one week for acclimatization and water was provided ad libitum. After this week, the rats were divided in to two main groups as follow:

The first main group (n = 7 rats) fed on basal diet (prepared according to Reeves et al., 1993), as a control negative group, while the second main group (n = 49 rats) fed two weeks on diet containing 2% arginine (W/W) to induce renal failure according to the method described by (Yokozawa et al., 2003). Then, the second main group divided into seven subgroups (7rats each).

The first subgroup fed on diet containing 2% arginine, as a control positive group. Subgroup (2) fed on low protein diet (diet containing 5%
protein) + 2% arginine. Subgroup (3) fed on medium protein diet (diet containing 10% protein) + 2% arginine. Subgroup (4) fed on high protein diet (diet containing 20% protein) + 2% arginine. Subgroup (5) fed on low protein diet (diet containing 5% protein) + 2% arginine and treated daily with (10% gum Arabic w/v) in the drinking water. Subgroup (6) fed on medium protein diet (diet containing 10% protein) + 2% arginine and treated daily with (10% gum Arabic w/v) in the drinking water. Subgroup (7) fed on high protein diet (diet containing 20% protein) + 2% arginine and treated daily with (10% gum Arabic w/v) in the drinking water. As illustrated in (Table 1).

Table 1: Composition of the diets (g/kg) fed to the investigated male albino rats.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Controls (g/kg)</th>
<th>Arginine diet (g/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*Control (−ve)</td>
<td>Control (+ve)</td>
</tr>
<tr>
<td></td>
<td>Without Arabic Gum</td>
<td>With (10% Arabic Gum w/v) in drinking water</td>
</tr>
<tr>
<td></td>
<td>5% protein</td>
<td>10% protein</td>
</tr>
<tr>
<td>Corn starch</td>
<td>662.5</td>
<td>642.5</td>
</tr>
<tr>
<td>Casein</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Corn Oil</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Mineral mixture</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Vitamin mixture</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Cellulose</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Choline chloride</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Arginine</td>
<td>---</td>
<td>20</td>
</tr>
</tbody>
</table>

During the experimental period (28 days), the diets consumed and body weights were recorded twice weekly. At the end of the experiment, the animals were fasted overnight, then the rats were anaesthetized and sacrificed, and blood samples were collected from the aorta. blood samples were centrifuged and the serum was separated to estimate some biochemical parameters, serum cholesterol by (Allain et al., 1974), triglycerides by (Fossati and principe 1982), HDL-c by (Lopes-Virella 1977), LDL-c & VLDL-c estimated according to the method of (Assmann, et al. 1984), uric acid by (Fossati et al., 1980), urea nitrogen by (Patton and Crouch, 1977), creatinine by (Bohmer, 1971), Serum AST & ALT by (Reitman and Frankel, 1957), sodium and potassium according to the methods described by (Henry et al., 1974).
Kidneys, heart and liver were removed from each rat, careful dissection, washed with saline solution, dried with filter paper and weighed according to the method described by (Drury and Wallington, 1980). The kidney and liver in each group was examined histopathologically, according to (Sheehan and Hrapchak 1980). All data were subjected to statistical analysis according to the procedure reported by Snedecor & Cochran, (1980) and the statistical analysis system program (SAS, 1996) using Student’s t-test.

RESULTS AND DISCUSSION:

Effect of diets contains different levels from protein in the presence of Arabic Gum on food intake, body weight gain % and some organs weight/body weight% of rats suffering from chronic renal failure.

The mean values ± standard deviation of food intake (g/day), body weight gain % and liver & kidney weight/body weight% for normal group (-ve control group), chronic renal failure group (+ve control group) and chronic renal failure groups fed on diets containing different levels from protein in the presence or absent of Arabic Gum are illustrated in table (1).

