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Department of Biochemistry and Toxicology Faculty of Animal and Breeding
University of Life Science in Lublin, Akademicka 13, 20-950 Lublin
e-mail: kasiaognik@poczta.fm

KATARZYNA OGNIK, IWONA SEMBRATOWICZ,
ANNA STĘPNIOWSKA, EWELINA CHOLEWIŃSKA,
MAGDALENA KRAUZE

Effect of aloe preparation and 5-oxo-1,2,4-triazine on the effects of performance and chemical composition of tissues of turkey hens subjected to stress

Wpływ preparatu aloesowego i pochodnej 5-okso-1,2,4-triazyny na efekty odchowu oraz skład chemiczny tkanek indyczek poddanych stresowi

Summary. The aim of this study was to determine the influence of the applied additives: aloe preparation (Aloes plus) and a 5-oxo-1,2,4-triazine derivative on production effects, results of slaughter analysis as well as chemical composition of muscles and liver of turkey hens under conditions of stress. The experiment was carried out on 360 turkey hens allocated at random and evenly to six groups, 60 birds each. Groups C and C+stress were control groups that did not receive any additive. Birds from groups A and A+stress were administered Aloes plus preparation in a dose of 0.70 ml/kg body weight (BW)/day. On the other hand, turkey hens from groups T and T+stress were receiving a derivative of 5-oxo-1,2,4-triazine in a dose of 30 μg/kg BW/day that was dissolved in a small quantity of ethanol (ca. 2 ml). The stress factor in the form of simultaneous crowding and changes in temperature and lighting conditions did not affect the production results, slaughter traits of carcasses or the chemical composition of the analyzed tissues of turkey hens. Hence, the effects noted upon the administration of both analyzed additives were not dependent on stress stimuli. Advantages of the Aloes plus preparation application included an insignificant improvement in the feed conversion ratio, a significant increase in the yield of breast muscles and shank muscles as well as in increased contents of dry matter, crude ash, in tissues. On the other hand, positive effects of applying a derivative of 5-oxo-1,2,4-triazine included stimulation of body weight gains and an increased dry matter content of the muscles.

Key words: turkey hens, aloes, 5-oxo-1,2,4-triazine, stress, tissues

INTRODUCTION

During industrial, large-scale rearing, animals are exposed to multiple stress factors. Especially high susceptibility to these factors has been reported for commercial livestock characterized by a fast growth rate including e.g. slaughter poultry. Birds are exposed to

many diversified stress factors during the so-called pre-slaughter handling that includes catching, weighing, transportation to a slaughter house and unloading. The response to stress stimuli involves the activation of mechanisms that are responsible for restoring body homeostasis. It is achieved via enhanced release of corticoids from the adrenal cortex and an increased rate of metabolism which is aimed at providing for increased energy demand. Unfortunately, these changes result in deterioration of production effects indicated by a reduced body weight and a lower feed conversion ratio [Quinteiro-Filho *et al.* 2012], but also in deterioration of dressing percentage and quality of poultry meat [Toghyani *et al.* 2011]. Stress is also a causative agent of debilitated immune response and antioxidative defense mechanisms. In order to reduce the adverse effects of stress factors the birds are exposed to in the production process and during pre-slaughter handling, attempts are made to use mineral-vitamin preparations [Wójcik *et al.* 2001], or herbal plants especially these with adaptogenic, immunostimulatory and antioxidative properties [Pande 2002, Pandurang *et al.* 2011]. Preparations with proven capability to stimulate immune and antioxidative reactions in poultry include juices and extracts from Krantz aloe (*Aloe arborescens*), especially Bioaron C which additionally contains vitamin C and chokeberry juice and Aloes plus [Ognik and Sembratowicz 2012, Sembratowicz *et al.* 2004b]. The Aloes plus is a preparation based on the synergistic action of active compounds of aloes, trans-resveratrol (an antioxidant isolated from Japanese knotweed) and vitamin C. The stimulating effect on mechanisms of immune and antioxidative defense of turkey hens was also demonstrated for a newly-synthesized derivative of amidrazones 5-oxo-1,2,4-triazine [Ognik and Sembratowicz 2011, Ognik *et al.* 2015]. This compound belongs to the derivatives of amidrazones, also exhibits anti-inflammatory, antibacterial, antiviral and antifungal [Modzelewska-Banachiewicz and Kamińska 2000]. Studies in turkeys showed stimulative effect of the 5-oxo-1,2,4-triazine on weight gain and beneficial modification of the mineral composition of tissues [Ognik and Merska 2012]. Taking into account the biological properties of extracts from aloe and newly synthesized derivative of 5-oxo-1,2,4-triazine attempted use of these additives during artificially induced stress in organisms of turkey hens.

