The Influence of Feed Mixtures with *Origanum Aetheroleum* on Broiler's Production in the Application of the Principles of Welfare

Kamil Močár, Dávid Štofan, Mária Angelovičová, Daniela Liptaiová

Slovak University of Agriculture Nitra. Faculty of Biotechnology and Food Sciences, Department of Hygiene and Food Safety, 949 76, Tr. Andreja Hlinku 2, Slovakia

Abstract

In this paper the effect of the *Origanum aetheroleum* - essential oil on the production growth and health of broiler chickens in conditions of welfare was studied. The animals had a free access to feedstuff and water. The experiment was carried out in 2 cycles on broiler types Ross 308 and Cobb 500. The viability, welfare and the body weight of broiler chickens at the end of each cycle was detected. The breeding was kept in the terms of welfare. The viability in trial groups (fed with feedstuff enriched with *Origanum aetheroleum* - essential oil was 100% while in the control groups the viability was 98% in first cycle carried out on Ross 308 and 98% in the second cycle carried out on Cobb 500. The average body weight of chickens at the end of the first cycle in control group was 1376.80 g while the average body weight of chickens at the end of the first cycle in trial group was 1767.2 g. The differences between these two groups were highly significant ($P<0.05$). The average body weight of chickens at the end of the second cycle in control group was 1589.6 g while the average body weight of chickens at the end of the second cycle in trial group was 1567.2 g. The difference between these two groups was not significant ($P>0.05$).

Keywords: broiler, essential oil, feedstuff, *Origanum aetheroleum*, production.

1. Introduction

Convenient and balanced diet is one of the crucial factors that affect performance, health and economy of broilers production [1].

In terms of good nutrition for livestock, but also for the production of high quality raw materials of animal origin are the subjects of scientific inquiry substances, which were added to feedstuff as additives to improve their quality, wholesomeness and nutritional value. By these feedstuffs is supported safe food production and environmental protection [2]. In the past has not yet been explored the possibility of acquisition and actual using of essential oils in view of the wide use of different spectrum of antibiotics. After the antibiotics use in animal nutrition was banned, there are knowledge of literature on methods of obtaining of the essential oils, their composition and antimicrobial effects [3,4,5]. Antimicrobial effects of essential oils in the prevention of metabolic and health problems, minimizing the incidence of diarrheal diseases, as well as maintaining good physical condition of animals were studied by [6-9]. Addition of essential oils in the feedstuff or drinking water increased the weight of chickens and positively influenced the conversion of feedstuff [10,11]. Origanum aetheroleum -essential oil, which is obtained by vapor distillation of Origanum vulgare ssp. Hirtum contains over 30 ingredients. They are mostly phenolic substances with antioxidant, bacteriostatic and fungicide activity [12- 16]. The main components with the highest percentage of representation are karvakrol and thymol which is about 78-82 g.100 g^{-1} total of essential oil [17].

Assessing of the effectiveness of 80% plant extract of essential oils in ethanol, was found its

* Corresponding author: Kamil Mocar, Department of Hygiene and food safety, FBP, SPU Nitra, A. Hlinku 2, 949 76 Nitra. Phone: 0042137/6415808, E-mail: kmocar@gmail.com

very high antioxidant effect [18]. Essential oils as well as antibiotics can positively influence feed intake, weight gain, nutrient utilization and improve efficiency in microbial digestive system [19]. Following the facts from the scientific literature the scientific research contribution was the adding of Origanum aetheroleum - essential oil into the feedstuff for chickens in relation to their production.

2. Materials and methods

In the trial feedstuff enriched with *Origanum aetheroleum* - essential oil was used. The characteristics and content *Origanum aetheroleum* - essential oil was determined by the use of gas chromatography (chromatograph, type 8015-91-6): relative density 0.915-0.975 g.cm^{-3}, effective compound carvacrol 57.0 %. In the experiment with fattening chickens, we have focused on observing the impact of *Origanum aetheroleum* - essential oil in four experimental groups, which were administered *Origanum aetheroleum* - essential oil compound in chickens in the following scheme: CS (control group) - no added probiotics and TG (trial group) - with the addition of 0.05% of *Origanum aetheroleum* - essential oil. In the experiment, one day old broilers of meat-type ROSS 308 and COBB 500 have been used. The trials were carried out in a poultry farms in the hall with the possibility of feeding of 24 000 broiler chickens. Boxes were created at the entrance door. Each box was intended for one group. Boxes have between separated by perforated netting and plastic fence between them. In each box were located 100 broiler chickens. Size of the area in each frame allowed unrestricted access to feed and water (as well as for natural activities) for each broiler chicken. Chickens were reared on deep litter material. The bottom layer of bedding was up to 8 cm and consisted of wood chips and the top layer consisted of 5 cm high straw. The total fattening period was divided into three phases:

a. Starter, intended for chickens aged from 1 to 18 day during which the chicks were fed the starter feed mixture (HYD-01),

b. growth for chicks aged 19 to 31 days with growth forage mixture HYD-02,

c. final, for chicks aged 32 to 38 days with final forage mixture HYD-03 .