Table (1) Effect of diets containing different levels from protein in the presence of Arabic Gum on food intake and body weight gain % of rats suffering from chronic renal failure.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Food intake (g/day/rat)</th>
<th>Body weight gain%</th>
<th>Organs weight / body weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Liver</td>
</tr>
<tr>
<td>Control (-ve)</td>
<td>16.531</td>
<td>26.270 ± 3.198 a</td>
<td>2.861 ± 0.105 g</td>
</tr>
<tr>
<td>Control (+ve)</td>
<td>13.650</td>
<td>7.475 ± 1.422 d</td>
<td>3.750 ± 0.110 a</td>
</tr>
<tr>
<td>5% protein</td>
<td>14.211</td>
<td>11.272 ± 1.588 bc</td>
<td>3.322 ± 0.120 c d</td>
</tr>
<tr>
<td>10% protein</td>
<td>14.815</td>
<td>12.818 ± 1.799 bc</td>
<td>3.452 ± 0.084 b c</td>
</tr>
<tr>
<td>20% protein</td>
<td>15.600</td>
<td>12.985 ± 1.675 bc</td>
<td>3.622 ± 0.085 a b</td>
</tr>
<tr>
<td>5% protein + AG</td>
<td>15.722</td>
<td>8.216 ± 1.087 d</td>
<td>2.900 ± 0.063 f g</td>
</tr>
<tr>
<td>10% protein + AG</td>
<td>15.902</td>
<td>10.151 ± 1.662 c</td>
<td>3.052 ± 0.138 e f</td>
</tr>
<tr>
<td>20% protein + AG</td>
<td>16.211</td>
<td>13.722 ± 0.610 b</td>
<td>3.109 ± 0.135 d e</td>
</tr>
</tbody>
</table>

- Values are expressed as mean ± SD.
- AG: Arabic Gum Significant at p<0.05 using one way ANOVA test.
- Values which have different letters in each column differ significantly, while those with have similar or partially are not significant.

The mean value of food intake decreased in chronic renal failure (CRF) group fed on diet containing 2% arginine, as compared to normal group fed on basal diet (B.D) negative group. Chronic renal failure groups which fed on diets containing different levels from protein (5%, 10% and
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20%) and treated or non-treated daily with (10% Arabic Gum w/v) in the drinking water increased the mean value of food intake, as compared to the positive control group. The highest increase in the mean value of food intake recorded for the group fed on diet containing 20% protein and treated daily with (10% Arabic Gum w/v), followed by the group fed on diet containing 10% protein and treated daily with (10% Arabic Gum w/v).

The data presented in the table (1) showed that, there was a significant decrease (p<0.05) in the mean value of BWG% for the positive control group fed on diet containing 2% arginine, as compared to the negative control group fed on basal diet. All treated groups fed on diets containing (5%, 10% and 20% protein) showed significant increase in BWG%, as compared to the positive control group. On the other hand, non-significant change in BWG% was observed between the groups fed on different levels from protein. Chronic renal failure groups fed on diets containing (10% and 20% protein) and treated or daily with (10% Arabic Gum w/v) in the drinking water caused significant increase p<0.05 BWG%, while feeding group of rats on diet containing 5% protein and treated with Arabic Gum showed non-significant differences in BWG%, as compared to the positive control group. Body weight gain % of chronic renal failure groups which treated with Arabic Gum increased gradually with increasing the levels of protein in the diet.

Fed rats on diet containing 2% (w/w) arginine (20g/kg diet) led to significant increase p<0.05 in liver and kidney weights / body weight %, as compared to healthy rats. All treated groups which fed on (diet containing some levels from protein) showed significant decrease p<0.05 in liver and kidney weights / body weight % of chronic renal failure groups, as compared to the positive control group. Treating chronic renal failure group with diet containing low level from protein decreased the liver and kidney weights / body weight % significantly, as compared to the group which treated with diet containing 20% protein. The results showed that, treating chronic renal failure groups with Arabic Gum solution showed significant decrease in liver and kidney weights / body weight %, as compared to non-treated groups. The best results in liver and kidney weights / body weight % recorded for chronic renal failure fed on low protein diet and treated daily with Arabic Gum, because this group showed non-significant changes in liver & kidney weights/body weight %, as compared to the negative control group.
Effect of diets contains different levels from protein in the presence of Arabic Gum on lipid profile of rats suffering from chronic renal failure.

