EFFECT OF ADDITION OF FREEZE DRIED FROM YOUNG GREEN BARLEY LEAVES ON HYPERCHOLESTEROLEMIC RATS

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ABSTRACT

The present study was performed to investigate the effect of the freeze-dried powder of young green barley leaves added to diets as hypocholesterolemic agents. For this purpose an experiment was carried out by using 24 rats which were divided into four groups. The control group (6 rats) was fed on basal diet and the second group (6 rats) was fed on hypercholesterolemic diet. The other two groups were fed on hypercholesterolemic diet with powder of young green barley at different concentrations of 10 and 20%. The results indicated that all groups which were fed on diet containing powder of young green barley had significant increment in body weight gain, food consumption and feed conversion compared with rats fed basal and hypercholesterolemic diets.

Total cholesterol, triglyceride, HDL, and LDL cholesterol were determined. It was found that the rats fed on diets containing powder of young green barley at different levels of 10 and 20% had the highest significant decrease in total cholesterol (112.89, 116.11%), triglyceride (106.1, 107.12%) when compared with the hypercholesterolemic diets rats, respectively.

The activities of alanine transaminase (ALT) and aspartate transaminase (AST) enzymes of liver and kidney functions were estimated. From the obtained results, it could be recommended that the addition of powder from young green barley leaves might improve the liver and kidney functions in hypercholesterolemic diets rats.

On the other hand, the histopathological picture indicated that the addition of freeze dried powder of young green barley leaves to the rats containing a high cholesterol had slightly effect on the microscopical lesions induced by feeding on high cholesterol diet. While, the histopathological examination of the kidneys of rats fed on high cholesterol with or without addition of powder from young green barley leaves at different levels (10 and 20%) revealed nearly similar microscopical changes.

INTRODUCTION

Hypercholesterolemia is an established major risk factor for coronary artery disease. Lifestyle modification is the preferable treatment for most types of hyperlipidemia (National Cholesterol Education Program, 1993).
Barley is one of the earliest cultivated cereal grains in the world. It is gaining interest for food use due to its desirable nutritional and functional characteristics. β-glucan content has become one of the main parameters for the evaluation of barley, which increase the value of barley, since it appears to reduce serum cholesterol (Baardon et al., 1999).

Barley contains non-starch polysaccharides which forms viscous solutions in the gut that delay transit and modifies nutrient digestion and absorption, thus the small intestinal reabsorption of bile acids is reduced, leading to increased fecal steroid excretion and fall in plasma cholesterol levels (Newman et al., 1989 and Kahan et al., 1993). A novel antioxidant from young green barley leaves was isolated by ethanol extract from freeze-dried. The fraction exhibiting strongest antioxidative activity, the active component was identified as 2-O-β-glycosyliso-vitexin by GC. Its antioxidative activity was almost equivalent to that of α-tocopherol in a lipid peroxidation system at 100 μg/l of α-tocopherol (Chawla et al., 1992).

Young green barley leaves extract (GBLE) is widely used in Japan and other countries as a nutritional supplement. It contains a high level of superoxide dismutase, a potent antioxidant also can play a role in cancer prevention or treatment. GBLE is considered rich in chlorophyll which suggested that this component may have a beneficial effect on chronic pancreatitis (Yokono, 1992).

Young green barley leaves are known to possess potent pharmacological properties, including anti-oxidative, anti-inflammatory, antimutagenic and anti-allergic activities. In particular, a flavonoid, 2-O-β-glycosyliso-vitexin (2-O-GIV) isolated from an ethanol extract of young green barley leaves, possesses a strong inhibitory effect toward lipid peroxidation. 2-O-GIV inhibited acetaldelyde formation from liver protein (LDL) by 76% at a level of 1 μmol/50μg, whereas fumaric acid inhibited it by 66% at the same level. In the blood plasma system, 2-O-GIV and protocol inhibited acetaldelyde formation by 89% and 94%, respectively, at a level of 3 μmol. 2-O-GIV and vitamin C (ascorbic acid) inhibited malondialdehyde formation by 54% and 22%, respectively, at a level of 0.1 μmol (Hartland, 1994).

Jackson et al. (1994) have demonstrated that hypercholesterolemic rats fed diets containing milled barley showed reduction in their plasma levels of total and low density lipoproteins (LDL) cholesterol.

