The use of eggplant peel powder in the treatment of hyperlipidemia caused by antibiotics administration in male local rabbits

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Abstract

This study was denoted to investigate the effect of eggplant peel powder in the treatment of hyperlipidemia caused by antibiotics (amoxicillin and cephalaxin) administration in male rabbits. In this study, fifteen male rabbits were used that divided into three groups; the first, the control, the second & third groups were treated with 10 mg/kg amoxicillin and cephalaxin, respectively for 14 days. Blood samples were collected from these groups and lipid profile tests were done. Then, the groups which treated with antibiotics were supplied with pellets mixed with 20 mg/kg eggplant peel powder once per day for 21 days. Again, blood samples were taken for lipids assays. Results illustrated a significant (p<0.05) elevation at total cholesterol, triglycerides, lipoproteins, and atherosclerosis index means in the groups treated with these two antibiotics as compared with the control group. Concerning the impact of eggplant peel powder on antibiotics administration, these results showed no significant differences in lipids profile parameters in the groups treated with these two antibiotics and eggplant peel powder except cholesterol and LDL-C in cephalaxin group which differ significantly. It concluded that eggplant peel powder act in the treatment of hyperlipidemia caused by antibiotics uptake and this may be due to the elevated levels of anthocyanins in peel powder especially nasunin. Thus, these compounds act to decrease the high concentrations of serum lipids and return them to the normal level.

Keywords: Eggplant peel powder, hyperlipidemia, antibiotics

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Introduction

Eggplant (Solanum melongena L.) is a vegetable typical food of the Mediterranean regions and consumed worldwide[1-3]. It is an essential vegetable cultivated over 2 million of the world’s[2]. This vegetable is rich in antioxidant compounds, ranking among the 10 vegetables in terms of antioxidant activity[1, 3-6]. Further, eggplant has an elevated level of free reduced saccharides, anthocyanins, phenols, alkaloids and amides[2]. In addition, it has significant importance in the prevention of some diseases, including cardiovascular disease, liver disturbances, diabetes and tumors[2, 3, 5].

An antibiotic; a chemical compound that kills and prevents the growth of microbial organisms[8]. Multiple studies have investigated to estimate their pharmacodynamic and adverse effects. Adverse effects are multiple, different and dangerous depending on the antibiotics used, microorganisms targeted and period of administration[9, 10]. Amoxicillin; a bactericidal antibiotic that excreted essentially by the kidney; glomerular filtration as well as tubular secretion[8, 9]. Cephalexin is a semisynthetic antibiotic that absorbed when uptake orally. Hypersensitivity is the most common side effect, further, the most side effects include nausea, vomiting, and gastrointestinal (GI) impairment[11].

Hyperlipidemia, due to the alternations in the total lipid, the main reason for heart diseases, such as coronary disease. In many regions, most hyperlipidemic people use herbs and plants to prevent hyperlipidemia and atherosclerosis formation. Natural herbs have few side impacts and many targets, while medical remedy possesses valuable side impacts[12]. Many studies demonstrated that the essential phenolics in eggplant peel are anthocyanins[4], therefore, the present study aimed to investigate the effect of eggplant peel powder in the treatment of hyperlipidemia caused by these two antibiotics; amoxicillin and cephalaxin in male rabbits.

Materials and Methods

Animal Collection
Fifteen male local rabbits with about 3.5-4 months age and between 1300 – 1500 g weights were chosen. These rabbits kept at Animal House for seven days before the experiment and given pellets; a standard diet which constitutes from corn starch, vitamins, fibers, and minerals. The condition in Animal House was 23- 25°C.

Experiment Design

Antibiotics Administration
Rabbits were equally classified into three groups (composed of five animals). The first group was a control, the second and the third groups were administrated orally with 10 mg/kg of amoxicillin and 10 mg/kg of cephalexin, respectively. Dose-volume was 1 ml per day and the experiment lasted for 14 days. Then, blood samples as about 2 ml, were collected by heart puncture, centrifuged and serum samples were preserved at about -6°C for lipids profile tests procedure.

Eggplant peel powder
Groups administrated antibiotics (GII and GIII) were supplied with pellets contained 20 mg/kg eggplant peel powder once per day for 21 days. Blood samples were collected from these groups and centrifuged. Serum preserved at about -20°C until used in the determination of lipids profile tests procedure.

Lipids Profile Tests
Total cholesterol, triglycerides, and HDL-cholesterol were estimated by using commercial kits (Biomeruik Company, France). These kits were dependent on enzymatic methods, while the HDL-C kit was depended on the formation of supernatant and reaction of precipitation.

The equation of Friedewald was used in order to calculate LDL-C, as below:

\[ \text{[LDL-C]} = \text{[TC]} - \text{[HDL-C]} - \text{[VLDL-C]} \]

Further, VLDL-C was estimated according to the following equation:

\[ \text{[VLDL-C]} = \text{TG} / 5 \]

While the estimation of the atherosclerosis index was done by dividing the concentration of LDL-C on HDL-C [13].