The different investigated groups of rats were fed on the tested diets including three levels of the investigated protein in the presence of Arabic Gum to look forward towards the generation efficiency of blood lipids. Subsequently, different groups of rats during the whole period of experiment were estimated as presented in Table (2). The control group (+ve) which was suffering from chronic renal failure has shown a highly significant increase p<0.05 in the mean value of serum cholesterol (150.409 ± 6.697 mg/dl), compared with those of the negative control group (88.309 ± 5.429 mg/dl). Feeding rats on Arginine diet (control +ve group) increased total serum cholesterol by about 70.321%, than that of basal diet (control – ve group). Feeding chronic renal failure groups on diet containing different levels from protein (5%, 10% and 20%) and treated daily with (10% Arabic Gum w/v) in the drinking water caused a significant decrease p<0.05 in serum cholesterol, as compared to the positive control group. The best results in serum cholesterol recorded for the group fed on diet containing 5% protein and treated daily with (10% Arabic Gum w/v) in the drinking water, this treatment decreased serum cholesterol by about 31.496% than that of the control +ve group.

Table 2: Effect of diets contains different levels from protein in the presence of Arabic Gum on lipid profile of rats suffering from chronic renal failure.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Cholesterol (mg/dl)</th>
<th>Triglycerides (mg/dl)</th>
<th>HDL-c (mg/dl)</th>
<th>LDL-c (mg/dl)</th>
<th>VLDL-c (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (-ve)</td>
<td>88.309 ± 5.429 g</td>
<td>45.226 ± 3.096 g</td>
<td>45.876 ± 2.663</td>
<td>33.389 ± 2.228</td>
<td>9.045 ± 0.619</td>
</tr>
<tr>
<td>Control (+ve)</td>
<td>150.409 ± 6.697 b</td>
<td>90.745 ± 3.249 b</td>
<td>39.137 ± 2.774</td>
<td>103.123 ± 3.576</td>
<td>18.149 ± 0.649</td>
</tr>
<tr>
<td>5% protein</td>
<td>126.517 ± 4.346 d</td>
<td>70.004 ± 3.658 d</td>
<td>38.819 ± 1.916</td>
<td>73.697 ± 2.362</td>
<td>14.000 ± 0.732</td>
</tr>
<tr>
<td>10% protein</td>
<td>137.831 ± 1.811 c</td>
<td>77.899 ± 2.859 c</td>
<td>32.960 ± 2.803</td>
<td>89.291 ± 2.357</td>
<td>15.579 ± 0.572</td>
</tr>
<tr>
<td>20% protein</td>
<td>159.338 ± 4.709 a</td>
<td>103.339 ± 2.785 a</td>
<td>26.632 ± 2.512</td>
<td>112.038 ± 2.419</td>
<td>20.668 ± 0.557</td>
</tr>
<tr>
<td>5% protein +AG</td>
<td>103.036 ± 5.183 b</td>
<td>60.056 ± 2.917 b</td>
<td>41.585 ± 1.774</td>
<td>49.440 ± 3.053</td>
<td>12.011 ± 0.583</td>
</tr>
<tr>
<td>10% protein +AG</td>
<td>112.096 ± 4.603 c</td>
<td>64.675 ± 2.523 c</td>
<td>38.675 ± 2.056</td>
<td>60.488 ± 2.482</td>
<td>12.935 ± 0.505</td>
</tr>
<tr>
<td>20% protein +AG</td>
<td>127.076 ± 4.427 d</td>
<td>68.373 ± 4.160 d</td>
<td>33.182 ± 2.443</td>
<td>80.219 ± 1.278</td>
<td>13.675 ± 0.832</td>
</tr>
</tbody>
</table>

- AG: Arabic Gum - CRF: Chronic Renal Failure - Values are expressed as mean ± SD.
- Values which have different letters in each column differ significantly, while those with have similar or partially are not significant. - Significant at p<0.05 using one way ANOVA test.
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The results in Table (2) indicated that, serum triglyceride increased gradually by increasing the levels of protein in the diet. On the other hand, the mean values of serum triglyceride decreased significantly p< 0.05 in chronic renal failure groups which treated with Arabic Gum, comparing with non treated groups with Arabic Gum. The highest decrease in triglyceride between all treated groups recorded for the group fed on low protein diet treated with Arabic Gum, followed medium level. These treatments decreased serum triglyceride 33.818 and 28.728%, respectively.

Treating chronic renal failure groups with diets containing (5% and 10% protein) resulted in significant increase p<0.05 in serum HDL-c, while chronic renal failure group which treated with (20% protein) showed non-significant difference in this parameter, as compared to the positive control group. The other treated groups with different levels from protein with Arabic gum increased the mean values of serum HDL-c, as compared to the positive control group.