McIntosh et al. (1995) reported that hypercholesterolemic rats fed whole barley grain show reduction in serum cholesterol, LDL cholesterol and triglycerides but HDL cholesterol increased.

Wang et al. (1997) reported that the presence of tocotrienols found in barley which have the potential to inhibit cholesterol and bile acid synthesis, possibly by the inhibition of hydroxymethyl-glutaryl-Coenzyme A (HMG-CoA) reductase and 7-alpha hydroxylase.

Effect Of Additive

Abd-Ekader et al. (1999) reported that the products had significantly increased when compared to the triacylglycerides and low significantly decreased significantly increased.

Delaney et al. (1999) reported that the addition of from rice bran, oat bran antiatherogenic in hypercholesterolemic rat.

Wilson et al. (1999) reported that the addition of LDL-cholesterol decreased and high MW β-glucan cholesterol ester concentration.

Materials:
I. Barley (G. barley)
II. Oxidized bread, ground at Agricultural Co.
III. Green barley leaves were used.
IV. Leaves were prepared in a 35 μm mesh size sieve to form the total.

Total cholesterol, triglycerides, protein, creatinine & uric acid kit and creatinine kit.
All chemicals used in this experiment were obtained from stock.

2. Biological experiment:

2.1. Animals and experiment

Twenty-four male obtained from Halwa strain.
The rats were fed on basal

The rats were divided into three groups: control group, fed on the basal diet containing cellulose, 4% sunflower meal, 10% corn oil, 5% cellulose mixture according to Shin and Popponi (1987). The rats were then weighed every week and samples were collected from cages. The results of the experiment were determined.
Abd-Elkader et al. (2000) found that all groups, which were fed barley products had significant increase in food consumption and body weight gain when compared to the positive control group. Also, plasma total cholesterol, triglycerides and low density lipoproteins (LDL) cholesterol levels were significantly decreased and high density lipoproteins (HDL) cholesterol was significantly increased.

Delaney et al. (2003) reported that the diets containing β-glucan fraction from rice bran, oat bran and barley were significantly reduced the development of atherosclerotic in hypercholesterolemic Syrian golden hamsters.

Wilson et al. (2004) found that decrease in plasma total cholesterol and LDL-cholesterol concentrations were occurred in the hamsters which fed reduced and high MW β-glucans diets. Liver total cholesterol, free cholesterol and cholesterol ester concentrations did not differ.

MATERIALS AND METHODS

Materials:
1. Barley (Giza 126 variety) was obtained from Barley Research Department, Agriculture Research Center, Giza, Egypt. Barley cereals were grown at Agricultural Chemistry Dept., Fac. of Agric., Montazah, then young green barley leaves were harvested after 21 days. Freeze-dried young green barley leaves were prepared in a freeze-dryer. Then were subsequently grounded to 2 mm mesh size sieve to form a fine and uniform powder.

Total cholesterol kit, HDL-cholesterol kit, LDL-cholesterol kit, triglycerides kit, transaminase kits, total proteins kit, albumin kit, uric acid kit, urea kit and creatinine kit were obtained from Biodiagnostics Co., Cairo, Egypt. All chemicals used in this study were analytical grade.

2. Biological experiment:
2.1. Animals and experimental design:

Twenty-four male albino rats weighing about 60-72 g for each one were obtained from Helwan station for experimental animals, Helwan, Cairo, Egypt. The rats were fed on basal diet for week to adaptation in the experimental animals cages. Then the rats were divided into 4 groups (6 rats each). The first group was fed on the basal diet consisted of 70% corn starch, 10% casein, 10% corn oil, 5% cellulose, 4% salt mixture and 1% vitamin mixture. The second group (6 rats) was fed on the hypercholesterolemic diet consisted of 69% corn starch, 10% casein, 10% corn oil, 5% cellulose, 4% salt mixture, 1% cholesterol and 1% vitamin mixture according to Shinnick et al. (1990). The other two groups of rats were fed on hypercholesterolemic diet with powder of young green barley leaves at levels of 10 and 20%, respectively, for 8 weeks. The salt and vitamin mixtures used were prepared according to the methods of Hegsted et al. (1941). Each rat was weighed every week, food intake was also daily recorded and food efficiency was determined. At the end of experiment, rats were fisted for 12 h and the blood samples were collected from the eye of the rats with heparinized capillary tubes.
then centrifuged at 3000 rpm for 20 min to obtain the serum. The liver was excised and washed with ice-cold isotonic saline and weighed. Serum and liver samples were stored at -20°C until used for the assay of the biochemical parameters.

