EFFECT OF PERIODIC SUPPLEMENTATION OF HERBAL INFUSION ON THE LIVER FUNCTION AND LIPID PROFILE OF BROILER CHICKENS

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ABSTRACT

The present research study was undertaken at poultry research unit of Agricultural University, Peshawar, Pakistan in June-July, 2010 to investigate the effect of different timings of supplementing medicinal plants (Berberis lycium, Allium sativum, Solanum nigrum and Terminalia arjuna) infusion on the liver function and lipid profile of broiler at day-42. 240 day-old boiler chickens were randomly allocated to four groups; TI-0D, TI-1D, TI-2D, and TI-3D and received infusion (50 ml L⁻¹) on daily, alternate, two and three days of interval, respectively. All groups were divided into two sub–groups (vaccinated and non-vaccinated) each replicated thrice (10 chickens/replicate). Significantly (P<0.05) lower Alanine aminotransferase (ALT) and serum Alkaline Phosphatase (ALP) levels were recorded in group TI-2D, while ALT and ALP levels were the highest in group TI-0D. Numerically lower serum protein in group TI-0D and the higher in group TI-2D was observed. Mean serum triglyceride level was lower (p<0.05) in group TI-2D and significantly higher group TI-0D. High density lipoprotein (HDL) level was significantly (P<0.05) higher in group TI-2D compared to other groups. Serum low density lipoprotein (LDL) was lowest in group TI-2D and highest in group TI-0D. It revealed that supplementing herbal infusion of Berberis lycium, Allium sativum, Solanum nigrum and Terminalia arjuna at two days of interval can improve the liver function and serum lipid profile of broiler chickens.

Key Words: Broiler, herbal infusion, berberis lycium, allium sativam, solanum nigram, terminalia arjuna.

INTRODUCTION

Poultry industry of Pakistan and Afghanistan has a significant contribution in fulfilling the increasing demand of quality protein in human diet in the form of eggs and meat. Presently the growth rate of poultry is 10% annually (Economic Survey of Pakistan, 2010) and it is expected that broiler sector will grow at faster rate globally in the coming years. “Beaf and veal meat production has been declined by 2.38% in Pakistan during 2011”. Poultry meat is the best substitute to fill this gap, as more poultry meat could be produced in shorter period of time from broilers. Geneticists are working to further improve the genetic potential of broiler to produce more meat in a short span of life and with less feed consumption. Balanced nutrition and optimum environment are also very essential to fully exploit the genetic potential of broiler.

Herbs, plant extracts and species can be valuable alternatives for the health and nutrition of the chicken. They have a wide range of activities such as stimulation of feed intake and endogenous secretions or have antimicrobial, coccdiostatic or anathematic activity. Plants have evolved a wide range of secondary metabolites. Most of these active secondary plant metabolites belong to classes of isoprene derivatives, flavonoids and a large number of these compounds have suggested functions as antibiotics or as antioxidants in vivo as well as in food (Shin et al., 1995).

Berbery (Berberis lycium) roots possess lipid lowering, antihypertensive and antiarrhythmic properties, which make it useful to reduce the risk of cardio vascular diseases (Doggrell, 2005; Abidi et al., 2006). It has immuonomodulatory, hypolipidemic and growth promoting properties (Niazi and Durrani, 2006). Berberis lycium roots are used as folk remedy worldwide for the treatment of various inflammatory ailments including lumbago, rheumatism and to reduce fever (Kupeli et al., 2002).

Garlic (Allium sativum) has antibacterial, antimicrobial (Elnimanat et al., 1983) and immuonomadulatry properties (Dorhoi et al., 2006). Epidemiological and animal studies have shown that garlic consumption reduces the incidence of cancer and risk factors for cardiovascular disease, including high cholesterol, high homocysteine, hypertension and inflammation. Low density lipoprotein (LDL) oxidation, arterial, plaque formation, and platelet
aggregation is controlled by garlic (Zeybek et al., 2007). Garlic has marked effect on the haematological parameters (Ademola et al., 2004). Extracts of garlic enhanced host resistance in poultry due to its specific immune response (Dorhoi et al., 2006).

