Biochemical response in piglets after application of essential oils from Sage (Salvia officinalis L.) and Oregano (Origanum vulgare L.)

Poracova, J., Maity, S., Blascakova, M.

1Excellence Center of Human and Animal Ecology, Presov University in Presov, Presov, Slovak Republic
2Centre for Environmental Studies, Visva-Bharati, Santiniketan, India

ABSTRACT

In order to find out the growth stimulators, essential oils from Sage (cineol 15%, thujone 24%, borneol 18%) and Oregano (carvacrol 65%, thymol 16%) were applied to feed (ČOS 1 and ČOS 2) of Slovak white noble breed x Pietrain at the age of 28 days at a concentration of 0.05%/kg. To determine the lipid metabolic pathway (cholesterol, triacylglycerides, HDL), blood samples were collected from both the control (CG = 6) and treated group (TG = 7) of piglets. Present study demonstrated a statistically significant decrease (p<0.05) in concentration of triacylglycerides (CG = 0.79 – 1.59 mmol.l⁻¹, TG 0.79 – 1.25 mmol.l⁻¹, P <0.05) and HDL (CG = 1.33-2.33 mmol.l⁻¹, TG = 1.48-1.85 mmol.l⁻¹, P < 0.01) and total cholesterol in treated animals with respect to the control during 28th days of experiment. It is concluded that essential oils from Sage and Oregano have the potential to decrease triacylglycerides levels in the blood of piglets important to enhance body weight and livestock productivity of animal.

Key words: Sage, Oregano, triacylglycerides, HDL, Piglets

Introduction

The health and productivity of livestock are important economic factors influencing pig production worldwide. Although many factors might influence the overall productivity of the pig herd. It has been suggested that non-specific activation of the immune system [17] as well as stimulation of some biochemical parameters are responsible for the well being of animals [11,26,22] and subsequently leading to productivity.

Plant extract is a source of different molecules which have intrinsic bio-activities on animal physiology and metabolism [12].

Plant secondary metabolites, including a wide variety of phytochemicals, have always been constituents of the diets of man and animals. Their effects depend to a great extent on the chemistry of the compounds, their concentration in the diet and the amount consumed, and are further depend on the health status of the animals [1]. The importance of the plant secondary metabolites in human and animal feeds, and as pharmaceuticals with chemical and biochemical influences has already been described in some details [2,18,7]. Bile acids are essential for the efficient digestion and absorption of lipid and lipid-soluble nutrients. Bile acids are synthesized from cholesterol by a pathway regulated by the microsomal cytochrome P450 enzyme cholesterol 7a-hydroxylase (EC 1.14.13.17, CYP7A; Shefer et al., 1969) and by an alternate pathway starting with 27-hydroxycholesterol [3,4,16,15] measured hepatic cholesterol 7a-hydroxylase activity in fetal, newborn, suckling, and weaned piglets. Their results suggest that developmental regulation of 7a-hydroxylase activity is the result of
a pretranslational mechanism. The specific role of dietary lipids in brain development has been widely studied [20]. Cholesterol is an essential constituent of all animal cells [6], the brain has the highest cholesterol concentration of any organ [8]. Myelin contains 20–25% C (dry basis) and the nerve growth cones responsible for establishing brain neuroarchitecture are as much as 30% C. The relationship between nutrition of the neonate and development of the central nervous system is well recognized. Pond et al. [21] measured neonatal dietary cholesterol and alleles of cholesterol 7-
hydroxylase affect on piglet cerebrum weight, cholesterol concentration and behavior. In light of the above discussion objective of the present study was to find out the biochemical response (cholesterol, triacylglycerides, HDL, LDL in blood serum of piglets) in piglets after application of essential oils from Sage (Salvia officinalis L.) and Oregano (Origanum vulgare L.)

Material and Methods

Model Schedule Experiment:

Suckling piglets of crossbred piglets Slovak White x Pietrain were divided into two groups: control group (n=6) and treated group (n=7). Extracted essential oils from sage and oregano were applied to treated group along with the feed at a concentration of 0.05%. During the experiment pigs were fed complete feed mixture for lactating sows. Suckling piglets had free access to adult pigs and from 5th day of their age they had free access to feed mixture. Weaning of piglets were done at the age 28 days. During weaning and postweaning the piglets were fed feed mixture ČSO1 and ČSO2. Feed intake was 0.5 kg/day. Water was administrated ad libitum. Data for the body weight, health status, excrementa and mortality of pigs were recorded through out the experimental duration. Blood samples were collected and production parameters were monitored at the age of 21st, 28th, 35th and 42nd days of Suckling piglets. The samples of feed were analyzed in the following way – sensory, microbial and physico-chemical examination.

Essential oil and its analysis

Dry raw materials of the sage and oregano herbs were collected from the commercial growers of the Eastern part of Slovakia for essential oils isolation. Total composition of sage and oregano essential oil was carried out using a HEWLETT – PACKARD 5890/5970 GC/MSD system. In model experiment sage essential oil were applied with optical rotation +8±10, refraction index 1.469 – 0.001, content of cineol 15±1%, thujone 24±1%, borneol 18±1% and oregano essential oil with optical rotation 0 ± 1º, refraction index 1.513 ± 0.001, with content of carvacol 65 ± 3.0%, thymol 16 ± 1.5.