2.2. Determination of biological parameters:

Serum total cholesterol (Aitam et al., 1979) and total triglycerides (Fonstad and Prentice, 1982) were estimated by standard methods. Serum HDL-cholesterol was determined by the method of Lopes-Virella et al. (1977), but LDL-cholesterol was determined according to Steinburg (1981).

Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities were measured colorimetrically according to the method described by Reitman and Frankel (1957). Urea in the serum was determined according to Fawcett and Scott (1960) and creatinine was estimated according to the method described by Bartles et al. (1972).

Uric acid in the serum was determined according to the method described by Hansman and Muller (1977). Blood haemoglobin was estimated according to Van-Kampen and Zijlstra (1967) method.

Total proteins in serum was determined according to the method described by Doumas (1975). Serum albumin was measured according to Doumas et al. (1971). The serum globulin was calculated by subtracting the amount of albumin from total protein.

3 Statistical analysis:

Statistical analysis of the obtained data was done following procedure outlined by Gomez and Gomez (1984). The treatment means were compared using the least significant difference test (LSD) at the 5% level of probability as outlined by Weiler and Dunsmun (1967) using the SAS institute program (SAS, 1990).

4. Histopathology:

The livers of the rats which fed on different diets were separated, and specimens were immediately fixed in 10% formalin, then decalced with conventional grades of ethyl alcohol and xylol, embedded in paraffin and sectioned at 5-6 μ thickness. The sections were stained with Haematoxylin and eosin (Hematoxylin and eosin) stain for studying the histopathological changes (Dry and Wallington, 1986).

RESULTS AND DISCUSSION

Effect of the freeze-dried powder of young green harley leaves on body weight gain, food intake and feed conversion ratio in rats after 8 weeks:

Table (1): Effect of different diets on body weight gain and feed conversion ratio in rats after 8 weeks. The results in Table (2) show that the effect of different diets on the body weight gain and feed conversion ratio in rats after 8 weeks. Mean values of these results are shown in Table (1). The results show that the effect of different diets on the body weight gain and feed conversion ratio in rats after 8 weeks.

Table (1): Effect of different diets on body weight gain and feed conversion ratio in rats after 8 weeks.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial weight (g)</th>
<th>Feed Intake (g)</th>
<th>Feed Conversion Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>69.2 ± 0.75</td>
<td>2.3 ± 0.2</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>G2</td>
<td>65.8 ± 0.25</td>
<td>2.2 ± 0.2</td>
<td>1.1 ± 0.2</td>
</tr>
<tr>
<td>G3</td>
<td>62.5 ± 1.24</td>
<td>2.1 ± 0.1</td>
<td>1.0 ± 0.1</td>
</tr>
<tr>
<td>G4</td>
<td>54.6 ± 0.74</td>
<td>2.0 ± 0.1</td>
<td>1.2 ± 0.1</td>
</tr>
<tr>
<td>LSD</td>
<td>2.9 ± 0.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

G1: Control group; G2: High cholesteral; G3: Powder of young harley (2.5%); G4: Powder of young harley (5%); cholesteral diet (2.5%).
the diet containing powder from barley leaves was significantly higher (P < 0.05) than that of corresponding rats fed basal diet and hypercholesterolemic diets. Body weight gain of rats increased from 81.09±1.5 g for control group to 113.35±1.59, 124.13±0.77 and 133.39±1.00 g for rats fed hypercholesterolemic and powder of young green barley leaves (at different levels of 10% and 20%), respectively. Also, data presented in Table (1) showed the average feed conversion ratio for experimental groups of rats. From the above-mentioned results it can be observed that rats fed diet containing powder from young green barley at different concentrations had greater feed efficiency than those of the rats fed basal diet and hypercholesterolemic diets. These results are in agreement with those described by Abdul-Elkadah et al. (2000).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial weight (g)</th>
<th>Final weight (g)</th>
<th>Body weight gain (g) [A]</th>
<th>Food intake (g) [B]</th>
<th>Feed conversion ratio [A/B]</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>69.2±0.79</td>
<td>156.3±0.51</td>
<td>87.0±1.15</td>
<td>549.3±60.16</td>
<td>0.15</td>
</tr>
<tr>
<td>G2</td>
<td>65.8±0.97</td>
<td>177.1±1.28</td>
<td>111.3±1.99</td>
<td>723.4±10.64</td>
<td>0.16</td>
</tr>
<tr>
<td>G3</td>
<td>65.2±1.27</td>
<td>189.3±1.07</td>
<td>124.1±0.77</td>
<td>547.1±10.64</td>
<td>0.23</td>
</tr>
<tr>
<td>G4</td>
<td>64.5±0.76</td>
<td>198.0±0.54</td>
<td>133.5±1.00</td>
<td>639.5±2±7.28</td>
<td>0.27</td>
</tr>
<tr>
<td>LSD</td>
<td>2.84</td>
<td>2.79</td>
<td>3.84</td>
<td>26.32</td>
<td></td>
</tr>
</tbody>
</table>

