Effect of Piperine on Lipid Profile of Non-Transgenic Mice


Abstract – Background: Piperine was isolated from Piper nigrum popularly known as black pepper. There were many studies earlier about piperine that it is a powerful bioenhancer for many drugs especially antibiotics. Piperine extract believed to potentiates drug into several folds. The present study was focused on its individual effect on biochemical parameters like blood sugar and lipid profile before and after the administration of piperine.

Materials and methods: 30 nontransgenic mice were taken for study obtained from animal house of faculty of Medicine, Garyounis University, Benghazi, Libya. These mice were fed with high cholesterol diet and divided into 2 groups. 20 mice were administered with piperine at a dose of 5mg/kg body weight. Piperine was isolated in Department of Pharmacognosy, Faculty of Pharmacy, Garyounis University, Benghazi and 10 mice were not administered with piperine but fed with high fat diet. These mice were anaesthetized with ketamine and halothane and blood was withdrawn from each mouse before study by cardiocentesis. Piperine was administered with high fat diet for 3 weeks one group of 20 mice and only high fat diet given to another group consists of 10 mice. Again blood samples were taken after 3 weeks from both groups. Blood sugar, Serum, Cholesterol, Serum triglycerides and Serum high density lipoprotein (HDL) cholesterol were measured in the Serum by authenticated methods.

Results: Blood sugar was significantly elevated (p=0.001) after 3 weeks after administration of the piperine whereas it was decreased in other group who were not given piperine. Serum cholesterol was significantly elevated (p=0.0025)3 weeks administration after piperine administration with high fat diet. There was no decrease in the cholesterol levels after when compared with other group where the piperine was not administered. Serum triglycerides levels were significantly decreased (p=0.0005) after the administration of piperine but there was no significant difference in other group. HDL cholesterol was significantly elevated (p=0.0032) after administration of piperine and it was not significant (p=0.6553) in the group where there was no piperine administration.

Conclusion: As per this study the beneficial effect of piperine appears to be lowering triglycerides and increasing HDL cholesterol. Further research may show promising results on HDL raise. This study has shown it does not have any role in reducing blood sugar and total cholesterol.

Keywords: Piperine, Nontransgenic Mice, Blood Sugar, Lipid Profile

I. Introduction

Piperine was isolated from Piper nigrum popularly known as black pepper. There were many studies earlier about piperine that it is a powerful bioenhancer for many drugs especially antibiotics. Piperine extract is believed to potentiate the drug actions by several folds. It strongly inhibits hepatic and intestinal aryl hydrocarbon hydroxylase and Uridine 5'-diphospho-glucuronosyltransferase (UDP-glucuronyl transferase). Piperine’s bioavailability enhancing property is also partly attributed to increased absorption as a result of its effect on the ultrastructure of intestinal brush border [1].

Additionally, piperine has shown various beneficial effects, like decrease in blood pressure, protection against oxidative damage, lowering the lipid peroxidation and anti-mutagenic and anti-tumor effects [1].

The present study was focused on its individual effect on biochemical parameters like blood sugar and lipid profile before and after the administration of piperine.

II. Materials and methods

A total of 30 nontransgenic, CF-1albino mice (strain 023) see fig.1obtained from animal house of faculty of Medicine, Garyounis University, Benghazi, Libya were studied. All these mice were fed with a high cholesterol diet and were divided into two groups. Group 1 comprised of 20 mice which were administered piperine at a dose of 5mg/kg body weight for a period of 3 weeks, in addition to high cholesterol diet. Group 2 comprised of 10 mice which were only fed with a high cholesterol diet, and not piperine.
Piperine was isolated in the Department of Pharmacognosy, Faculty of Pharmacy, Garyounis University, Benghazi.

The study mice were anesthetized with ketamine and halothane and blood was withdrawn from each mouse by cardiocentesis. Piperine was administered with high fat diet for 3 weeks to mice in Group 1 and only high fat diet was given to mice in Group 2. Blood samples were again collected after 3 weeks from both groups. At both times, blood sugar, serum cholesterol, serum triglycerides and serum high density lipoprotein (HDL) cholesterol were measured by authenticated methods. Total cholesterol (TC) was estimated using the Cholesterol Oxidase Phenol 4-Aminoantipyrine Peroxidase (CHOD-PAP) Method [2], [3]. The GPO-PAP method was used to estimate triglyceride (TG) levels [2], [4]. High density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) were estimated using a two-step procedure: (i) precipitation and (ii) enzymatic determination [2], [5], [6].

Statistical analysis was done using Microsoft excel and GraphPad software, GraphPad inc, USA. P-values were calculated by using t-test. This study was approved by the university ethics committee before it was started.