The best results in serum HDL-c, LDL-c recorded for the group fed on low protein diet (5%) and treated daily with (10% Arabic Gum w/v in the drinking water), followed by the group fed on medium level (10%). The highest decrease in serum VLDL-c between all treated groups recorded for the group fed on low protein diet and treated daily with Arabic Gum, followed by the group fed on the medium protein diet and treated daily with Arabic Gum 33.82% and 28.728%, respectively.

Such results agree with those obtained by Mee and Gee (1997) they mentioned that the decrease was confined to LDL and VLDL cholesterol only, with no effect on HDL and triglycerides. Sicart and Sablé-Amplus (1987) noticed that, in 6 weeks the significant cholesterol-lowering effect. Total cholesterol dropped by 10% and LDL by 14%, with no significant change in either HDL or triglyceride concentration.

Correlation between histological changes in the kidney and its functions

It is well recognized that urea is a major uremic toxin and plays an important role in human diseases. It is usually accepted that levels above 50mmol/liter induce anorexia. Furthermore, the level of blood urea is used for the clinical evaluation renal function, and it is considered as an indicator for the accumulation of all the nitrogen waste products producing from the degradation of protein Kely & Mitch(1983) and Amin (1993). While Al-Mosawai, (2004) reported that, Gum Arabic is commonly prescribed for
chronic renal failure in patients in Sudan; it results in decreased uraemia and reduces the frequency of dialysis, hence improving the quality of life.

From the results given in Table (3), it could be noticed that administration of 2% L-arginine for 30 days produced a significant increase p< 0.05 in serum uric acid, as compared to negative control group (4.374 ± 0.147 mg/dl vs. 1.587 ± 0.112 mg/dl), respectively. Also it could be observed an improvement of serum uric acid at the end of experimental period after administration of diet containing low level from protein (5% protein), while the administrated of diet containing (10% & 20% protein) did not improve this parameter, as compared to the positive control group.

Table 3: Effect of diets contains different levels from protein in the presence of Arabic Gum on kidney function, serum sodium and potassium of rats suffering from chronic renal failure.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Uric acid</th>
<th>Urea nitrogen</th>
<th>Creatinine</th>
<th>Na</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (+ve)</td>
<td>3.50 ± 0.112</td>
<td>0.57 ± 0.045</td>
<td>3.50 ± 0.206</td>
<td>137.732 ± 1.912</td>
<td></td>
</tr>
<tr>
<td>Control (+ve)</td>
<td>3.50 ± 0.112</td>
<td>0.57 ± 0.045</td>
<td>3.50 ± 0.206</td>
<td>137.732 ± 1.912</td>
<td></td>
</tr>
<tr>
<td>5% protein</td>
<td>3.26 ± 0.169</td>
<td>3.24 ± 0.189</td>
<td>104.128 ± 4.281</td>
<td>7.874 ± 0.579</td>
<td></td>
</tr>
<tr>
<td>10% protein</td>
<td>4.19 ± 0.457</td>
<td>3.97 ± 0.183</td>
<td>100.120 ± 3.456</td>
<td>8.182 ± 0.587</td>
<td></td>
</tr>
<tr>
<td>20% protein</td>
<td>5.92 ± 0.229</td>
<td>4.53 ± 0.333</td>
<td>85.344 ± 4.312</td>
<td>10.435 ± 0.562</td>
<td></td>
</tr>
<tr>
<td>5% protein+AG</td>
<td>2.25 ± 0.154</td>
<td>2.10 ± 0.108</td>
<td>118.519 ± 4.015</td>
<td>6.500 ± 0.528</td>
<td></td>
</tr>
<tr>
<td>10% protein+AG</td>
<td>2.89 ± 0.250</td>
<td>2.70 ± 0.139</td>
<td>113.826 ± 3.321</td>
<td>6.761 ± 0.572</td>
<td></td>
</tr>
<tr>
<td>20% protein+AG</td>
<td>3.42 ± 0.259</td>
<td>3.18 ± 0.152</td>
<td>109.213 ± 2.935</td>
<td>7.911 ± 0.288</td>
<td></td>
</tr>
</tbody>
</table>

- Na: Sodium. - K: Potassium. - AG: Arabic Gum - CRF: Chronic Renal Failure - Values are expressed as mean ± SD. - Significant at p<0.05 using one way ANOVA test - Values which have different letters in each column differ significantly, while those with have similar or partially are not significant.