They were usually served mixed compound feed for chickens for fattening with the balanced content of nutrients and metabolizable energy in accordance with their needs.

In the experiments, we have monitored the following indicators:

Indicators of welfare:

- Total area for unlimited access of chickens to feedstuff and water. The total area the area of each box for the chickens we calculated based on measured values of length and width of the tape by using the formula:

$S = a. b$

S = area of the box [m^2]

a = width of box [m]

b = box length [m]

Calculation of free surface at 30 kg live weight at the end of the experiment

$$[m^2]: \quad \frac{\text{total area of the box}}{\text{number of chickens in the box}}$$

- Hygienic condition of bedding (straw absorption properties) (daily check).

- Viability of broilers (mortality) (daily check).

- Body weight of broilers at the end of the experiment (on a balance-type weighing Kern ECB 20K20 d with an accuracy of ± 0.1 grams).

3. Results and discussion

Under Council Directive 2007/43/EC from 28 of June 2007 laying down minimum principles for the protection of chickens kept for meat production in the application of welfare is 30 kg.m^{-2}. The specific measures to improve living conditions for chickens by [20] are to reduce the concentration of surface stable deep litter under 30 kg body weights of animals on one m^2. In our attempt to start the experiment we have set up boxes for each group whose length was 2.9 m^2 and width was 2.2 m. The area of each box was 6.38 m^2. Deep litter was composed of wood chips and top layer was from wheat straw. Chickens had unlimited access to the feeder and water and enough space to carry out activities of natural movement.

Viability of chickens

Intestinal microflora may be contaminated with pathogens that adversely affect the normal population and microorganisms in the gut. That is why the use of certain supplements to animal feedstuffs in order to maintain or even improves the balance of gut microflora [21]. During the experiments was checked daily the viability of chickens, we expressed the number of live chickens at the end of the experiment, after deduction of dead birds. Death of chickens was recorded only in the control groups, in 1st trial were 2 chickens found (98% viability) and in 2nd trial also 2 chickens were found (98% viability. Causes of death were not investigated.

Body weight of chickens at the end of the experiment

Body weight of chickens ranged from 1376.80 g (control group) to 1767.20 g (trial group) in the first experiment and from 1567.20 g (trial group) to 1589.60 g (control group) in the second experiment. Differences in body weight of chickens at the end of the experiment in the first reference experiment with broilers - Ross 308 were statistically highly significant ($P < 0.05$). In the second experiment monitored the broilers - Cobb 500 were differences in body weight of broilers not statistically significant ($P > 0.05$).

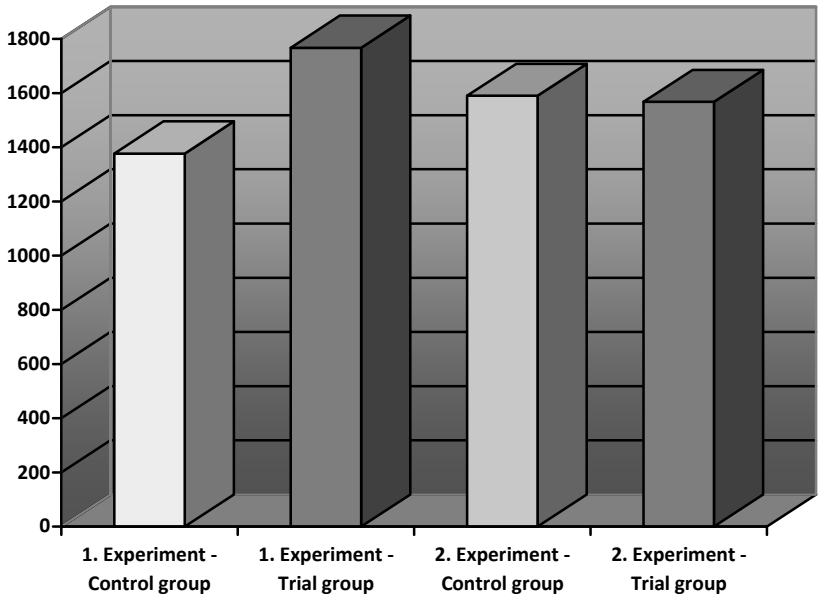

Figure 1. Body weight of broilers at the end of experiment [g]

