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Effectiveness of rearing Big-6 turkey-hens for slaughter fed with garlic, coneflower preparation and 1,2,4-triasole derivative additions

Efektywność odchowu indyczek rzeźnych Big-6 otrzymujących dodatek czosnku, preparatu z jeżówki oraz pochodnej 1,2,4-triazolu

Summary. The experiment was conducted using 360 turkey-hens of heavy type Big-6 divided into 4 groups (each with three replicates of 30 birds). All birds were fed with identical standard full-dose mixtures in a 5-stage system. An addition of tested supplements Echinovit C, garlic, and 1,2,4-triasole derivative was given with drinking water. The birds in group I (control) did not receive additives. The turkey-hens of group II received natural poultry immune stimulant Echinovit C, at the daily dose of 0.25 ml/dm^3 of water. The birds in group III were given fresh and ground garlic at the daily dose 0.25 g/dm^3 of water. The turkey-hens of group IV daily were given 1,2,4-triasole derivative in the amount of 25 µg/dm^3 of water. All supplements were given from the first day of life during the entire period of rearing period twice in week. At the end of the experiment after 16 weeks, the birds in group III (receiving garlic) were significantly, 600 g, i.e. 6.5%, heavier than in the control group. The addition of garlic favorably affected the feed conversion ratio. The turkey-hens of this group used on average 4.8% less feed per kilogram gain than the birds in the control group.

Key words: rearing performance, hematological and immunological indices, turkey-hens Big-6

INTRODUCTION

Numerous investigations in recent years have focused on finding new additives stimulating health and immune reactions and improving the performance of animals. The beneficial effect of garlic and coneflower on humans and animals has been known for a long time. The 1,2,4-triaole derivative is a newly synthesized compound whose healthy activity is being intensively tested [Truchliński *et al*. 2006a, b]. This study examined the influence of easily accessible supplements such as garlic and coneflower preparation as compared with synthetic 1,2,4-triasole derivative. Successful tests of Truchliński *et al*. [2000] indicating the lack of toxic action of 1,2,4-triasole derivative to living organisms qualify that substance for experiments involving slaughter turkey-hens.

The aim of the present study was to evaluate the influence and to compar of garlic, coneflower extract and synthetic 1,2,4-triasole derivative application on the efficiency of slaughter turkey-hens rearing.

MATERIAL AND METHODS

The experiment material comprised 360 one-day old heavy Big-6 turkey-hens. The birds were allocated to four feeding groups, each with three replicates of 30 turkey-hens, and they were maintained for 16 weeks of rearing. The turkey-hens in each group were fed identical granulated standard feeds in a 5-stage system, IB-1, IB-2, IB-3, IB-4 and IB-5. Feed composition and nutrient value are presented in Table 1. All tests were previously accepted by Local Ethic Commission. The tested additives were given into drinking water. The birds in group I (control) did not receive additives. The turkey-hens of group II were given natural poultry immune stimulant Echinovit C at a dose of 0.25 ml/dm^3 of water (P.W. Mikita, Poland), prepared from coneflower (Echinacea) and enriched in synthetic vitamin C. The birds of group III were fed fresh and ground garlic (*Allium sativum*) at a dose of 0.25 g/dm^3 of water, prepared directly before administration. The birds of group IV were given 1,2,4-triasole derivative (3-(2-pyridyl)-4-phenyl-1,2,4-triasole-5-carboxylic acid) at a dose of 25 µg/dm^3 of water. Earlier, this compound was dissolved in a small amount of ethanol (0.5 ml), then adjusted with water to achieve an expected concentration. All additives were given twice a week beginning with the first day of rearing. The 1,2,4-triasole derivative was produced by means of chemical synthesis at Department of Organic Chemistry, Pharmaceutical Faculty, Medical University in Lublin. FCR and water use, survival and body weight were monitored during the whole experiment. After the end of the experiment 20 birds from each group with body weights close to those of the group average were slaughtered and dissected. Slaughter and simplified dissection were made in accordance with recommendations of Faruga and Jankowski [2000]. The slaughter performance and the percentage of breast and leg muscles contents in a carcass, the share of edible cuts and abdominal fat were determined. Moreover, samples for sensory analysis made in accordance to Litwińczuk *et al*. [2000] were collected from breast muscles. Breast meat was immediately minced, homogenized and simples were subjected to chemical and physiochemical analysis. The dry matter, crude protein, crude fat and crude ash content were determined by conventional methods. Water holding capacity was determined by the Grau and Hamm method [1953], colour on the basis of the spectrometric method of Kortz *et al*. [1968], acidity on the basis of pH of aqueous homogenates using a Backmann pH-meter. Blood for hematological tests was sampled in 16th week of rearing. The number of red (RBC) and white blood cells (WBC) was determined by the chamber method (Natt-Herrick's luquid was applied for

dying the white blood cells). The percentage of white blood cells was made by dying the smears applying Pappenheim's method. The hemoglobin content (Hb) was assayed colorimetrically, hematocryte value (Ht) was assessed by the micro-hematocryte method.