Statistical Assay
The results of the present investigation were tested by depending on the analysis of variance (ANOVA) and Duncan test was used to determine the significance among means depending on the program of SPSS (ver. 22) at p< 0.05 [14].

Results and Discussion
The results of the present study in Table (1) and (2) showed a significant (p< 0.05) increase at the means of total cholesterol as well as triglycerides concentration at groups administrated amoxicillin and cephalexin as in comparison with the control group. Total cholesterol means were 124.42 ± 2.31, 129.29 ± 4.25 and 104.34 ± 3.90 mg/ dl in amoxicillin, cephalexin and control groups, respectively. On the other hand, the triglycerides concentration means were 89.37 ± 3.03, 85.33 ± 4.47 and 68.20 ± 3.96 g/ dl in amoxicillin, cephalexin and control groups, respectively. Further, no significant differences in the means of total cholesterol and triglycerides concentration at the group administrated with amoxicillin and eggplant peel powder. The cholesterol and triglycerides concentration means were 106.4 ± 2.56 and 70.56 ± 2.21 mg/ dl, respectively. Concerning the group treated with cephalexin + eggplant peel powder, a significant (p<0.05) difference in total cholesterol concentration mean and no significant difference in triglycerides concentration mean were shown in comparison with the control. Total cholesterol and triglycerides concentrations were 112.22 ± 4.04 and 71.32 ± 4.21 mg/ dl, respectively.
Table (1): Effect of amoxicillin and eggplant peel powder on cholesterol and triglycerides concentrations.

<table>
<thead>
<tr>
<th>Parameters Groups</th>
<th>Total cholesterol (TC)</th>
<th>Triglycerides (TG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>104.34 ± 3.90 a</td>
<td>68.20 ± 3.96 a</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>124.42 ± 2.31 b</td>
<td>89.37 ± 3.03 b</td>
</tr>
<tr>
<td>Amoxicillin+ eggplant peel powder</td>
<td>106.4 ± 2.56 a</td>
<td>70.56 ± 2.21 a</td>
</tr>
</tbody>
</table>

*The values represented means ± SD
*Similar small letters denote no significant differences between means, while different small letters denote significant (p<0.05) differences.

Table (2): Effect of cephalexin and eggplant peel powder on cholesterol and triglycerides concentrations.

<table>
<thead>
<tr>
<th>Parameters Groups</th>
<th>Total cholesterol (TC)</th>
<th>Triglycerides (TG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>104.34 ± 3.90 a</td>
<td>68.20 ± 3.96 a</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>129.29 ± 4.25 b</td>
<td>85.33 ± 4.47 b</td>
</tr>
<tr>
<td>Cephalexin+ eggplant peel powder</td>
<td>112.22 ± 4.04 c</td>
<td>71.32 ± 4.21 a</td>
</tr>
</tbody>
</table>

*The values represented means ± SD
*Similar small letters denote no significant differences between means, while different small letters denote significant (p<0.05) differences.

Concerning lipoprotein concentration, results of the present investigation in Table (3) and (4) illustrated a significant (p<0.05) elevation at the means of LDL-cholesterol, VLDL-cholesterol, atherosclerosis index in the groups treated with amoxicillin and cephalexin in comparison with the control group. LDL-C means were 23.16 ± 2.08, 39.98 ± 3.82 and 37.41 ± 2.58 mg/dl in control, amoxicillin and cephalexin groups, respectively. The VLDL-C means were 14.64 ± 0.30, 19.82 ± 0.52 and 17.52 ± 0.92 mg/dl in the three groups, respectively. Atherosclerosis index means in the three groups were 304 ± 0.08, 0.636 ± 0.31 and 0.526 ± 0.11, respectively.

Further, these results showed a significant (p<0.05) decrease in HDL-C means in amoxicillin and cephalexin groups in comparison with the control. HDL-C concentration means were 71.30 ± 2.77, 64.83 ± 2.24 and 65.41 ± 3.83 mg/dl in control, amoxicillin and cephalexin groups, respectively. On the other hand, no significant difference was showed in lipoproteins and means of atherosclerosis index in group’s administrated amoxicillin and eggplant peel powder. Lipoproteins means were 69.62 ± 2.32, 25.02 ± 3.54 and 13.71 ± 0.52 mg/dl, respectively, while atherosclerosis index mean was 0.361 ± 0.22. In addition, the cephalexin and eggplant peel powder group demonstrated that no significant difference in HDL-C, VLDL-C, as well as atherosclerosis index, means, while significant difference was found in LDL-C mean. The lipoprotein (HDL, LDL, and VLDL) means were 70.02 ± 1.67, 28.93 ± 2.24 and 13.78 ± 0.72 mg/dl, respectively, while the mean of atherosclerosis index was 0.392 ± 0.10.

Table (3): Effect of amoxicillin and eggplant peel powder on lipoproteins concentrations and atherosclerosis index.