Statistical Analysis:

The experimental values were tabulated as mean ± standard deviation (S.D.) of three replicates. Data of the biochemical parameters were statistically analysed by Mann-Whitney U test within control and treated group. Significant test was further performed by one-way ANOVA between groups within specific duration of treatment considering P<0.05. Statistical analysis was performed using the UNISTAT 4.53 system.

Results and Discussion

Table.1 and 2 showed the statistically significant difference between biochemical parameters between control (CG) and treated animals (TG). A highly significant difference in triglycerides level was noted in Sage and Oregano treated group (TG=1.25±0.255) with respect to control group (CG=0.797±0.322) (1st collection of blood – 21st day of age).

Gudev et al. [9] studied effect of the probiotic on some biological parameters and nonspecific resistance in neonatal pigs. Supplemental probiotic (Lactina) decreased plasma cholesterol level (P<0.05) at 35 days of age in treated group of piglets.

Several investigators reported the effects of different natural and chemical compounds in animals [10,13]. Sliwa et al. [23] monitored the impact of chemical substances in piglets and recorded the blood serum level of total cholesterol, glucose and electrolytes. Result of the present investigation is substantiated by the earlier investigators [24] that herbal extracts could be successfully used as growth stimulators, replacing nutritive antibiotics in pig diets. Bindas [5] studied the effects of low protein diets supplemented with crystalline amino acids on biochemical parameters and performance of crossbred piglets weaned at 28 days of age. The decrease in the diet crude protein was manifested by significant decrease in blood urea. The observed biochemical parameters in blood serum of weaned piglets varied in relatively wide ranges of physiological values for piglets, presented by earlier investigators [14,25]. The mean values of biochemical parameters, such as cholesterol, total proteins, urea, some enzymes AST, ALP did not differ significantly within the groups.
The effect of feeding sows conjugated linoleic acid in late pregnancy on blood thyroid hormone, total cholesterol and cholesterol fraction (LDL, HDL) levels in piglets was observed by Pietras et al. [19]. Lower total cholesterol and HDL (P<0.05) and LDL (P<0.01) levels were found in the blood plasma of piglets in the treated group in comparison with those in the control group. The obtained results show that conjugated linoleic acid contained in the colostrum of sows increases plasma thyroid hormone levels in the blood of piglets and lowers the levels of total cholesterol and cholesterol fractions.

Figures 1-4 show dynamic changes of the measured biomarkers in the blood serum of piglets. After the application of both essential oils decrease in the levels of total cholesterol, HDL and LDL in blood serum of piglets was performed in control and experimental groups. Statistically significant changes (p<0.05) were observed in concentration of triacylglycerides when the decrease was monitored in the treated group comparing to the control one on 28th day of experiment.

Table 1: Values of lipid metabolism in blood serum of piglets – control group

<table>
<thead>
<tr>
<th>Age</th>
<th>Cholesterol (mmol. l⁻¹)</th>
<th>Triacylglycerides (mmol. l⁻¹)</th>
<th>HDL (mmol. l⁻¹)</th>
<th>LDL (mmol. l⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. day</td>
<td>4.26 ± 0.801</td>
<td>0.79 ± 0.179</td>
<td>2.33 ± 0.264</td>
<td>1.65 ± 0.380</td>
</tr>
<tr>
<td>28. day</td>
<td>3.59 ± 0.761</td>
<td>1.03 ± 0.575</td>
<td>1.52 ± 0.240</td>
<td>1.76 ± 0.374</td>
</tr>
<tr>
<td>35. day</td>
<td>3.64 ± 0.294</td>
<td>1.59 ± 0.322</td>
<td>1.48 ± 0.140</td>
<td>1.69 ± 0.118</td>
</tr>
<tr>
<td>42. day</td>
<td>2.97 ± 0.219</td>
<td>0.87 ± 0.182</td>
<td>1.33 ± 0.226</td>
<td>1.49 ± 0.207</td>
</tr>
</tbody>
</table>

Table 2: Values of lipid metabolism in blood serum of piglets – treated group (sage and oregano)

<table>
<thead>
<tr>
<th>Age</th>
<th>Cholesterol (mmol. l⁻¹)</th>
<th>Triacylglycerides (mmol. l⁻¹)</th>
<th>HDL (mmol. l⁻¹)</th>
<th>LDL (mmol. l⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. day</td>
<td>4.25 ± 0.904</td>
<td>1.25 ± 0.255</td>
<td>1.85 ± 0.294</td>
<td>2.08 ± 0.572</td>
</tr>
<tr>
<td>28. day</td>
<td>3.48 ± 0.317</td>
<td>1.01 ± 0.254</td>
<td>1.63 ± 0.083</td>
<td>1.67 ± 0.214</td>
</tr>
<tr>
<td>35. day</td>
<td>3.73 ± 0.530</td>
<td>1.21 ± 0.243</td>
<td>1.71 ± 0.253</td>
<td>1.82 ± 0.311</td>
</tr>
<tr>
<td>42. day</td>
<td>2.96 ± 0.241</td>
<td>0.79 ± 0.161</td>
<td>1.48 ± 0.114</td>
<td>1.46 ± 0.172</td>
</tr>
</tbody>
</table>

Note:
n – number of animal
x – average value
s – standard deviation

Fig. 1: Dynamics of changes of total cholesterol concentration in blood serum of piglets.
It is concluded that essential oils from Sage and Oregano have the potential to decrease triacylglycerides levels in the blood of piglets important to enhance body weight and livestock productivity of animal.

Acknowledgments

This research is supported by the Agency of Ministry of Education SR for the Structural Funds of the EU, the project: ITMS 26220120023.

References