Table 1. Nutritive value g/kg, and periods of feeding standard feeds
Tabela 1. Wartość pokarmowa, g/kg, oraz okresy skarmiania mieszanek paszowych

Specification	Feed mixtures and period of feeding (weeks of life)				
	1–2 starter	3–5	6–9	10–12	13–16
Crude protein	244.4	219.6	209.4	188.3	150.2
ME, MJ/kg	11.46	11.74	12.19	12.59	13.10
Crude fibre	28.6	27.7	27.2	27.1	27.1
Lysine	18.2	17.1	15.8	13.4	11.8
Methionine	5.9	5.0	5.0	4.4	4.0
Methionine + Cysteine	9.9	9.0	8.9	7.9	7.0
Tryptophan	3.5	2.9	2.8	2.5	1.9
Ca	13.9	12.4	11.7	10.6	9.5
Availablie P	7.7	6.8	6.0	5.7	4.8

Numerical data were subjected to statistical analyses using Statistica ver. 5 software and applying single-variable variance test ANOVA at 0.05 significance level ($p \leq 0.05$).

RESULTS AND DISCUSSION

The basic production indices and results of meat sensory analysis listed in Tables 2–4 were similar to those found by Faruga and Jankowski [2000]. At the end of the experiment after 16 weeks, the birds in the group III (receiving of garlic) were significantly, 600 g, i.e. 6.5%, heavier than in the control group. The addition of garlic favorably affected the feed conversion ratio (Table 2). The turkey-hens of this group used on average 4.8% less feed per kilogram gain than the birds in the control group. The influence of garlic supplementation on survival is noteworthy (Table 2). Although no diseases were observed during the experiment, mortality of the control (I) birds was 11.11%, whereas in the group III (garlic) deaths were observed only in 3.33% and only in one repetition of the entire group. In all groups the major causes of turkey losses were infected navel, insufficiency of the circulation system, stump and body injuries. The European Production Index for the control group (I) was 292, whereas in group III (garlic) it was much higher and equaled 355 points. The addition of garlic did not significantly affect the results of analysis after the slaughter, except an increase ($p \leq 0.05$) of the crude protein content in breast muscle by 2.08% (Table 3). The results of sensory analysis of breast muscles revealed that meat from turkey-hens receiving garlic and Echinovit C preparation had the best culinary traits. Meat was characterized by the highest scores for juiciness, flavor and test intensity and desirability. These traits were assessed significantly higher ($p \leq 0.05$) than analogous ones in control group.

Table 2. Body weight, kg, survival, %, feed conversion ratio (FCR), kg/kg, consumption of water, dm^3/head, and European Production Index (EPI), scores
Tabela 2. Masa ciała, kg, przeżywalność, %, wykorzystanie paszy (FCR), kg/kg, zużycie wody, dm^3/szt, europejski indeks produkcyjny (EPI) pkt.

Specification	Experimental groups				SEM
	I (Control)	II (Echinovit C)	III (Garlic)	IV (1,2,4-triasole derivative)	
Body weight at weeks:					
5	1.60	1.69	1.57	1.58	0.14
9	4.98	4.95	5.01	4.99	1.27
13	7.69	7.72	7.78	7.88	0.56
16	9.20[b]	9.65[b]	9.80[a]	9.40[b]	0.84
FCR, kg/kg					
0–16	2.50	2.42	2.38	2.48	0.12
Consumption of water, dm^3/head	4.10	4.11	4.15	4.10	0.36
Survival, %	88.89	91.12	96.67	94.45	
EPI, scores	292	324	355	320	

[a, b] mean values in the rows with different letters were significantly different at $p \leq 0.05$
SEM – standard error for mean values

Table 3. Chemical composition, physical and chemical properties and sensory analysis of breast muscle of turkey-hens after 16 weeks of rearing
Tabela 3. Skład chemiczny, fizyczne i chemiczne właściwości oraz analiza sensoryczna mięśnia piersiowego indyczek po 16 tyg. odchowu