The aim of this study was determine whether the introduction of stressor affected the effects of rearing, the results of carcass slaughter and chemical composition of turkey hens tissues, and whether applied together with stress additives formulated Aloe plus preparation and derivative of 5-oxo-1,2,4-triazine led to mitigate the possible adverse changes in examined indicators.

MATERIAL AND METHODS

The experiment was carried out on 360 turkey hens of the BUT-9 line, aged from 6 to 15 weeks. The birds were randomly assigned to 6 experimental groups of 60 birds. Each group was further subdivided into 6 replicates, each with 10 birds. The birds were reared under standard conditions following recommendations by Faruga and Jankowski [1996]. The experimental procedure was approved by the Second Local Ethics Commission for Experiments with Animals in Lublin (approval no. 11/2009). During the experimental period, the birds from all groups had access to drinking water and were fed *ad libitum* with complete feed mixtures (table 1) balanced according to nutrient requirements for poultry [Normy… 2005].

Table 1. Ingredient and nutrient content of standard diets
Tabela 1. Zawartość składników odżywczych w standardowej diecie

Ingredient Składnik	Feeding period (weeks of age)/Okres żywienia (tydzień życia)				
	Starter (1–2)	Grower I (3–5)	Grower II (6–9)	Grower III (10–12)	Finisher I (13–15)
Maize meal Mączka kukurydziana (g/kg)	256	274	238	352	474
Wheat/ Pszenica (g/kg)	200	250	300	250	250
Rape cake Rzepak (g/kg)	-	-	-	-	-
Wheat bran (g/kg) Otręby pszenne (g/kg)	30	-	-	-	-
Soybean meal 46% protein Mączka sojowa 46% białka (g/kg)	410	417	388	327	204
Soybean meal 45% protein Mączka sojowa 45% białka (g/kg)	20	-	-	-	-
Fish meal 60% Mączka rybna (g/kg)	35	-	-	-	-
Fodder chalk Kreda pastewna (g/kg)	12	17	17	14	15
Soybean oil Olej sojowy (g/kg)	5	10	25	30	30
Cytromix Plus[1] Zakwaszacz-Cytromix (g/kg)	2	2	2	2	2
Premix[2]/ Premiks (g/kg)	30	30	30	25	25
Crude protein/ Białko surowe (g/kg)	271.0	255.0	245.0	220.0	175.0
ME (MJ/kg)	11.45	11.73	12.19	12.58	13.09
Crude fibre/ Włókno surowe (g/kg)	28.6	27.7	27.2	27.1	27.0
Lysine/ Lizyna (g/kg)	18.1	17.1	15.7	13.8	11.7
Meth.+ cyst./ Metionina (g/kg)	9.8	9.0	8.8	7.9	7.0
Tryptophan/ Tryptofan (g/kg)	3.4	2.8	2.7	2.3	1.9
Arginine/ Arginina (g/kg)	17.7	15.7	15.0	13.2	9.8
Calcium/ Wapń (g/kg)	13.9	12.3	11.7	10.6	9.4
Available P Fosfor przyswajalny (g/kg)	7.7	6.7	5.9	5.7	4.7
Sodium/ Sód (g/kg)	1.5	1.6	1.5	1.5	1.5

[1] Cytromix Plus: citric acid, fumaric acid, phosphoric acid (62%)
[2] Premix mineral and vitamin premix provided the following per kilogram of diet: 3 000 000 IU vitamin A; 900 000 IU vitamin D_3; 10 000 mg vitamin E; 500 mg vitamin K_3; 700 mg vitamin B_1; 2000 mg riboflavin; 1200 mg vitamin B_6; 6 mg vitamin B_{12}; 400 mg folic acid; 72 mg biotin; 15 000 mg niacin; 120 000 mg of choline; 4200 mg of calcium pantothenicum; 30 000 mg Mn; 18 000 mg Zn; 12 000 mg Fe; 3000 mg Cu; 200 mg I; 60 mg Se; 40 mg Co; 15 g Ca; 15.5 g P