<table>
<thead>
<tr>
<th>Parameters Groups</th>
<th>HDL-C concentration (mg/dl)</th>
<th>LDL-C concentration (mg/dl)</th>
<th>VLDL-C concentration (mg/dl)</th>
<th>Atherosclerosis index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>71.30 ± 2.77 a</td>
<td>23.16 ± 2.08 a</td>
<td>14.64 ± 0.30 a</td>
<td>0.304 ± 0.08 a</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>64.83 ± 2.24 b</td>
<td>39.98 ± 3.82 b</td>
<td>19.82 ± 0.52 b</td>
<td>0.636 ± 0.31 b</td>
</tr>
<tr>
<td>Amoxicillin+ eggplant peel powder</td>
<td>69.62 ± 2.32 a</td>
<td>25.02 ± 3.54 a</td>
<td>13.71 ± 0.52 a</td>
<td>0.361 ± 0.22 a</td>
</tr>
</tbody>
</table>

*The values represented means ± SD
*Similar small letters denote no significant differences between means, while different small letters denote significant (p<0.05) differences.
Table (4): The effect of cephalexin and eggplant peel powder on lipoproteins concentrations and atherosclerosis index.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>Cephalexin</th>
<th>Cephalexin+ eggplant peel powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL-C concentration (mg/dl)</td>
<td>71.30 ± 2.77 s</td>
<td>65.41 ± 3.83 b</td>
<td>70.02 ± 1.67 s</td>
</tr>
<tr>
<td>LDL-concentration (mg/dl)</td>
<td>23.16 ± 2.08 s</td>
<td>37.41 ± 2.58 b</td>
<td>28.93 ± 2.24 c</td>
</tr>
<tr>
<td>VLDL-C concentration (mg/dl)</td>
<td>14.64 ± 0.30 s</td>
<td>17.52 ± 0.92 b</td>
<td>13.78 ± 0.72 c</td>
</tr>
<tr>
<td>Atherosclerosis index</td>
<td>0.304 ± 0.08 s</td>
<td>0.526 ± 0.11 b</td>
<td>0.392 ± 0.10 s</td>
</tr>
</tbody>
</table>

*The values represented means ± SD
*Similar small letters denote no significant differences between means, while different small letters denote significant (p<0.05) differences.

Antibiotics pharmacodynamic impacts on blood elements, plasma enzymes, chemicals, and minerals were investigated in experimental and domesticated models [9]. In the present work, the measurement of the concentration means of total cholesterol, triglycerides, lipoproteins, and atherosclerosis index illustrated a significant elevation (except HDL-C which decline significantly) in amoxicillin and cephalexin groups compared with control animals.

The elevation in the concentration of total cholesterol in the present study may be related to these antibiotics which inhibit CYPA, an essential enzyme participates in the breakdown of total cholesterol molecules into fatty bile acids. It might be causing an elevation in total cholesterol concentrations when cholesterol molecules are not breakdown into fatty bile acids and precipitate in the bloodstream [15]. Recent studies on serum lipids denoted total cholesterol/phosphoglycerides lipids incorporated with other indicators are the essential elements in the fluidity of the plasma membrane. This finding might be suggesting a decline in this fluidity and lead to disturbances in the functions of the plasma membrane [8, 10].

On the other hand, the increase in the level of plasma triglycerides may be possibly due to the activation of the regulatory enzymes in triglycerides biosynthesis. As the breakdown of lipids occurs in the liver, any alteration in the concentration of lipids may be due to the toxicity of the liver which is the main adverse impact of antibiotics uptake [15].

Generally, peel tissue has elevated levels of antioxidants such as phenolics, anthocyanins, and flavanols than pulp tissue (about two and four times greater than in pulp) [4, 5, 6]. Eggplant peel demonstrated higher levels of those components than pulp [4, 5]. Especially, the anthocyanin level in the peel which is much than the pulp tissue [9]. Various types of anthocyanins have been extracted and diagnosed from eggplant peel [4, 5]. Nasunin, delphinidin-3-(pcoumaroylrutinoside)-5-glucoside, the main anthocyanin in this peel powder [4, 5] (ranging from 69.1% to 87.7%) [7]. Many investigated illustrated that anthocyanins may possess essential impacts on declining coronary diseases and tumors risks, chemoprotective and anti-inflammatory agents [7, 12].

The uptake of this powder caused a decrease at the means of cholesterol, triglycerides and LDL-C concentrations. In our investigation, antioxidant especially anthocyanin significantly declined the levels of lipids in the hyperlipidemic animals, denoted peel anthocyanin may decrease the development of cardiovascular disease [12]. In this study, the anthocyanins in eggplant peels declined the concentrations of total cholesterol, LDL-C, and elevating HDL-C. Therefore, eggplant peel powder use in the treatment of hyperlipidemia caused by antibiotics administration may be due to the high levels of anthocyanins in these peels especially nasunin. Thus, these compounds act to minimize the high concentrations of lipids and return them to the normal level.

References


