Effect of canola oil on blood lipid in ostriches (Struthio camelus)

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Abstract

In order to study the lipid profile of ostriches in relation to diet, 6 blue-neck male ostriches (Struthio camelus) were used and fed with 3% canola oil supplement on diets ad libitum consisting. In the morning, after about 12 h of fasting, blood was collected from the wing vein on days 0 and 60. Blood samples were collected from ostriches to measure levels of the following lipid parameters include high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, very low-density lipoprotein (VLDL), triglyceride, total cholesterol were determined. Results showed that from days 0 to 60, LDL and total cholesterol levels increased significantly, whereas HDL, VLDL and triglyceride didn't change.

1. Introduction

Blood profiling, initially used to detect subclinical disorders due to incorrect feeding, has recently been used more widely to evaluate the effects of different treatments on metabolic, nutritional and welfare conditions of animals (Bertoni et al., 2000). Oils are the most important energy source of broiler rations. In order to get the optimum productivity from chickens, the protein and energy levels of ration should be high. By compensation of energy requirements of chickens with oils instead of carbohydrates, a better performance was attained (Tuncer et
Studies on adding oil to the poultry diets started in the 1950s and the latest studies showed that up to 7% oil could be added to the rations (Cullision et al. 1987). Use of fats in animal feed has many benefits. Some of these benefits are increase in energy level and palatability of diet, improvement of growth rate, feed efficiency, absorption of fat soluble vitamin and decrease of metabolic heat production during heat stress. Dietary fats are also source of essential fatty acids (Baiao NC 2005). Various studies have been conducted on the inclusion of fish oil in the diet of broilers (Herstad et al., 2000), pigs (Leskanich, Matthews, & Warkup, 1996) and beef (Choi, Enser, Wood, & Scollan, 2000) in order to try and manipulate the lipid composition of the meat. Canola oil has a high content of α-linolenic acid, which is susceptible to oxidation, and has very rich source of monounsaturated oleic acid (Mourot and Hermier, 2001). The present work, within the framework of broader research on ostrich lipid profile, studies the effect of oil in diet on the blood lipid values of 4-month-old birds.

2. Materials and methods

2.1. Ostriches

The study was carried out on 6 ostriches born and raised on the Arak (Iran); the birds were 4 months old age. The animals were in one group (about 150 m2) and fed ad libitum of diets (Table 1) for period of around 60 days. The feed was mixed on a weekly basis and stored in bags in a cold feed storage shed. No anti-oxidants were added to diets. From each animal, in the morning (from 08:00 to 10:00) after about 12 h of fasting, blood collection by Vacutainer was made from the wing vein (v. ulnaris subcutanea). In comparison with the usual collection made from the jugular vein, this appears safer for the collector, who can avoid possible front-kicks from the animal by taking the sample at the animal’s side. Moreover, in a previous study (Moniello et al., 2005) the two collection sites (jugular vs wing vein) showed similar blood parameter values. Within two hours, the blood samples were centrifuged in order to obtain the plasma and immediately frozen at −21°C, prior to analytical determination.

2.2. Plasma biochemical analyses

Triglyceride, total cholesterol, high-density lipoprotein cholesterol (HDL-C), very-low-density lipoprotein (VLDL-C), and low-density lipoprotein cholesterol (LDL-C) were measured. All analyses were made using the commercial kits (Pars Azmoon, Iran) and a standard auto analyzer apparatus (Biotecnica, BT-3000, Rome, Italia).