G1: Control group.  
G2: High cholesterol group  
G3: Powder of young green barley leaves (10%).  
G4: Powder of young green barley leaves (20%).

Effect of freeze-dried powder of young green barley leaves on weight of rat organs:

The weights of liver, kidney, heart, lungs, spleen and testis expressed as percent of body weight for the different experimental diets groups using different levels of the powder from young green barley leaves. These results are recorded in Table (2). It could be found that the relative liver weight was significantly increased with rats fed diets at different levels (10% and 20%) of the powder from barley (4.75±0.31, 5.71±0.56) than with the control diet (3.39±0.12) and high cholesterol diet (2.58±0.09).

Data in the same table also revealed that the weights of kidney, heart, lungs, spleen and testis were significantly increased with two groups of rats fed diet containing the powder of barley leaves than that of rats fed basal diet (control group). From these results, it could be concluded that the increase of all organ weights in comparison to control and high cholesterol experiment rats under the effect of different diets may be due to increase in body weight of rats fed diets containing the powder at the above-mentioned different levels from barley leaves (Abd-Elkadah et al., 2000).
Table (2): Effect of powder from young green barley leaves on weight of rat organs.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Liver</th>
<th>Kidney</th>
<th>Heart</th>
<th>Lungs</th>
<th>Spleen</th>
<th>Testis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(g)</td>
<td>(g)</td>
<td>(g)</td>
<td>(g)</td>
<td>(g)</td>
<td>(g)</td>
</tr>
<tr>
<td>G1</td>
<td>0.72</td>
<td>0.29</td>
<td>0.55</td>
<td>0.15</td>
<td>0.48</td>
<td>0.35</td>
</tr>
<tr>
<td>G2</td>
<td>1.34</td>
<td>0.29</td>
<td>0.55</td>
<td>0.15</td>
<td>0.48</td>
<td>0.35</td>
</tr>
<tr>
<td>G3</td>
<td>1.08</td>
<td>0.29</td>
<td>0.55</td>
<td>0.15</td>
<td>0.48</td>
<td>0.35</td>
</tr>
<tr>
<td>G4</td>
<td>1.08</td>
<td>0.29</td>
<td>0.55</td>
<td>0.15</td>
<td>0.48</td>
<td>0.35</td>
</tr>
</tbody>
</table>

G1: Control group.
G2: High cholestrol group
G3: Powder of young green barley leaves (19%).
G4: Powder of young green barley leaves (29%).

Effect of different experimental diets on cholesterol types and triglycerides of rats:

The effect of the powder of young green barley leaves and hypercholesteremic diets on serum total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides of rats were studied and illustrated in Table (3).

The obtained results are presented in Table (3) showed that serum total cholesterol of rats fed on basal diet (G1) and high cholestrol (G2) were 118.20±3.81 and 250.05±2.00 mg/100 ml serum, respectively. While rats fed diet containing the powder from young green barley (G3 and G4) had the least mean values of total cholesterol i.e. 116.62±2.44 and 122.81±2.59 mg/100 ml serum under different levels (10% and 20%), respectively. From the above-mentioned results, it can be seen that the rats fed diet containing barley powder at the above different levels (G3 and G4) were not significantly decrease of compared with rats fed basal diet control (G1). On the other hand, the total cholestrol concentrations in two groups (G3 and G4) were highly significantly lower when compared with rats fed diet high cholestrol (G2). Serum total cholesterol concentrations were lower in the rats fed barley powder (-53% and -55%) at 10 and 20%, respectively, compared with rats fed the hypercholesteremic diet. While, very density lipoprotein (VLDL) cholesterol concentrations significantly increased with rats fed diet containing barley powder at two levels (10% and 20%, G3 and 20%, G4) compared with other groups (G1 and G2).