*Solanum nigrum* has been used in traditional Chinese medicine for centuries because of its diuretic, antipyretic and antitumor effects (Li et al., 2007). *Solanum nigrum* serve as immunomodulating agent (Li et al., 2008). Aqueous extract of the leaves of *Solanum nigrum* has anti-convulsant property in chickens, mice and rats (Wannang et al., 2008). *S. nigrum* leaves possessed antinociceptive, anti-inflammatory and antipyretic effects (Zakaria et al., 2009). It has marked antibacterial and antifungal activities (Al-Fatimi et al., 2007). *Solanum nigrum* contain saponins, solanigroside A and solanigroside B (Zhou et al., 2007), 6-methoxy-hydroxycoumarin, syringaresinol-4-O-beta-D-glucopyranoside, pinosin-4-O-beta-D-glucopyranoside, 3, 4-dihydroxibenzoic acid, p-hydroxybenzoic acid, 3-methoxy-4-hydroxyienzoic acid, adenosine (Wang et al., 2007) and alkaloids (Li et al., 2008).

*Terminalia arjuna* is a well documented medicinal plant. It has antibacterial (Perumal et al., 1998; Rani and Khullar, 2004), antimitagenic (Unknown author, 1999), hypolipidemic (Shaila et al., 1998), antioxidant and hypcholesterolametic (Gupta et al., 2001) and anti-inflammatory effects (Tripathi et al., 2005). *Terminalia arjuna* protects the liver and kidney tissues against CCl4-induced oxidative stress by increasing antioxidative defense activities (Manna et al., 2006). It also acts as a gastro protective agent (Devi et al., 2007). Terminalia's active constituents include tannins (Kandil and Nassar, 1998), triterpenoid saponins (*arjunic* acid, *arjunolic* acid, *arjungenin*, *arjunglycosides*) (Manna et al., 2007), flavonoids (*arjunone*, *arjunolone*, *luteolin*), gallic acid, ellagic acid, oligomeric proanthocyanidins (OPCs), phytoestrols, calcium, magnesium, zinc, and copper (Unknown author, 1999) and polyphenol (Kaur et al., 2002). Keeping in view the effectiveness and significant importance of the aforementioned medicinal plants their mixture with different administration schedules was used in broiler chickens.

**MATERIALS AND METHODS**

Present research study was conducted at Poultry Unit of Agricultural University, Peshawar, Pakistan in two factorial randomized complete block design. Broiler chickens were alienated into four treatment groups TI-0D, TI-1D, TI-2D, and TI-3D. Group TI-0D received infusion on daily basis, group TI-1D received infusion on alternate day, and group TI-2D received infusion on alternate two days while group TI-3D received infusion on alternate three days. Each group was divided into two vaccinaed (TI-0DV, TI-1DV, TI-2DV, TI-3DV) and non-vaccinated (TI-0DNV, TI-1DNV, TI-2DNV, TI-3DNV) sub-groups. Each sub groups was carrying three replicates having ten chickens each. Chickens were reared in an open sided house in pens. Feeder, drinker, bulb and other necessary materials were provided to chickens in each pen to maintain sound management and environmental conditions. Experiment was lasted for 35 days.

**Preparation of Infusion**

Medicinal plants (*Berbeis lycium*, *Allium sativum*, *Solanum nigrum* and *Terminalia arjuna*) were purchased from the local market and were ground to powder form. In order to prepare the infusion, 12.5 g of each plant was taken in non metallic container and one liter of hot boiling water was added. The container was kept at room temperature over night. Next morning the infusion was filtered and used in drinking water at the dose rate of 50ml per liter in all groups at different time interval.

**Vaccination**

All the birds of sub group, TI-0DV, TI-1DV, TI-2DV and TI-3DV were vaccinated with Newcastle Disease (ND) and infectious bronchitis (IB) vaccine at day 5th and infectious bursal Disease (IBD) vaccine at day 12th. The Birds were administered with boosting dose of IBD at day 19th and ND at day 22nd. All the birds of sub group TI-0DNV, TI-1DNV, TI-2DNV and TI-3DNV remained unvaccinated.