[22] observed health and overall production of broilers after vaccination against coccidia in combination with the organic component Orego-Stim (Origanum vulgare). Allowance of Orego-Stim (Origanum vulgare) affected weight gain and feed intake of chickens during the first 58 days, but feed conversion was not affected. Significantly higher body weight of chickens has been achieved mainly between 34th and 48th day of chickens compared with chickens in the group, in which chickens were vaccinated. The results of this research have shown that vaccination against coccidia in combination with Origanum vulgare supplement may be a suitable solution for organic farming of chickens.

[23,24] observed differences in body weight of broilers from hens fed with feedstuff with essential oil. Their research findings have confirmed the validity of the using of essential oils in broilers nutrition.

Table 1: Mathematics and statistical evaluation of results of broilers weight at the end of the experiment and differences between groups

Group	n	s[g]	v_k	Control - 1.Experiment	Trial – 1.Experiment	Control - 2.Experiment	Trial – 2.Experiment
Control - 1.Experiment	100	131.87	9.58		+		
Trial – 1.Experiment	100	151.36	8.49	+			
Control - 2.Experiment	100	169.72	10.68				-
Trial – 2.Experiment	100	184.34	11.66			-	

Scheffe´s test at significance level $P_{0.05}$; ¯P>0.05

4. Conclusions

Essential oils are characterized by inflammatory and bacteriostatic effect and act as antimicrobial agents in the digestive system of broilers. Many important variables affecting the production of broilers as digestion of nutrients, increased of body weight, feed palatability, improve feed conversion as well as sensory properties of meat. Therefore, we studied their effects in our experiments. In the first experiment, in which we used broilers type Ross 308 were found body weight of broilers at the end of the experiment from 1376.80 g (control group) to 1762.80 g (trial groups), which were statistically highly significant (P <0. 05). In the second experiment with broilers type Cobb 500 were measured body weight at the end of the experiment from 1567.20 g (trial groups) to 1589.60 g (control group), which were not statistically significant (P> 0.05).

Acknowledgements

This work was supported by Scientific Grant Agency by financial support No. VEGA 1/4420/07.

References

1. Stiess, P. Strategie fázové výživy ve výkrmu kuřecích brojleru. VVS Verměřovice. In Krmivářství, roč. 1, 2006, s. 55.
2. Straková, E., Suchý, P., Večerek, V. Vliv přípravku zeofeed na užitkovost brojlerových kuřat. In VI. Kábrtovy dietetické dny. Brno : VFU, 2005, s. 218. ISBN 80-7305-521.
3. Habán, M., Šalamon, I., Poláček, M. The Development Programme of Medicinal Aromatic and Spicy Plant Cultivation and Processing in the Slovak Republic. In 3rd Conference on Medicinal and Aromatic Plant of Southeast European Countries. Nitra : SUA, 2004, s. 17.
4. Růžičková, G. Distillation Methods Used in the Czech Republic for Determination of Essential Oil Content. In 3rd Conference on Medicinal and Aromatic Plants of Southeast European Countries. Nitra : SUA, 2004, p. 33.
5. Slavkovska, V., Couladis, M., Tzakou, O., Jancic, R., Lakusic, B. 2004. Essential Oil Acinos majoranifolius (Mill.) Silic (Lamiaceae) from Montenegro. In 3rd Conference on Medicinal and Aromatic Plants of Southeast European Countries. Nitra : SUA, 2004, p. 90
6. Marcin, A., Mati, R., Vplyv rastlinných extraktov aplikovaných do kŕmnych zmesí na základné produkčné a zdravotné parametre prasiat v podmienkach veľkochovu. In VI. Dni výživy a veterinárnej dietetiky. Košice : UVL, 2004, s. 224–228.
7. Vasilková, Z., Lauková, A., Szabóová, R., Simonová, M., Chrastinová, Ľ., Strompfová, V., Rafay, J., Ondruška,Ľ., Poráčová, J., Prírodné aditíva v chove králikov a ich vplyv na redukciu oocýst Eimeria spp. In Nové směry v chovu brojlerových králíků. Praha, Uhříněves : VÚŽV, 2007, p. 28–30.
8. Wenk, C., Herbs and botanicals as feed additives in monogastric animals. In Asian-Australasian Journal of Animal Science, 2003, no. 16, p. 282–289.
9. Wenk, C. Eisatz von Kräutern und deren Extrakten in der Tierernährung: Erwartungen und Möglichkeiten. In 1st World Congress on Genetics Applied to Livestock Production. Madrid. P. 2005, p.925-930.
10. Alcicek, A., Bozkurt, M., Cabuk, M., The effects of an essential oil combination derived from selected herbs growing wild in Turkey on broiler performance. In South African Journal of Animal Science, 2003, no. 33, p. 89–94.
11. Bassett, R., Oreganos positive impact on poultry production. In World Poultry, Elsevier, 2000, no. 16, p. 31–34.
12. Adam, K., Sivropoulou, A., Kokkini, S., Lanaras. T., Arsenakis, M.. Antifungal activities of Origanum vulgare ssp. Hirtum, Mentha spicata, Lavandula