Our study demonstrated a beneficial effect of piperine on the serum lipid levels, by lowering triglycerides and increasing HDL cholesterol. However, there was no reduction in the blood sugar and total cholesterol levels. Vijayakumar et al. have conducted various studies on the use of piperine. They demonstrated that in antithyroid drug-induced hyperlipidemic rats, the simultaneous administration of piperine and high-fat diet (HFD) significantly reduced plasma lipids and lipoproteins levels, except for HDL, which was significantly elevated. Piperine supplementation also improved the plasma levels of apolipoprotein A-I (apo A-I), triiodothyronine (T3), thyroxine (T4), testosterone, and significantly reduced apolipoprotein B (apo B), thyroid stimulating hormone (TSH), and insulin to near normal levels [7]. Another study showed that supplementation with black pepper or piperine, could reduce HFD induced oxidative stress to the cells [8]. Yet another study by the same group, piperine supplementation markedly protected erythrocytes from oxidative stress by improving the antioxidant status in HFD fed antithyroid drug treated rats [9].

In a study by Park et al., piperine attenuated fat cell differentiation by down-regulating Peroxisome proliferator-activated receptor gamma (PPARγ) activity as well as suppressing PPARγ expression, thus leading to potential treatment for obesity-related diseases [10].

Our study showed a significant elevation in the blood sugar levels with piperine. However, Kaur and Meena demonstrated that treatment of the streptozocin-induced diabetic rats on a HFD with a combination of piperine, and it was not significant (p=0.6553) in the group where there was no piperine administration.

### Table 1: Change in various parameters in mice fed with Piperine and high fat diet

<table>
<thead>
<tr>
<th>Parameter</th>
<th>At baseline</th>
<th>After 3 weeks of piperine administration</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood sugar</td>
<td>140.6±68.32</td>
<td>278.8±101.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>132.6±27.46</td>
<td>170.6±31.9</td>
<td>0.003</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>103.1±1.119</td>
<td>87.39±18.55</td>
<td>0.0005</td>
</tr>
<tr>
<td>HDL</td>
<td>60.35±16.33</td>
<td>74.35±11.44</td>
<td>0.003</td>
</tr>
</tbody>
</table>

### Table 2: Change in various parameters in mice fed with only high fat diet

<table>
<thead>
<tr>
<th>Parameter</th>
<th>At baseline</th>
<th>After 3 weeks of high fat diet</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood sugar</td>
<td>236.7±48.73</td>
<td>176.7±65.38</td>
<td>0.01</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>155.1±70.61</td>
<td>183.4±37.74</td>
<td>0.271</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>103.7±0.7</td>
<td>104±0.7</td>
<td>0.774</td>
</tr>
<tr>
<td>HDL</td>
<td>65.89±17.10</td>
<td>72±16.11</td>
<td>0.655</td>
</tr>
</tbody>
</table>

### IV. Discussion

Black pepper (Piper nigrum) is a commonly used spice, valued for its unique biting quality attributed to the alkaloid, piperine. Black pepper is used not only in our normal diet, but also for a various other purposes such as medicinal, as a preservative, and in perfumery [1].

Our study demonstrated a beneficial effect of piperine on the serum lipid levels, by lowering triglycerides and increasing HDL cholesterol. However, there was no reduction in the blood sugar and total cholesterol levels. Our study showed that supplementation with black pepper or piperine, could reduce HFD induced oxidative stress to the cells [8]. Yet another study by the same group, piperine supplementation markedly protected erythrocytes from oxidative stress by improving the antioxidant status in HFD fed antithyroid drug treated rats [9].

Fig. 1.

### III. Results

The results of the study are shown in Table 1. Blood sugar was significantly elevated (p=0.001) at the end of 3 weeks after administration of the piperine in Group 1 whereas it was decreased in Group 2 (p=0.01). Serum cholesterol was significantly elevated (p=0.0025)3 weeks administration after piperine administration with high fat diet. There was no decrease in the cholesterol levels after when compared with other group where the piperine was not administered. Serum triglycerides levels were significantly decreased (p=0.0005) after the administration of piperine but there was no significant difference in other group. HDL cholesterol was significantly elevated (p=0.0032) after administration of piperine and there was no significant difference in other group.

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In a study by Park et al., piperine attenuated fat cell differentiation by down-regulating Peroxisome proliferator-activated receptor gamma (PPARγ) activity as well as suppressing PPARγ expression, thus leading to potential treatment for obesity-related diseases [10].

Our study showed a significant elevation in the blood sugar levels with piperine. However, Kaur and Meena demonstrated that treatment of the streptozocin-induced diabetic rats on a HFD with a combination of piperine,
curcumin and quercetin resulted in a marked decrease in plasma glucose, triglycerides, total cholesterol, and LDL with a concomitant increase in plasma HDL [11]. This requires further evaluation to see if the hypoglycemic effects are seen when piperine is given alone. Apart from this, several studies have demonstrated a blood pressure lowering effect of piperine [1], [12]-[14]. As already discussed, the main role of piperine is in enhancing the action of drugs, by preventing their biotransformation. It also seems to have antimutagenic and antitumor effects [1].

Piperine seems to have multiple beneficial effects, especially in terms of reducing the triglyceride levels as well as increasing the HDL levels as shown in our study. The blood sugar levels, however were elevated. Furthermore, this study, like most data available on piperine is from animal studies. Therefore, there is a need for clinical trials to be conducted to extrapolate these findings in human beings.

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References