**Blood Sampling and Analysis**

At the end of experiment, randomly selected one bird per replicate was sampled. Their blood samples were analyzed for Serum Alanine aminotransferase (ALT), Alkaline Phasphatase (ALP) and serum total protein according to the IFCC (International Federation of Clinical Chemistry), serum cholesterol (Allain et al., 1974), triglycerides (TGR) (Werner et al., 1981) and high density lipoprotein (HDL) (Lopes-Virella et al., 1997). Low density lipoprotein (LDL) was calculated by the following formula:

\[
LDL_{cholesterol} \text{ (mg/dl)} = \text{total cholesterol} - \left( \frac{TGR}{5} \right) + HDL_{cholesterol}
\]
The data was statistically analyzed using standard procedure of analysis of variance, using two factorial randomized complete block design as described by (Steel and Torrie 1981). The statistical package SAS (1988) was used to perform the data analysis.

RESULTS AND DISCUSSION

The experiment was carried out periodic supplementation of herbal infusion on the liver function and lipid profile of broiler chickens. The results obtained are presented and discussed as follows:

**Serum Hepatic Parameters/Liver Function Tests**

Mean Alanine aminotransferase (ALT) values per chicken in four groups TI-0D, TI-1D, TI-2D and TI-3D was 32.33, 24.66, 23.66 and 23.50 IU/L, respectively. Data analysis showed significant (P<0.05) differences among the groups. However, effect of vaccination practice and interactive effects were non significant. Significantly lower ALT level was recorded in group TI-2D, while ALT level was the highest in group TI-0D as present in Table I.

**Table I**  
Mean Alanine aminotransferase (ALT) (IU/L), serum alkaline phosphatase (ALP) (IU/L) and serum protein (g/dl) in broiler chickens received medicinal plants* infusion with different schedules of administration.

<table>
<thead>
<tr>
<th>Groups (Administered Schedules)</th>
<th>ALT Mean ± SE</th>
<th>CV%</th>
<th>ALP Mean ± SE</th>
<th>CV%</th>
<th>Protein Mean ± SE</th>
<th>CV%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI-0D</td>
<td>32.33±2.09</td>
<td>15.85</td>
<td>2183.83±203.38</td>
<td>22.81</td>
<td>19.83±2.65</td>
<td>32.74</td>
</tr>
<tr>
<td>TI-1D</td>
<td>24.66±2.26</td>
<td>22.45</td>
<td>1822.67±241.59</td>
<td>32.46</td>
<td>26.16±1.40</td>
<td>13.10</td>
</tr>
<tr>
<td>TI-2D</td>
<td>23.66±2.18</td>
<td>22.62</td>
<td>1366.33±66.56</td>
<td>11.93</td>
<td>27.00±2.14</td>
<td>19.45</td>
</tr>
<tr>
<td>TI-3D</td>
<td>23.50±1.87</td>
<td>19.54</td>
<td>1513.83±58.67</td>
<td>9.49</td>
<td>21.50±2.21</td>
<td>25.26</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>24.83±1.68</td>
<td>23.46</td>
<td>1678.67±135.47</td>
<td>27.95</td>
<td>24.50±1.73</td>
<td>24.52</td>
</tr>
<tr>
<td>Non vaccinated</td>
<td>27.25±1.83</td>
<td>23.37</td>
<td>1764±153.75</td>
<td>30.18</td>
<td>22.75±1.65</td>
<td>25.15</td>
</tr>
<tr>
<td>TI-0DV</td>
<td>31.66±2.02</td>
<td>11.09</td>
<td>1886.67±334.97</td>
<td>30.75</td>
<td>19.66±3.84</td>
<td>33.85</td>
</tr>
<tr>
<td>TI-0DNV</td>
<td>33.00±4.16</td>
<td>21.85</td>
<td>2481.00±79.39</td>
<td>5.54</td>
<td>20.00±4.50</td>
<td>39.05</td>
</tr>
<tr>
<td>TI-1DV</td>
<td>24.00±21.64</td>
<td>19.09</td>
<td>2050±323.57</td>
<td>27.33</td>
<td>27.00±1.52</td>
<td>9.79</td>
</tr>
<tr>
<td>TI-1DNV</td>
<td>25.33±4.25</td>
<td>29.09</td>
<td>1595±368.05</td>
<td>39.96</td>
<td>25.33±2.60</td>
<td>17.79</td>
</tr>
<tr>
<td>TI-2DV</td>
<td>20.66±3.17</td>
<td>26.64</td>
<td>1300±27.48</td>
<td>3.66</td>
<td>27.66±3.52</td>
<td>22.08</td>
</tr>
<tr>
<td>TI-2DNV</td>
<td>26.66±2.18</td>
<td>14.19</td>
<td>1432.3±130.54</td>
<td>15.78</td>
<td>26.33±3.17</td>
<td>20.91</td>
</tr>
<tr>
<td>TI-3DV</td>
<td>23.00±2.64</td>
<td>19.92</td>
<td>1477.67±61.43</td>
<td>7.20</td>
<td>23.66±4.05</td>
<td>29.67</td>
</tr>
<tr>
<td>TI-3DNV</td>
<td>24.00±3.21</td>
<td>23.19</td>
<td>1550±110.15</td>
<td>12.30</td>
<td>19.33±1.85</td>
<td>16.62</td>
</tr>
</tbody>
</table>