The highest decrease in serum uric acid recorded for the group fed on low protein diet and treated with (10% Arabic Gum w/v) in the drinking water was 33.950%, comparing with the positive control group. Feeding chronic renal failure groups on diets containing different levels from protein and treated daily with Arabic Gum decreased the mean value of urea nitrogen significantly, as compared to the positive control group. The best results in serum urea nitrogen recorded for the group fed on low protein diet (5% protein), because this treatment showed significant decrease in this parameter, as compared to other treated groups. In this respect Frey, (2007)
who published that the serum urea nitrogen is a substance that is formed in the liver when the body breaks down protein. In healthy people, most urea nitrogen is filtered out by the kidneys and leaves the body in the urine. If the patient’s kidneys are not functioning properly or if the body is using large amounts of protein, the serum urea nitrogen level will rise.

The mean value of serum creatinine in the positive control group was 4.162 ± 0.313 mg/dl, while the respective value of the negative control group was 0.577 ± 0.045 mg/dl. The mean value of serum creatinine in the group (fed on low protein diet and treated with Arabic Gum) achieved the best results. This group recorded significant decrease in this parameter, as compared to other treated group. From obtained results, it can be noticed that, feeding rats on diet containing 2% arginine led to significant increase in serum uric acid, urea nitrogen and creatinine, as compared to healthy rats. Bliss et al. (1996) investigated that supplementation with gum Arabic fiber increases fecal nitrogen excretion and lowers serum urea nitrogen concentration in chronic renal failure patients consuming a low-protein diet. Younes et al., (1999) indicate that under these dietary conditions, the addition of oligosaccharides (gum Arabic) to the diet induced a 20 to 30% decrease in blood urea and renal and renal nitrogen excretion relative to the control, indicating a potential for oligosaccharide diet therapy in chronic renal disease.

Nasir et al., (2008) concluded that, treatment with GA resulted in moderate but significant increases of creatinine clearance and altered electrolyte excretion, i.e., effects favorable in renal insufficiency. Al-Mosawi (2004) reported that acacia gum supplementation of a low-protein diet in children with end-stage renal disease. the author concluded that, dietary supplementation with acacia gum may be an alternative to renal replacement therapy to improve the quality of life and reduce or eliminate the need for dialysis in children with ESRD in some developing countries. Ali et al., (2008) studied the effect of gum Arabic (Acacia Senegal) oral treatment on the metabolic profile of chronic renal failure (CRF) patients and found that, serum uric acid, urea nitrogen and creatinines showed significantly decreased in the groups of gum Arabic and conclude that oral administration of gum Arabic could conceivably alleviate adverse effects of CRF.

In Fig (1) the histology changes were noticed in kidney in different treatment diet. (Ali, et al.;2010) mention that, GA (6% and 12% in drinking water for four consecutive weeks) significantly ameliorated the adverse
biochemical alterations indicative of renal failure, abated the decrease in body weight and reduced the glomerular, tubular and interstitial lesions induced by adenine. This study provides evidence that GA attenuated renal dysfunction in this model of CRF, suggesting a promising potential for it in protecting against renal failure progression.

Fig. 1: Histopathological changes in kidneys.
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1) control -ve rat revealed the normal histological structure of renal parenchyma; 2) control +ve rat showed cystic dilatation of some renal tubules; 3) hypertrophy of glomerular tufts; 4) showed vascular degeneration of renal tubular epithelium; 5,6,7) no histopathological changes, 8) showed vascular degeneration of epithelial lining some renal tubules.

From the obtained results in Table (3) it could be deduced that chronic administration of L-arginine due to abnormal changes in serum sodium and potassium levels. With regard to serum sodium levels, it could be observed that through the experimental period there were a significant decrease (P<0.05) in serum sodium of rats with chronic renal failure, as compared to the negative control. There were significant increases in serum sodium levels in all treated groups, except group of rats fed on diet containing 20% protein, as compared to the positive control group. Feeding chronic renal failure group on diet containing 5% protein and treated daily with Arabic Gum increased serum sodium by about 30%, than that of the positive control group.