On the other hand, low density lipoprotein (LDL) cholesterol concentrations were lower in groups fed barley powder (53.48±2.53, 49.53±2.49 mg/100 ml serum) compared with hypercholesterolemic diet (160.54±1.29 mg/100 ml serum). The data presented in Table (3) showed that serum triglycerides of rats fed on basal diet was 143.06±1.54 mg/100 ml serum but rats fed on high cholesterol was found to be higher 293.81±2.53 mg/100 ml serum. These mean values were decreased to 142.17±3.95 and 140.57±0.51 mg/100 ml serum by feeding with barley at different concentrations (10 and 20%), respectively.

From the studied results, serum cholesterol and triglycerides levels in G4 were lower (<0.05) compared with rats fed diet containing differences in LDL and HDL cholesterol were about 10% and Wilson et al. (2000) showed that hypercholesterolemic diet increased with the level of barley powder. While, very density lipoprotein (VLDL) cholesterol concentrations significantly increased with rats fed diet containing barley powder at two levels (10% and 20%), G3 and 20%, G4) compared with other groups (G1 and G2).

The concentration of serum cholesterol and triglycerides were increased (34.3±2.96, 50.0±2.8 U/ml) while, hypercholesterolemia that the rats fed on it was increased serum AST and ALT activities significantly different (0.001) among rats fed high cholestrol diet as well as mean of AST in rats was significantly different (0.001) fed basal diet (35.00±1.5) and hypercholesterolemic (40.00±1.5) with agreement with these results.
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<table>
<thead>
<tr>
<th>Parameters</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/100 ml)</td>
<td>118.32</td>
<td>205.05</td>
<td>116.62</td>
<td>112.84</td>
<td>8.69</td>
</tr>
<tr>
<td>Relative %</td>
<td>100.00%</td>
<td>211.55%</td>
<td>98.65%</td>
<td>95.44%</td>
<td></td>
</tr>
<tr>
<td>HDL-Cholesterol (mg/100 ml)</td>
<td>32.43</td>
<td>33.73</td>
<td>35.36</td>
<td>34.51</td>
<td>2.57</td>
</tr>
<tr>
<td>Relative %</td>
<td>100.00%</td>
<td>94.76%</td>
<td>105.03%</td>
<td>106.41%</td>
<td></td>
</tr>
<tr>
<td>LDL-Cholesterol (mg/100 ml)</td>
<td>60.93</td>
<td>60.54</td>
<td>53.48</td>
<td>49.53</td>
<td>6.17</td>
</tr>
<tr>
<td>Relative %</td>
<td>100.00%</td>
<td>98.12%</td>
<td>101.09%</td>
<td>101.05%</td>
<td></td>
</tr>
<tr>
<td>Triglycerides (mg/100 ml)</td>
<td>183.86</td>
<td>232.81</td>
<td>143.17</td>
<td>148.57</td>
<td>7.23</td>
</tr>
<tr>
<td>Relative %</td>
<td>100.00%</td>
<td>205.31%</td>
<td>99.99%</td>
<td>98.56%</td>
<td></td>
</tr>
<tr>
<td>Risk ratio (%)</td>
<td>3.66</td>
<td>8.14</td>
<td>3.60</td>
<td>3.28</td>
<td>5.40</td>
</tr>
</tbody>
</table>

From the above-mentioned results, it can be concluded that the total cholesterol and triglycerides of rats fed barley powder were not significantly lower (P<0.05) compared with rats fed basal diet and significantly higher compared with rats fed the hypercholesterolemic diet, but there were slightly differences in LDL- and HDL-cholesterol compared with rats fed the hypercholesterolemic diet. These results are in agreement with those reported by Osawa et al. (1992), Hartland (1994), Wang et al. (1997), Arimoto et al. (2000), and Wilson et al. (2004).

Effect of powder from young green barley leaves on liver and kidney functions of rats:

Determination of transaminase enzymes activity. Alanine transaminase (ALT) and Aspartate transaminase (AST) released into the blood by the damaged liver is one of the most useful indicators of liver function. Since the increase in these enzymes activities means that the liver becomes abnormal case.