Means in the same column with different superscripts are significantly different at α = 0.05  
* Berberis lycium, Allium sativum, Solanum nigrum and Terminalia arjuna.  
TI= represents treatment interval; 0D-3D= 0 to 3 days interval; V= vaccinated; NV= non vaccinated

Mean serum alkaline phosphatase (ALP) values per chicken are presented in Table I. The ALP data when subjected to statistical analysis showed significant (P<0.05) differences among the groups, while non significant between vaccinated and non-vaccinated birds. Similarly non-significant (P>0.05) differences were found in the interaction effects. Significantly lower ALP level was recorded in group TI-2D, while ALP level was the highest in group TI-0D.

ALP is an enzyme, which is associated with the biliary tract. It is not specific to the biliary tract. It is also found in bone and the placenta. Renal or intestinal damage can cause the alkaline phosphatase to rise. When it is present in large amounts, it may indicate liver or bone disease or a tumor.

Berberine, active alkaloid in Berberis lycium, protects the liver due to its antioxidant property. Berberine exhibited antioxidant property by its ability to quench free radicals of 1,1-diphenyl-1-picrylhydrazyl, decrease the leakage of lactate dehydrogenase and ALT and prevent the formation of malondialdehyde induced (Arun et al., 2007).

Findings of the present research study are in agreement to those of Janbaz and Gillani (2000), who reported reduction in serum ALT and ALP levels in rodents by feeding berberine, which is the active alkaloid in Berberis lycium (component of the present infusion). Our results are also supported by Manna et al. (2006) who report reduction in ALP level by Terminalia arjuna. The results of present study are in agreement with Yousef (2009), who worked on mixture of medicinal plants and reported significantly lower ALT values. Similarly Mostefa et al.
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(2009) and Suchy et al. (2008) also reported lower ALT values by fenugreek and Milk thistle in fish and broilers, respectively.

Mean serum protein values per chicken at the end of experiment were 19.83, 26.16, 27.00 and 21.50 g/dl for group TI-0D, TI-1D, TI-2D and TI-3D, respectively. Serum protein was least in the daily administered schedule. Serum protein showed high value at the alternate two days administered schedule. However differences were not significant statistically. Similarly, the effect of vaccination practice and interaction of vaccination practice with water based infusion was also non significant (Table I).

Our findings are supported by Ademola et al. (2004) who worked on ginger and garlic mixture and found non significant effect on serum protein.

Serum Total Cholesterol

Mean serum cholesterol per chicken is presented in Table II. Data analysis revealed significant (P<0.05) differences among the groups. Cholesterol level was significantly lower in the alternate two days administered schedule (group TI-2D), while it was the highest in the daily administered schedule (group TI-0D). Cholesterol level was the same in group TI-1D and TI-3D. Effect of vaccination practice and interactive effects were found non-significant.

<table>
<thead>
<tr>
<th>Groups (Administered Schedules)</th>
<th>Cholesterol Mean ± SE</th>
<th>CV%</th>
<th>Triglyceride Mean ± SE</th>
<th>CV%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI-0D</td>
<td>213.16±7.60</td>
<td>8.73</td>
<td>209.15±7.60</td>
<td>7.73</td>
</tr>
<tr>
<td>TI-1D</td>
<td>183.66±11.49</td>
<td>15.32</td>
<td>179.65±11.49</td>
<td>15.09</td>
</tr>
<tr>
<td>TI-2D</td>
<td>159.00±10.44</td>
<td>16.09</td>
<td>155.00±10.44</td>
<td>14.32</td>
</tr>
<tr>
<td>TI-3D</td>
<td>185.50±13.93</td>
<td>18.45</td>
<td>181.50±13.97</td>
<td>17.45</td>
</tr>
</tbody>
</table>