angustifolia and Salvia fruticosa Essentials oils against human pathogenic fungi. In Journal of Agricultural and Food chemismy, no. 46, 1998, p. 1739–1745.
13. Botsoglou, N. A., Florou-Paneri, P., Christaki, E., Fletouris, D. J., Spais, A. B.. Effect of dietary oregano Essentials oil on performance of Dickens and on iron-induced lipid oxidation of breast thigh and abdominal fat tissues. In British poulty science, no. 43, 2002, p. 223–230.
14. Ecomomou, R. M., Oreopoulou, V., Thomopoulos, C. D. Antioxidant properties of some plant extracts of the Labiatae family. In Journal of the American Oil Chemical Society, no. 68, 1991.p. 109–113.
15. Sivropoulou, A., Paranikolaou, E., Nikolaou, C., Kokkini, S., Lanars, T., Asenakis, M. Antimicrobial and cytotoxic activities of origanum essential oils. In Journal of Agricultural and Food Chemistry, no. 44, 1996., p. 1202–1205.
16. Tsimidou, M., Papavergou, E., Boskou, D. Evaluation of oregano antioxidant aktivity in mackerel oil. In Food Research International, 1995, no. 28, p. 431–433.
17. Voslářová, E., Janáčková, B., Rubešová, L., Kozák, A., Bedáňová, I., Steinhauser, L., Večerek, V. Mortality Rates in Poultry Species and Categories during Transport for Slaughter. In Acta Vet. Brno, vol. 76, 2007, p.101–108.
18. Madsen, L. – Nielsen, R. – Bertelsen, G. – Skibsted, H. L. Screening of antioxidative activity spices. A comparison between assai based on ESR spin tramping and electrochemical measurement of oxygen consumption. In Food Chemistry, 1996, no. 57, p. 331–337.
19. Amrik, B. – Bilkei, G. Influence of farm application of oregano on performances of sows. In The Canadian Veterinary Journal, vol. 45, 2004, p. 674–677.
20. Debrecéni, O., Juhás, P. Súčasný stav welfare hospodárskych zvierat v Slovenskej republike a programy jeho riešenia. In Agri-Ecnvironment and Animal Welfare [CD ROM], Nitra : SPU, 2007, p. 379–386. ISBN 978-80-8069-962-8.
21. Gibson, G. R., Fuller, R. Aspects of in vivo research approaches directed toward identifying probiotics for human use. In J. Nutri., 2000, no. 130, p. 391–395.
22. Waldenstedt, L. Effect of vaccination against coccidiosis in combination with an antibacterial oregano (Origanum vulgare) compound in organic broiler production. In Acta Agricultura Scandinavia, no. 53, 2003, p. 101–109.
23. Peebles, E. D., Doyle, S. M., Pansky, T., Gerard, P. D., Latour, M. A., Boyle, C. R., Smith, T. W. Effects of breeder age and dietary fat on subsequent broiler performance. 1. Growth, mortality, and feed concersion. In Poultry Science, 1999, no. 78, p. 505–511.
24. Peebles, E. D., Doyle, S. M., Pansky, T., Gerard, P. D., Latour, M. A., Boyle, C. R., Smith, T. W. Effects of breeder age and dietary fat on subsequent broiler performance. 2. Slaughter yield. In Poultry Science, 1999, no. 78, p. 512–515.