2.3. Statistical analysis

All results are expressed as means ±standard error of mean (SEM). Raw data were checked for normal distribution using Kolmogorov–Smirnov method. All analyses utilized parametric statistical methods. A value was considered to be statistically significant if the associated P value was less than 0.05. Paired t tests were performed using SAS software (2001).

| Table 1 | Ingredients composition of the diet. |
| Ingredient | (%) |
| Corn, Grain | 37.4003 |
| Alfalfa Meal-20 | 28.0502 |
| Soybean Meal-44 | 27.5827 |
| Dical. Phos | 2.3004 |
| Canola Oil | 3 |
| Limestone | 0.6924 |
| Common Salt | 0.3101 |
| Vitamin Premix | 0.2338 |
| Mineral Premix | 0.2338 |
| DL-Methionine | 0.1314 |
| L-Lysine HCl | 0.0636 |
3. Results

The effects of canola oil ingestion on plasma biochemical variables are reported in Table 2. All ostrich chicks exhibited proper growth and active ingestion during the feeding period. There was no significant difference in VLDL, HDL and triglyceride at two times. But from days 0 to 60, LDL and total cholesterol levels increased significantly.

Table 2
Comparison between two blood sampling (day 0–60) for some plasma biochemical parameters, results are expressed as mean ± SEM (n=6).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit of measure</th>
<th>Day 0</th>
<th>Day 60</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL</td>
<td>Mg/dl</td>
<td>51.25±2.83</td>
<td>49.67±1.68</td>
<td>0.25</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Mg/dl</td>
<td>93.55±15.28</td>
<td>152.07±39.95</td>
<td>0.02</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>Mg/dl</td>
<td>107.35±13.89</td>
<td>111.16±11.21</td>
<td>0.49</td>
</tr>
<tr>
<td>LDL</td>
<td>Mg/dl</td>
<td>20.83±14.43</td>
<td>80.16±40.14</td>
<td>0.03</td>
</tr>
<tr>
<td>VLDL</td>
<td>Mg/dl</td>
<td>21.47±2.77</td>
<td>22.23±2.24</td>
<td>0.49</td>
</tr>
</tbody>
</table>

NS not significant (P>0.05) and *P<0.05.

4. Discussion

Use of fats for animal feed has many advantages. The fats and oils are esters of glycerol; the former are solid, whereas the latter are liquid at room temperature. It is the major source of increasing the energy content of diets. Addition of fat in broiler diet also provides increased growth rate, increased feed efficiency, decreased feed intake, linoleic acid, low dustiness of feeds. Canola is the name given to a cultivar bred naturally from rapeseed in Canada that contains less than 2% of erucic acid (C22:1, ω9) in relation to the total fatty acid. Canola oil has a high content of α-linolenic acid, which is susceptible to oxidation, although less susceptible than fish oil and linseed oil (Mourot and Hermier, 2001). Findings of this study showed that feeding of canola oil growing in ostrich can significantly increase plasma levels of HDL and cholesterol in the 60th day, compared to that of day 0 (Table 2).

Supplementation canola oil to feed had no effect on the health of ostriches during the experiment. Diet composition plays an important role in the management of cholesterol concentrations in the blood. The major finding of current study was a no significant reduction in HDL along with a significant rise in LDL concentration. The results of this study indicate that the mean values of triglyceride (111.16±11.21mg/dl) and total cholesterol (152.07±39.95mg/dl) were different with the average values reported by Ghasemi et al 2013, Omidi et al. (2012) and Samour et al. (2011) but similar that described by Bovera et al. (2007). The major finding of the present study was a significant increase in the total cholesterol and LDL by approximately 59 and 59/5 %, respectively.

Chisholm et al (2005) report that a dietary supplement of canola oil decreased the cholesterol of human. This is not supported by the present study. This finding may reflect the harmful effects of canola oil on health. Canola oil increased the hypercholesterolemia conditions in the ostriches. This research will serve as a base for future studies on the effects of types of oils on health. A limitation of this study is that the numbers of ostriches were relatively small. More broadly, research also needed to determine where the effects of canola oil on fatty acid profile content of ostrich muscle and plasma and hepatic lipids in high fat-fed animals.

There are few reports concerning the effects of canola oil of diet on blood lipid profile of the ostrich. The mechanisms by which dietary oil increase blood lipid levels are not fully understood.

In summary the dietary canola oil supplement had no beneficial effect on the physiological parameters include increased LDL and cholesterol of ostrich.

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