Vaccination

| Vaccinated                      | 183.41±10.03          | 18.96| 179.40±10.03           | 17.96|
| Non vaccinated                  | 187.25±8.81           | 16.31| 183.24±8.81            | 15.31|

Interaction

| TI-0DV                          | 220.33±5.60           | 4.40 | 216.32±5.60            | 4.40 |
| TI-0DNV                         | 206.00±14.36          | 12.07| 204.00±14.36           | 12.07|
| TI-1DV                          | 173.66±20.34          | 20.28| 171.66±20.34           | 19.79|
| TI-1DNV                         | 193.66±12.11          | 10.83| 194.66±8.21            | 9.72 |
| TI-2DV                          | 171.66±17.87          | 17.99| 173.66±20.34           | 20.28|
| TI-2DNV                         | 146.33±8.21           | 9.72 | 193.66±12.11           | 10.83|
| TI-3DV                          | 168.00±23.18          | 23.89| 168.00±23.18           | 23.89|
| TI-3DNV                         | 203.00±11.53          | 9.83 | 203.00±11.53           | 9.83 |

Means in the same column with different superscripts are significantly different at α = 0.05

* Berberis lycium, Allium sativum, Solanum nigram and Terminalia arjuna.
TI= represents treatment interval; 0D-3D= 0 to 3 days interval; V= vaccinated; NV= non vaccinated.

Cholesterol is a soft, waxy substance normally found in cell walls and membranes, vitamin D, certain hormones and fat digesting enzymes. A small fraction of cholesterol, which is produced within body and is also received from feed sources, is utilized in meeting above needs in the body. Excess deposition in coronary arteries is usually harmful and leading to certain heart diseases in human mainly because of atherosclerosis, hardening of the arteries. Cholesterol is divided into low density lipoprotein (LDL) which is usually known as “bad” cholesterol and high density lipoprotein (HLD) usually known as “good” cholesterol.

Different herbs and natural products are highly effective in lowering cholesterol level. Garlic (component of the present mixture) reduced plasma, liver and muscle cholesterol by decreasing the activity of 3-Hydroxy-3-methylglutaryl reductase (Kunjufca et al., 1997).

The results of present study are in agreement with the findings of Doggrell (2005), who reported the cholesterol lowering property of Berberis lycium. Findings of the present study are supported by Chowdhary et al. (2002), who fed garlic paste to laying hens and reported a decrease in serum and egg yolk cholesterol concentrations. The results of present study are also in agreement with the findings of (Chand et al., 2007) and who recorded a decreasing trend in total serum cholesterol in response to increasing level of Berberis lycium upto 2.0%. Similarly Metwally (2009) reported the cholesterol lowering property of garlic, which is in agreement to the findings of the present study.
Serum Triglycerides

Mean serum triglyceride levels per broiler with decreasing frequency of medicinal plants infusion is presented in Table II. Significantly (P<0.05) lowest mean serum triglyceride level was recorded in alternate two days administered schedule (group TI-2D), while highest value was recorded in group TI-0D which received infusion on daily basis. Effect of vaccination practice and interaction of vaccination practice with water based infusion on serum triglyceride was non significant.

Berberis lycium (component of the present mixture) has reduced serum triglycerides in human and animals. In hamster serum triglycerides level was reduced by alkaloid berberine (Brusq et al., 2006). Chen et al. (2003) reported reduction in serum triglycerides level in man as a response feeding alkaloid beberine from Cortidis rhizome. Results of the present study are in agreement to Hokanson and Austin (1996), who reported significant reduction in the level of triglyceride in rats by garlic paste. Our findings are also supported by the work of Leng et al. (2004), who worked on the effect of barbery on lipid profile and found that berbery infusion significantly reduced the triglyceride level in blood. Thomson and Ali (2003) supported our results by reporting triglyceride lowering property of garlic, which is component of the present mixture.

Serum High Density Lipoprotein (HDL)

Mean HDL level per chicken is presented in Table III. Data analysis revealed significant differences among the groups. Significantly (P<0.05) higher HDL level was recorded in group TI-2D as compared to all other groups. Effect of vaccination practice and interactive effects were non-significant different (P>0.05).