The mean values of plasma transaminase activities of ALT and AST were presented in Table (4). Mean values of ALT of rats fed powder from young green barley at different concentrations (10 and 20%) had a similar values (34.33±2.06, 34.06±1.00 U/ml, respectively) with rats fed basal diet (36.67±2.93 U/ml) while, hypercholesterolemic diet was 50.67±4.26 U/ml. It could be seen that the rats fed on the powder from barley exhibited a significant decrease among rats fed high cholesterol and basal diet. On the other hand, the values of AST in rats fed the powder from barley at 10 and 20% were not significantly different (36.33±2.03 and 37.33±1.33 U/ml, respectively) with rats fed basal diet (35.00±1.00 U/ml), while significantly higher with among rats fed hypercholesterolemic (HCD) diet (73.67±6.89 U/ml). These results are in agreement with those reported by Delaney et al. (2003).
Table (4): Effect of powder from young green barley leaves on liver and kidney functions of rats after 8 weeks

<table>
<thead>
<tr>
<th>Parameters</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT (U/ml)</td>
<td>36.67</td>
<td>50.87</td>
<td>34.63</td>
<td>34.60</td>
<td>8.00</td>
</tr>
<tr>
<td>AST (U/ml)</td>
<td>38.85</td>
<td>67.67</td>
<td>38.33</td>
<td>36.33</td>
<td>11.47</td>
</tr>
<tr>
<td>Urea (mg/100 ml)</td>
<td>35.8</td>
<td>57.85</td>
<td>53.55</td>
<td>50.55</td>
<td>6.49</td>
</tr>
<tr>
<td>Creatinine (mg/100 ml)</td>
<td>0.45</td>
<td>0.60</td>
<td>0.55</td>
<td>0.50</td>
<td>0.33</td>
</tr>
<tr>
<td>Uric acid (mg/100 ml)</td>
<td>4.33</td>
<td>3.87</td>
<td>3.71</td>
<td>3.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Data of serum urea, creatinine and uric acid of different experimental diets after 8 weeks are illustrated in Table (4). Mean of values of urea were 50.67±2.60 and 40.33±2.91 mg/100 ml serum for rats fed the powder barley at 10 and 20%, respectively. These values were lower than that of rats fed basal diet and 20%, respectively. The values were lower compared with rats 26.51±0.22 mg/100 ml serum, but these values were lower compared with rats 65.67±1.45 mg/100 ml serum. While, the values of creatinine for rats fed the barley powder were found to be 1.23±0.09, 0.79±0.02 mg/100 ml serum, the obtained values were lower than that of rats fed hypercholesterolemic diet (1.60±0.12 mg/100 ml serum) and higher than those rats fed basal diet (0.65±0.01 mg/ml serum). But uric acid values were significantly lower of rats fed the barley powder when compared with rats fed basal diet and similar to that fed with high cholesterol diet.

These results are in the same trend with that reported by Jackson et al. (1994) and Delamay et al. (2003).

Effect of different experimental diets on total proteins, albumin, globulin and hemoglobin of rats:

Total proteins, albumin, globulin and hemoglobin of rats serum fed on test diets are illustrated in Table (5). Results show that the mean of values of total proteins were 6.79±0.04, 6.34±0.06 mg/100 ml serum in rats fed the powder barley at concentrations of 10% and 20%, respectively. These values were similar with rats fed hypercholesterolemic diet (6.42±0.20 mg/100 ml serum) and higher than that of rats fed basal diet (5.82±0.06 mg/100 ml serum). But the serum albumin of rats fed different experimental diet non significatively increased when compared with control group.

On the other hand, the mean values of globulin in rats fed the powder barley at different levels (10 and 20%) and high cholesterol were non significatively higher with rats fed basal diet. Data concerning albumin/globulin (A/G) ratio in rats serum after feeding of rats on different diets showed a significant decrease when compared with control group. While, the mean values of hemoglobin in rats fed the powder from barley were non significant with rats fed basal diet and high cholesterol. These results are in agreement with those reported by Jackson et al. (1994) and Wilson et al. (2004).