On the other hand feeding rats which suffer from chronic renal failure with diets containing (5%, 10% and 20% protein) and treated them with Arabic Gum led to decrease serum potassium significantly p<0.05, as compared to the positive control group. The highest decrease in serum potassium recorded for the groups fed on high protein diets with or without treatment by Arabic Gum. These result was agree with Giebisch (2007) who observed that a serum potassium level is apparent even among people with chronic renal failure insufficiency.

Correlation between histological changes in the liver and its function:

Effect of feeding rats on diets containing different levels from protein (5%, 10% and 20%) with treated or non-treated with Arabic Gum on the liver enzymes aspartate amino transferase (AST) and alanine amino transferase (ALT) in serum of rats suffering from chronic renal failure was illustrated in Table (4). Feeding rats on arginine diet increased serum AST and ALT enzymes 57.767% and 176.168%, respectively. In this respect, Abd-ELFattah et al., (2006) revealed that the high levels of AST &ALT in serum are indicators for liver dysfunction. This significant increasing may be attributed mainly to the hepatotoxic effect of arginine.

As shown in this Table, feeding groups of rats which were suffering from chronic renal failure on diets containing 5% and 10% protein recorded
a significant decrease p<0.05 in these enzymes, while feeding chronic renal failure rats on diet containing (20% protein) increased AST and ALT enzymes, as compared to the positive control group.

Feeding rats which suffer from chronic renal failure on diets containing different levels from protein (5%, 10% and 20%) and treated with (10% Arabic Gum w/v) led to significant decrease p<0.05 in AST & ALT enzymes, as compared with positive control group. The highest decrease in AST & ALT enzymes recorded for the groups fed on low protein diet and treated them with (10% Arabic Gum w/v) in the drinking water, followed by the group fed on medium protein diet with the same treatment.

Gmal al-Din et al (2003)Arabic gum is effective in protecting mice against acetaminophen-induced hepatotoxicity. This protection may involve the reduction of oxidative stress.

In experimental rats, the histology changes were noticed in liver in different treatment diet Fig (2).

Table 4: Effect of diets containing different levels from protein in the presence of Arabic Gum on liver enzymes of rats suffering from CRF.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>U/L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AST</td>
</tr>
<tr>
<td>Control (-ve)</td>
<td>61.064 ± 2.018 e</td>
</tr>
<tr>
<td>Control (+ve)</td>
<td>96.339 ± 4.282 a</td>
</tr>
<tr>
<td>5% protein</td>
<td>88.376 ± 3.3167 b c</td>
</tr>
<tr>
<td>10% protein</td>
<td>89.825 ± 3.072 b</td>
</tr>
<tr>
<td>20% protein</td>
<td>98.502 ± 5.349 a</td>
</tr>
<tr>
<td>5% protein + AG</td>
<td>76.519 ± 3.187 d</td>
</tr>
<tr>
<td>10% protein + AG</td>
<td>85.055 ± 3.091 c</td>
</tr>
<tr>
<td>20% protein + AG</td>
<td>88.603 ± 1.625 b c</td>
</tr>
</tbody>
</table>

- **AST**: aspartate amino transferase  
- **ALT**: alanine amino transferase.

- **AG**: Arabic Gum  
- **CRF**: Chronic Renal Failure  
- Values are expressed as mean ± SD.  
- Significant at p<0.05 using one way ANOVA test.  
- Values which have different letters in each column differ significantly, while those with have similar or partially are not significant.

These results are in broad agreement with Mariusz et al. (1996) who found that chronic renal failure is associated with multiple disturbances in other organs as liver as down regulation of the mRNA of the liver enzymes.
On the other side, Akmal (2000) found that chronic renal failure associated with an impairment of liver functions. Yokozawa et al., (2003) confirmed that excess L-arginine lead to impairment in liver functions.