Table 2. Experimental design
Tabela 2. Układ doświadczenia

Specification Opis	Control Kontrola		Experimental groups Grupy doświedczalne			
	C	C+stress	A	A+stress	T	T+stress
36–63 day of life/ dzień życia	-	-	Aloes plus (0.70 ml/kg BW/day)	Aloes plus (0.70 ml/kg BW/day)	5-oxo-1,2,4--triazine (30 µg/kg BW/day)	5-oxo-1,2,4--triazine (30 µg/kg BW/day)
61–63 day of life/ dzień życia	-	+stress	-	+ stress	-	+ stress
64–77 day of life/ dzień życia	-	-	-	-	-	-
78–105 day of life/ dzień życia	-	-	Aloes plus (0.70 ml/kg BW/day)	Aloes plus (0.70 ml/kg BW/day)	derivative of 5-oxo-1,2,4--triazine (30 µg/kg BW/day)	derivative of 5-oxo-1,2,4--triazine 30 µg/kg BW/day)
103–105 day of life/ dzień życia	-	+stress	-	+stress	-	+stress

Groups C and C(+)stress were control groups that did not receive any additive (table 2). Birds from groups A and A(+)stress were administered aloe extract with trans-resveratrol and vitamin C (table 2) added in the amount of 0.70 ml/kg body weight (BW)/day. The additive is a Polish aloe preparation with the commercial name Aloes Plus, produced by Herbapol Lublin, a producer of herbal products. Turkey hens from groups T and T(+) stress received the amidrazone derivative: 5-oxo-1,2,4-triazine in the amount of 30 µg/kg BW/day, dissolved in a small quantity of ethanol (ca. 2 ml). The 5-oxo-1,2,4-triazine was synthesized by the Department of Organic Chemistry of the Medical University of Lublin. The additives were administered to the birds in their drinking water for 28 days (table 2) starting from the 36th day of life. The dose of the additives per kg BW/day was determined on the basis of average values for performance parameters (body weight and daily weight gain) in BUT-9 turkey hens. The experimental additives were administered every morning in drinking troughs with about 1–2 litres of water, which guaranteed that the additives would be consumed, and then clean drinking water was added as needed. A two-week break followed, during which the birds drank water without additives. After the break, the birds again received the additives for another 28 days. On days 26, 27 and 28 of administration of the additives an experimental factor in the form of stress stimuli was introduced in groups C(+)stress, A(+)stress and T(+)stress for 1 hour each day. The stress stimuli were crowding and changes in temperature and lighting, applied simultaneously. The birds were placed in 85 × 50 × 35 cm plastic containers (crowding) used to transport birds. A maximum of three birds were placed in one container. The containers had holes enabling access to cool fresh air when the birds were moved outdoors (to a place not shielded from wind) in order to induce a rapid change of lighting conditions from artificial light to daylight, as well as a decrease in temperature of ca. 20–30°C, as during the study (November – January) the air temperature ranged from +5°C to –10°C. The treatments were conducted in the daytime, always at the same time of day. The experimental conditions were adjusted to resemble the conditions of the production process, especially during intensive rearing at large

production farms. The same procedure for inducing the stress factor was applied on days 68, 69 and 70 of the life of the turkey hens (table 2).

The following parameters were throughout the study period: body weight of turkey hens (once they completed 35th, 63rd, 77th and 105th day of life) and intakes of feed mixtures. Based on the production results, the European Productivity Index (WEO) was calculated for particular groups from the following formula:

$$WEO = \frac{\text{mean body weight after rearing (kg)} \times \text{liveability (\%)} \times 100}{\text{day of rearing} \times \text{feed conversion (kg/kg)}}$$

After the rearing (105th day of life) were slaughtered, preceded by 12 h period of fasting – approved by the II Local Ethical Commission for Experiments with Animals in Lublin slaughter proceedings 12 pieces of each experimental group (weighed all the individuals of the group/subgroup and based on the average was selected animals to further experimental actions. During dissection, samples of breast muscles, leg muscles and edible giblets (liver, heart, gizzard) were collected for analyses. Contents of the main nutrients in the analyzed samples were determined with standard AOAC methods [2000].

Data achieved were analyzed using the Statistica software package version 6.0 (StatSoft Corp., Kraków, Poland). A two-way repeated measures Anova was applied to assess the effect of main factors: stress (S), additives (D) and their interactions (S × D). If the analysis revealed a significant interaction or that both factors had a significant influence, the differences among the individual groups were then analyzed using Tukey's multiple range post hoc test. Data had been checked for normality before the statistical analysis was performed. Differences were considered to be significant at $P \leq 0.05$. The pooled SEM was calculated as the standard deviation from all measurements divided by their square root.

RESULTS

Data presented in table 3 demonstrate that the applied stress factors had no significant effect on rearing parameters of turkey hens. It ought to be noticed, however, that stress contributed to slight inhibition of body weight as it was observed that in the 77th and 105th day of life the birds exposed to stress achieved slightly lower body weights than the birds not exposed to stress. In the whole fattening period, the greatest body weight gains were recorded for the birds receiving the derivative of 5-oxo-1,2,4-triazine (T). In the 77th day of life, their body weight was significantly ($P \leq 0.05$) higher compared to the values noted for control birds (C).