Table (5): Effect of powder from young green barley leaves on total protein and A/G ratio in serum of rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (g/100 ml)</td>
<td>6.79</td>
<td>6.34</td>
<td>6.42</td>
<td>5.82</td>
<td>0.33</td>
</tr>
<tr>
<td>Albumin (g/100 ml)</td>
<td>3.24</td>
<td>2.96</td>
<td>3.18</td>
<td>2.80</td>
<td>0.30</td>
</tr>
<tr>
<td>Globulin (g/100 ml)</td>
<td>3.55</td>
<td>3.38</td>
<td>3.24</td>
<td>3.02</td>
<td>0.33</td>
</tr>
<tr>
<td>A/G ratio (%)</td>
<td>0.93</td>
<td>1.02</td>
<td>0.93</td>
<td>0.94</td>
<td>0.01</td>
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</tbody>
</table>

Histopathological findings:

Liver:

Control group:

The histopatho logical findings of control group revealed normal hepatic architecture, no necrosis, and no inflammation (Fig. 1).

High cholesterol group:

The microscopical examination of liver tissue revealed vacuolation in the hepatocytes and hepatocytes were arranged in a normal manner. The liver weight was detected (Fig. 2).

Hypercholesterolemia group:

The histopathological findings of group were associated with elevation of serum cholesterol and triglyceride levels. The liver weight was increased (Fig. 3). The liver of rats fed on 10% and 20% barley was recognized.

Kidneys:

Control group:

The microscopical examination of kidney tissue revealed normal architecture of tubules.
Table (5): Effect of different experimental diets on total proteins, albumin, globulin and hemoglobin in rats after 8 weeks.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (g/100 ml serum)</td>
<td>6.82</td>
<td>6.42</td>
<td>6.79</td>
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</tr>
<tr>
<td>Albumin (g/100 ml serum)</td>
<td>3.83</td>
<td>3.70</td>
<td>3.26</td>
<td>3.58</td>
<td>0.43</td>
</tr>
<tr>
<td>Globulin (g/100 ml serum)</td>
<td>2.47</td>
<td>2.73</td>
<td>2.71</td>
<td>2.77</td>
<td>0.71</td>
</tr>
<tr>
<td>A/G ratio (%)</td>
<td>1.61</td>
<td>1.96</td>
<td>1.54</td>
<td>1.50</td>
<td>0.42</td>
</tr>
<tr>
<td>Hemoglobin (mg/100 ml serum)</td>
<td>12.68</td>
<td>13.97</td>
<td>13.76</td>
<td>13.85</td>
<td>0.17</td>
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</table>

Histopathological findings:
Liver:
Control group:
The histopathological examination of the liver of rats fed basal diet (control group) revealed nearly histologic hepatic tissues, where normal hepatocytes were arranged in cords around central vein. Moreover, small bile ducts lined by cuboidal epithelium with portal vessels were observed in the portal area (Fig. 1).

High cholesterol group:
The microscopic examination of the liver rats fed on high cholesterol revealed vacuolation of the most hepatocytes. Multiple areas of lymphocytic cellular aggregation among the hepatic parenchyma. Thrombosis of the portal vessels with lymphocytic cellular infiltration of the portal areas were also detected (Fig. 2).

Hypercholesterolemic diet with powder of young green barley leaves groups:
The histopathological examination of the liver rats diet on high cholesterol with powder from young green barley leaves at different concentrations (10 & 20%) were illustrated in the following figures. Addition of powder from young green barley leaves with concentrations of 10 and 20% was associated with enhancement of the microscopic picture of the liver where vacuolation of the cytoplasm with few hepatocytes was noticed in liver of rat fed on 10% barley (Fig. 3). While, no vacuolation of the hepatocytes was detected in the liver of rat fed on 20% barley. However, lymphocytic cellular infiltration of the portal area was recorded in liver of rats fed on 10% or 20% barley (Fig. 4).

Kidneys:
Control group:
The microscopic examination of the kidneys of rats fed on basal diet revealed nearly normal histological structure of the renal tissues. The renal tubules were lined by simple cuboidal epithelium with round nuclei and
eosinophilic cytoplasm. The glomeruli were formed from glomerular tufts and Bowman's capsule with clear Bowman's space (Fig. 5).

**Hypercholesterole diet with powder of young green barley leaves groups:**

On the other hand, addition of powder from barley to the rats containing high cholesterol had little effect on the microscopic lesions induced by feeding on high cholesterol diet whereas, the histopathological examination of the kidneys of rats fed on high cholesterol with or without addition of powder from young green barley leaves at different levels (10 and 20%) revealed nearly similar microscopic changes. However, the severity of these changes was more in the kidneys of rats fed on high cholesterol diet alone. These changes were reported by cloudy swelling of the lining epithelium of renal tubules (Fig. 6). Moreover, hyaline casts within the lumen of the some renal tubules were also seen (Fig. 7).