Indices	Experimental groups			
	I (Control)	II (Echinovit C)	III (Garlic)	IV (1,2,4-triasole derivative)
Dry matter, %	26.97 ±0.64	27.28 ±0.45	27.42 ±0.57	26.31 ±0.87
Crude protein, %	23.61[b] ±0.44	24.01[a] ±0.25	24.10[a] ±0.86	23.93[b] ±0.44
Crude fat, %	1.25 ±0.02	1.18 ±0.04	1.17 ±0.05	1.24 ±0.02
Crude ash, %	1.18 ±0.07	1.20 ±0.08	1.22 ±0.03	1.17 ±0.02
Water holding capacity, cm^2	6.73 ±0.05	7.15 ±0.06	7.20 ±0.08	6.92 ±0.05
Colour, %	24.5 ±0.78	23.19 ±0.77	23.85 ±0.36	24.82 ±0.55
pH 24 h	5.67 ±0.04	5.6 ±0.02	5.63 ±0.01	5.62 ±0.02
Tenderness, pts.	4.22 ±0.64	4.44 ±0.47	4.52 ±0.48	4.31 ±0.54
Juiciness, pts.	3.88[b] ±0.81	3.94[b] ±0.45	4.52[a] ±0.42	3.98[b] ±0.98
Flavor, pts.				
– intensity	4.10[b] ±0.42	4.54[a] ±0.39	4.64[a] ±0.34	4.22[ab] ±0.69
– desirability	4.21[b] ±0.80	4.38[ab] ±0.65	4.64[a] ±0.30	4.28[b] ±0.64
Tastiness, pts.				
– intensity	4.28[b] ±0.69	4.42[a] ±0.26	4.70[a] ±0.28	4.39[ab] ±0.58
– desirability	4.29[b] ±0.71	4.43[ab] ±0.37	4.70[a] ±0.28	4.42[ab] ±0.54

[a, b] mean values in the rows with different letters were significantly different at $p \leq 0.05$

Table 4. Slaughter analysis of turkey-hens after 16 weeks of rearing, % of body weight
Tabela 4. Analiza rzeźna indyczek po 16 tyg. odchowu, % masy ciała

Specification	Experimental groups			
	I (Control)	II (Echinovit C)	III (Garlic)	IV (1,2,4-triasole derivative)
Slaughter performance	79.66 ±1.4	81.53 ±1.28	82.05 ±1.42	81.20 ±1.26
Breast muscles	23.96 ±1.24	23.72 ±1.03	24.88 ±1.42	22.67 ±1.25
Legs muscles	18.34 ±1.35	18.96 ±1.65	19.22 ±1.24	18.32 ±1.03
Heart	0.35 ±0.02	0.36 ±0.05	0.36 ±0.06	0.36 ±0.04
Liver	1.5^{a} ±0.12	1.58^{a} ±0.16	1.19^{b} ±0.12	1.38^{ab} ±0.13
Gizzard	0.94 ±0.19	0.86 ±0.11	0.88 ±0.12	0.92 ±0.09
Abdominal fat	0.73^{b} ±0.25	0.68^{b} ±0.13	1.45^{a} ±0.14	0.63^{b} ±0.15

$^{a, b}$ mean values in the rows with different letters were significantly different at $p \leq 0.05$

Table 5. Hematological indices of turkey-hens' blood after 16 weeks of rearing
Tabela 5. Hematologiczne wskaźniki krwi indyczek rzeźnych po 16 tyg. odchowu

Indices	Group				SEM
	I (Control)	II (Echinovit C)	III (Garlic)	IV (1,2,4-triasole derivative)	
Ht, %	37.69	37.35	37.87	37.69	0.22
Hb, g/dl	13.14	13.28	13.12	13.15	0.15
RBC, 10^{12}/l	2.44^{a}	2.37^{b}	2.43^{a}	2.29^{c}	0.03
WBC, 10^{9}/l	29.05^{c}	34.4^{a}	34.53^{a}	31.12^{b}	0.69
Heterophils, %	43.2	44.1	44.2	45.2	0.45
Lymphocytes, %	51.3	50.4	50.2	49.9	1.47
Monocytes, %	1.9	2.1	2.1	2.0	0.04
Bazophils, %	2.6	2.5	2.7	2.3	0.03
Eozynophils, %	1.0	0.9	0.8	0.6	0.03