Fig. 2: Histopathological changes in liver.
1) control -ve rat revealed the normal histological structure of renal parenchyma; 2,3) control +ve revealed fatty change of hepatocytes; 4) showed kupffer cells activation and presence of small vascular in the cytoplasm of some hepatocytes; 5) revealed small vascular in the cytoplasm of hepatocytes as well as portal infiltration with leucocytes; 6) showed cytoplasmic vacuolization of hypatocytes; 7) revealed kupffer cells activation and small vacuoles in the cytoplasm of hepatocytes; 8) revealed no histopathological changes.
Effect of Treatment with Arabic Gum on Rats Suffering from Chronic Renal Failure

References:


Effect of Treatment with Arabic Gum on Rats Suffering from Chronic Renal Failure

تأثير المعاملة بالصمع العربي على الفضلات المصابة بالفشل الكلوي المزمن
دراسة بيولوجية

أشرف عبد العزيز عبد المجيد
سماح محمد إسماعيل

المست references

البحث

استخدمت هذه الدراسة عينة تأثير الوجبات الحيوية على مستويات مختلفة من البروتين مع
أو بدون تناول الصمع العربي عن طريق القم على الفضلات المصابة بالفشل الكلوي المزمن. استخدمت
هذ الدراسة مجموعات رئيسيتين. المجموعة الرئيسية الأولى (7 فضلات) تم استخدامها كمجموعة
ضابطة سلبية (غير مصابي) تم تغذيتها على غداء أساسي. المجموعة الثانية الأخرى (14 فضلة) تم
تغذيتها على غداء تحتوي على 2% أرجينين (وزن/ وزن) لإحداث الفشل الكلوتي. تم تقسيم هذه
المجموعة إلى سهية مجموعات فرعية (7 فضلات لكل منها). المجموعة الفرعية الأولى تم تغذيتها
علي غداء تحتوي على 2% أرجينين (وجبة أرجينين) وقامت بتجميعها كمجموعة
(بائية). المجموعات الفرعية الثانية والثالثة والرابعة تم تغذيتها على وجبات الأرجينين المحتوية
علي 5 % و10% و20% بروتين، على التوالي. الستة الفضلات الفرعية الخاصة والسلسلة والثانية تم
تغذيتها على وجبات الأرجينين المحتوية على نفس نسب البروتين السابقة كما تم معاملتهم
بالصوم العربي [10 % صمع عربي مذاب في ماء الشرب (وزن/ حجم) ]. تغذية الفضلات على وجبة
تحتوي على 2% أرجينين أحدث تناقص في المناوسل من الجمل والنسبة المولية للزيادة في الوزن، و
كولسترول الлиبيدرونات علاج الكثافة في السيرم و أيضا الصدريومات. في حين حدد زيادة معتودة في
النسبة النموية لوزن الأعضاء ومستويات (كولسترول والجلدريوتينات الثلاثية وكولسترول
الليبيدرونات منخفضة الكثافة وكولسترول الليبيدرونات منخفضة الكثافة جدادا وحامض
البروكسيش ونيتروجن البوريا والكرياتينين والبيوتامينات والتيزامات الكبد في سيرم الفضلات). مقارنة
بالمجموعة السالبة التي تم تغذيتها على غداء أساسي.

معالجة الفضلات المصابة بالفشل الكلوي المزمن بالمستويات المتوسطة والمنخفضة من البروتين
اردت الدراسة تحسين هذه التقديرات. وخصوصا مع المستوى المنخفض من البروتين. من ناحية
أخرى، أظهرت النتائج أن معالجة الفضلات المصابة بالفشل الكلوي المزمن يوميًا بالصمع العربي [10 %

قسم التغذية وعلم الأطعمة - عاليات الاقتصاد المزمن - جامعة حلوان - القاهرة - جمهورية مصر العربية
قسم الاقتصاد المزمن - علمية التربية - جامعة عين شمس - القاهرة - مصر

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مجلة بحوث التربية المزمن - عدد 27 - يوليو 2012
صمغ عربي مذاب في ماء الشرب (وزن / حجم) [سجل تحسن أكثرا لهذه التقديرات، وخاصة عند
استخدام الصمغ العربي مع المستوي المنخفض من البروتين.
اقترحت الدراسة أن استخدام الصمغ العربي مع اتباع نظام غذائي منخفض البروتين يجب أن
تنفد لمرضى الفشل الكلوي المزمن. وينبغي في الوقت نفسه أن تنظم البرامج التعليمية الصحية
والغذائية الموجهة للجمهور لحماية أنفسهم من هذا المرض.
الكلمات المفتاحية: الصمغ العربي - فنرانتيببا - أرجينين - الفشل الكلوي المزمن - صورة
الدهن - وظائف الكلى - انزيمات الكبد.