HDL, mostly known as “high-quality” cholesterol, carries cholesterol from blood vessels and body tissues to the liver for reutilization or excertion from the body. HDL helps to keep blood vessel winded (dilated), thereby promoting better blood flow. HDL also reduces blood vessel injury through its antioxidant and anti-inflammatory function. Findings of the present research are in agreement to Tang et al. (2006), who reported increase in serum HDL level in rats by feeding beberine, active alkaloid of Berberis lycium.

Results of Nishant et al. (2006) are also inline with the present findings, who reported that Withania sumnifera significantly (P<0.05) increased the HDL level in hypercholesteremic male albino rats.

Serum Low Density Lipoprotein (LDL)

Mean serum LDL per broiler chicken is presented in Table III. Data analysis revealed non significant differences among the groups. Effect of vaccination practice and interaction of vaccination practice with water based infusion was also non significant. Numerically mean serum LDL level was lowest in alternate two days administered schedule (group TI-2D) and highest in group TI-0D.

Table III Mean glucose, high density lipoprotein (HDL) and low density lipoprotein (LDL) (mg/dl) in broiler chickens received medicinal plants* infusion with different schedules of administration

<table>
<thead>
<tr>
<th>Groups (Administered Schedules)</th>
<th>HDL</th>
<th>LDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI-0D</td>
<td>91.16±7.68</td>
<td>71.00±3.19</td>
</tr>
<tr>
<td>TI-1D</td>
<td>98.83±5.33</td>
<td>68.00±4.48</td>
</tr>
<tr>
<td>TI-2D</td>
<td>120.50±8.74</td>
<td>61.66±9.92</td>
</tr>
<tr>
<td>TI-3D</td>
<td>118.33±6.79</td>
<td>62.50±6.96</td>
</tr>
<tr>
<td>Vaccination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TI-0DV</td>
<td>93.33±7.31</td>
<td>76.66±2.96</td>
</tr>
<tr>
<td>TI-0DNV</td>
<td>89.00±15.39</td>
<td>65.33±3.17</td>
</tr>
<tr>
<td>TI-1DV</td>
<td>104.33±4.09</td>
<td>74.33±5.69</td>
</tr>
<tr>
<td>TI-1DNV</td>
<td>93.33±9.76</td>
<td>61.66±8.96</td>
</tr>
<tr>
<td>TI-2DV</td>
<td>119.66±6.17</td>
<td>55.66±15.76</td>
</tr>
<tr>
<td>TI-2DNV</td>
<td>121.33±7.85</td>
<td>67.66±14.43</td>
</tr>
<tr>
<td>TI-3DV</td>
<td>113.33±12.44</td>
<td>62.66±3.17</td>
</tr>
<tr>
<td>TI-3DNV</td>
<td>123.33±7.12</td>
<td>62.33±15.24</td>
</tr>
</tbody>
</table>

Means in the same column with different superscripts are significantly different at α = 0.05

* Berberis lycium, Allium sativum, Solanum nigrum and Terminalia arjuna.

TI= represents treatment interval; 0D-3D= 0 to 3 days interval; V= vaccinated; NV= non vaccinated
LDL, also called as bad cholesterol, is the major cholesterol carrier in the blood. If too much LDL cholesterol circulates in the blood, it can slowly build up in the walls of the arteries feeding the heart and brain. Together with other substances it can form plaque, a thick, hard deposit that can clog those arteries. A high level of LDL cholesterol reflects an increased risk of heart disease.

Berberine, active alkaloid in *Berberis lycium*, reduced LDL cholesterol in human (Cheng et al., 2006; Kong et al., 2004) and animals (Jean-Marie et al., 2006; Tang et al., 2006; Kong et al., 2004). Similarly Abidi et al. (2006) reported reduction in LDL level by berberine in hamsters. The present findings are in agreement to the findings of Chand et al. (2007), who reported reduction in LDL level by *Berberis lycium* in broilers.

**CONCLUSION AND RECOMMENDATIONS**

It is concluded that water based infusion of *Berberis lycium*, *Allium sativum*, *Solanum nigrum* and *Terminalia arjuna* at now improved the liver function and lipid profile of broiler chickens. The infusion was prepared successfully by adding 12.5g of each plant to one liter of drinking water. On the basis of present findings it is recommended that water based infusion of the aforementioned plants may be used to improve liver function and lipid profile of broiler chicks.

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