$^{a, b, c}$ mean values in the rows with different letters were significantly different at $p \leq 0.05$
SEM – standard error for mean values

Schleicher *et al.* [1996] also indicated the positive influence of garlic in poultry nutrition as well as in swine Rekiel *et al.* [1997] and Krusiński [2000]. Reasons for such positive effects may probably result from better fodder conversion or the positive influence of garlic towards turkey-hens' appetite. The increase of deposition of abdominal fat was observed in the group with garlic. Due to the lack of results on the influence of garlic on intensified abdominal fat deposition in poultry, it is interesting that a similar phenomenon was observed by Nürnberg and Ender [1989] in porkers given fodder with garlic. The authors concluded that intensified fat deposition may result from a high rate of the animal's growth. Such results seem to be also confirmed by studies of Krusiński [2000]. In our study the sensory analysis of bird's meat (Table 3) meat from group III (garlic) achieved the highest scores. The present results confirmed earlier observations

by Fritz *et al*. [1994], and Majewska [2001] on positive influence of garlic supplementation on culinary traits of poultry meat. Also, in studies by Krusiński [2000], taste virtues of pork from porkers fed with garlic in fodder achieved high scores.

Body weight of turkey-hens supplemented with Echinovit C was similar to the values for control group for all rearing period. Therefore, it suggests that the factor did not significantly affect the bird's growth rate. The slaughter analysis revealed a positive influence of Echinovit C addition on carcass slaughter efficiency manifested with an insignificantly higher percentage of breast and leg muscles than in control (Table 4). Elevated liver weight of that group of birds probably suggests intensification of metabolic processes due to a great diversity of bioactive substances present in coneflower. Our results of the sensory analysis were confirmed by those achieved by Faruga and Pudyszek [1999] and Vandergrift [1998], who proved a positive influence of herbs, including coneflower extracts, on slaughter performance and culinary traits of roasted meat from slaughter turkey-hens. The slaughter analysis did not show a positive effect of 1,2,4-triasole derivative addition on turkey-hen's slaughter features. Only liver weight appeared to be significantly higher, which may suggest intensified work of the organ. The addition of 1,2,4-triazole derivative did not significantly affect results of the analysis of meat. The analysis of blood (Table 5) revealed significant differences in RBC between the groups. The most significant degrease of this parameter ($p \leq 0.05$) was found in group given Echinovit C and 1,2,4-triaosle derivative. A significantly ($p \leq 0.05$) higher total number of WBC was observed in all groups with additives. Hematological control values of blood differed from those presented by Koncicki and Krasnodębska-Depta [2005]. A decrease of RBC number may point to worse adsorption of protein and minerals from a fodder [Koncicki and Krasnodębska-Depta 2005].

CONCLUSIONS

1. After intake of Echinovit C a statistically significant ($p \leq 0.05$) increase of liver's weight and content of WBC was observed. The coneflower preparation was favorably influenced on the intensity of flavour and testiness of bird's meat and raised the crude protein.

2. An addition of garlic in the amount of 0.25 g/dm^3 water improved the rearing performance and quality of meat turkey-hens. Garlic reduced mortality and increased the crude protein content in breast muscles and WBC number in blood.

3. The application of 1,2,4-triazole derivative did not significantly increase rearing performance and quality of meat. This compound indeed raised the level of WBC and decrease of RBC in blood of turkey-hens.

REFERENCES

Faruga A., Jankowski J. 2000. Indyki – hodowla i użytkowanie. PWRiL, Warszawa.

Faruga A., Pudyszak K. 1999. Rearing efficiency and meat quality of slaughter turkey-hens fed with fodder supplemented with herbs. Zesz. Nauk. Prz. Hod. 45, 349–357 (in Polish).

Fritz Z., Kinal S., Schleicher A. 1994.The influence of feeding broiler chicken with mixtures containing the peat preparation or herbs on hematological dissection and histological indices as well as the quality of meat. Zesz. Nauk. AR Wrocław 39, 252, 59–71 (in Polish).

Fritz Z., Schleicher A., Kinal S. 1995.Application of selected herbs or garlic in mixtures for broiler chickens. Biul. Nauk. Przem. Pasz. 2, 25–33.

Grau R., Hamm R. 1953. Über das Wasserbindungs vermögen des toten Saugetiermuskels. I Mitteilung der Einfluss des pH-waters auf die Wasserbidungs von Zerkleinertem. Rinder Muskel. Biochem, 1, 325–328.