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**Fig. (1):** Liver of rat fed on basal diet showing normal histologic structure of hepatic parenchyma. H & E stain X 400

**Fig. (2a):** Liver of rat fed on high cholesterol diet showing hemorrhage of portal vessel with lymphocytic cellular infiltration of the portal area and vacuolation of the cytoplasm of hepatocytes. H & E stain X 400

**Fig. (3a):** Liver of rat fed on high cholesterol diet with 10% powder of young green barley leaves showing vacuolation of few hepatocytes. H & E stain X 400

**Fig. (4):** Liver of rat fed on high cholesterol diet and 20% powder of young green barley leaves showing no vacuolation of hepatocytes with lymphocytic cellular infiltration of the portal area. H & E stain X 400
Effect Of Addition Of Freeze Dried From Young Green .... 1699

Fig. (5): Kidney of rat fed on basal diet showing normal histological structure of renal tubules (T) and glomeruli (G). H & E stain X 400

Fig. (6): Kidney of rat fed on high cholesterol diet showing cloudy swelling of renal tubules. H & E stain X 400

Fig. (7): Kidney of rat fed on high cholesterol diet with powder of young green barley leaves showing eosinophilic cast inside the lumen of renal tubules. H & E stain X 400.

REFERENCES


تأثير إضافة أوراق الشعير الخضرة المجففة على القنوات منخفضة مستوي الكولسترول

أرجأ فرحة على فرد

عين الكيمياء الزراعية - كليّة الزراعة - جامعة بني

أجريت هذه الدراسة لمعرفة تأثير تركز تكاثر مختلفة من بوذة أوراق الشعير الخضراء المجففة على أداء مسؤول الكولسترول ومستويات دهون الدم. وكلاً يتضمن بفوائد خاصة وآتيا في فرار النرجس التي تتم على وجهة مرتبطة في محاولة كولسترول وذلك لمجلة 8 أعداد. وقد أجريت هذه الدراسة في 21 قار تقسيمها إلى أربعة مجموعات أثرت على فريق الابتكار الفعلي من الكولسترول. والثانية على مجموعة مكون من الكولسترول وباقي المجموعات على الابتكار الفعلي.MODULES الملاحظة تكثّف من الكولسترول وبناء تكاثك من 1000 إلى 2000 في نهاية الجريدة. وتم تقديم كل من زمن القنوات وكمية الطعام المذبوح وبكافة اتخاذ.

لاجأت النتائج حدوث زيادة مماثلة في زمن القنوات وأستيلات الطعام. لمجموعة القنوات التي تمت على مواد أوراق الشعير مغذية بتقسيم الابتكار في جميع المجموعات. وكذلك لم أجز الحقيقة تكثّف الكولسترول النبئي والأيضي كليات الكولسترول، والبروتينات التي مرتبط في الكولسترول، والبروتينات الدهنية مرتبط في الكولسترول (LDL) والبروتينات الدهنية مرتبط في الكولسترول (HDL) والبروتينات الدهنية مرتبط في الدهون (VLDL).

الثلاثية والليピروتيتين المنخفضة الكثافة بينما يحدث ارتفاع معنوي في الليپروتيتين المرتفعة الكثافة في المجموعة التي تحتوي على مسحوق أوراق الشعير، فضلاً عن المجموعة المنخفضة الكثافة بالمقارنة بالمجموعة مرتفعة الكولسترول وزيادة الإفرازات. تأثرت هذه الاختلافات بتلك النتائج بتقليل نسبة الترويج للإفرازات في تلك المجموعة. وتبين هذه النتائج أن استخدام مسحوق أوراق الشعير يقلل من النتائج بالإفرازات. كما توضح النتائج تحليل وظائف الزيوت النباتية المختلفة في مجموعة الأغذية والمجموعة منخفضة الكولسترول. وتستخدم هذه النتائج لتحسين مستويات الدهون النباتية والخضروات. كما تظهر النتائج أن استخدام مسحوق أوراق الشعير يقلل من水平 الدهون النباتية. وتوضح النتائج أن استخدام مسحوق أوراق الشعير يقلل من نسب الدهون النباتية.