Kortz J., Różyczka J., Grajewska-Kołaczyk S. 1968. Methodical aspects of the objective determination of colour in fresh pork meat. Rocz. Nauk Rol. B-90, 3, 333–344.

Koncicki A., Krasnodębska-Depta A. (2005). Opportunities to apply the hematological and biochemical test results in poultry disease diagnostics. Vet. Mag. 20–22.

Krusiński R. 2000.Influence of selected herbs supplementation on swine fattening effects and meat quality. Ann. UMCS, sec. EE, 269–277.

Litwińczuk A., Litwińczuk Z., Borkowska D., Barłowska J., Górska A. 2000. Przewodnik do ćwiczeń z oceny i wykorzystania surowców zwierzęcych. Wyd. AR Lublin.

Majewska T. 2001. Effect of fresh garlic water extract supplement on production performance of slaughter turkeys. Current Problems Breeding, Health and production of Poultry, Proc. of the 9th Intern. Symp., Czeskie Budziejowice, 6 Febuary 2001, 95 (in Polish).

Nürrnberg K., Ender K. 1989. Fattsäunestzung des Rückenspeck von Kastraten, weiblichen Sweinem und Jungebern. Arch. Tierzucht., 32.

Rekiel A., Brzeziński P., Więcek J. 1997. Influence of herbal and garlic supplements to feed mixtures on the production and postmortem effects of broiler chickens. Zesz. Nauk. Zoot. AR. Wrocław 89–94.

Schleicher A. Fritz Z., Kinal S. 1996. Influence of herbal and garlic supplements to feed mixtures on the production and postmortem effects of broiler chickens. Zesz. Nauk. AR Wrocław 297, 181–189 (in Polish).

Truchliński J., Kifer-Wysocka E., Modzelewska-Banachiewicz B. 2000. Action of 1,2,4-triazole and 1,2,4-triazyne derivatives on cells of green monkey kidney in *in vitro* culture. Ann. UMCS, sec. DD, 55, 37–43.

Truchliński J., Krauze M., Cendrowska-Pinkosz M., Modzelewska-Banachiewicz B. 2006a. Influence of garlic, synthetic 1,2,4-triazole derivative and herbal preparation Echinovit C on selected indices of turkey hens non-specific immunity. Pol. J. Vet. Sci. Vol. 9,1, 51–55.

Truchliński J., Krauze M., Zasadowski A. 2006b. Inter-relations between contents of some biocomponents in tissues of turkey-hens fed with herb additives and 1,2,4-triazole derivative. Pol. J. Environ. Stud. 15, 3a, 151–155.

Vandergrift B. 1998. Equine applications for herbal products. Passport to the Year 2000. Biotechnology in the feed industry. Proc. of Allteh's 14th Annual Symp. „Herbs and species: implication for modern animal production". 293–301.

Streszczenie. Doświadczenie przeprowadzono na 360 indyczkach rzeźnych typu ciężkiego Big-6, podzielonych na 4 grupy (w każdej po trzy powtórzenia po 30 sztuk). Wszystkie ptaki żywiono jednakowymi granulowanymi mieszankami standardowymi w systemie 5-stopniowym. Dodatki badanych substancji, Echinovitu C, czosnku oraz pochodnej 1,2,4-triazolu, podawano wraz z wodą do picia. Ptaki grupy I (kontrola) nie otrzymywały dodatków. Indyczki grupy II otrzymywały

naturalny stymulator odporności dla drobiu w dziennej dawce 0,25 ml/dm^3 wody. Ptaki grupy III otrzymywały świeży i rozdrobniony czosnek w dawce dziennej 0,25 g/dm^3 wody. Indyczki grupy IV dziennie otrzymywały pochodną 1,2,4-triazolu w dawce 25 µg/dm^3 wody. Wszystkie dodatki były podawane dwa razy w tygodniu od pierwszego dnia życia do końca odchowu.

Po 16 tygodniach odchowu u ptaków grupy III (otrzymujących czosnek) stwierdzono istotnie wyższą masę ciała o 600 g, tj. o 6,5%, niż w kontroli. Dodatek czosnku korzystnie wpłynął na wykorzystanie paszy. Indyczki tej grupy znacznie lepiej wykorzystywały paszę na kilogram przyrostu w porównaniu z kontrolą.

Słowa kluczowe: efektywność odchowu, hematologiczne i immunologiczne wskaźniki krwi, indyczki rzeźne Big-6