In most of the groups the feed conversion ratio (FCR) was higher than the normal value, i.e. 2.50 kg/kg [Normy… 2005]. The lowest FCR value (2.49 kg/kg) was determined in the group administered additive Aloes plus preparation (A+stress). However, both applied additives, i.e. Aloes plus and a derivative of 5-oxo-1,2,4-triazine, had no significant effect on feed conversion ratios. The intake of water, recorded in each week of observations, did not diverge from standard values adopted for poultry [Normy… 2005]. The highest value of the WEO index was noted in the groups receiving feed mixtures with the addition of 5-oxo-1,2,4-triazine derivative, in the case of birds both exposed to

(T+stress) and those not exposed to stress (T). These values were significantly ($P \leq 0.05$) higher than the respective values reported for control groups (C and C-stress).

Table 3. Performance of turkey hens
Tabela 3. Efekty produkcyjne indyczek

Experimental factors Czynniki doświadczalne		Body weight/ Masa ciała (kg)				FCR[1] (kg/kg)	WEO[2] (points/ pkt)
		35 day of life/ dzień życia	63 day of life/ dzień życia	77 day of life/ dzień życia	105 day of life/ dzień życia		
C	–stress	1.75	3.96	5.02	8.04^{ab}	2.71^{a}	385.4^{b}
A	–stress	1.75	3.50	5.05	7.60^{b}	2.53^{b}	390.1^{ab}
T	–stress	1.77	3.58	5.60	8.53^{a}	2.61^{ab}	424.5^{a}
C	+stress	1.76	3.65	4.72^{b}	7.57^{ab}	2.60^{ab}	378.1^{b}
A	+stress	1.74	3.52	4.88^{ab}	7.12^{b}	2.49^{b}	371.4^{b}
T	+stress	1.76	3.78	5.25^{a}	8.33^{a}	2.70^{a}	400,6^{a}
SEM		0.003	0.071	0.086	0.134	0.083	0.938
Additivs effect Wpływ dodatku (D)	C	1.75	3.80	4.87^{b}	7.80^{ab}	2.65	381.7
	A	1.74	3.51	4.96^{ab}	7.36^{b}	2.51	380.7
	T	1.76	3.68	5.42^{a}	8.43^{a}	2.65	412.5
Stress effect Wpływ stresu (S)	–stress	1.75	3.68	5.22	8.05	2.61	400.0
	+stress	1.75	3.65	4.95	7.67	2.59	383.3
D		ns	ns	**	**	ns	ns
S		ns	ns	ns	ns	ns	ns
D × S interaction Interakcja D × S		ns	ns	**	**	**	**

[a, b] Means in the same column without common superscripts differ significantly at: * $p \leq 0,01$; ** $p \leq 0,05$; ns $p > 0,05$/ Wartości w kolumnach różnią się istotnie przy: * $p \leq 0,01$; ** $p \leq 0,05$; ns $p > 0,05$
[1] Feed conversion ratio (35–105 day)/ Wykorzystanie paszy
[2] Index of rearing effectiveness (35–105 day)/ Wskaźnik efektywności odchowu

Both in the group exposed to stress (A+stress) as well as in that not exposed to stress (A) the addition of aloe preparation (Aloes plus) affected a significant ($P \leq 0.05$) increase in the content of breast muscles and shank muscles in carcasses. In turn, the administration of the 5-oxo-1,2,4-triazine derivative contributed to an insignificantly ($P > 0.05$) higher fat content of the carcasses (table 4).

The statistical analysis of results characterizing the chemical composition of the analyzed muscles and livers of turkey hens demonstrated (table 5) that the stress factor had no significant effect on the values of the analyzed parameters. Both additives applied, i.e. Aloes plus preparation (A) and derivative of 5-oxo-1,2,4-triazine (T), evoked an increase ($P \leq 0.05$) in dry matter content of the analyzed tissues. The aloe preparation (A) additionally contributed to a significant ($P \leq 0.05$) decrease in crude protein content of liver and to an increased content of crude fat in breast and thigh muscles. Breast muscles and liver of the turkey hens receiving the aloe preparation were also characterized by a significant ($P \leq 0.05$) increase in the content of crude ash.

Table 4. Slaughter analysis of turkey hens (%)
Tabela 4. Analiza rzeźna indyczek (%)

Experimental factors Czynniki doświadczalne		Breast muscles Mięśnie piersiowe	Thigh muscles Mięśnie udowe	Shank muscles Mięśnie podudzia	Abdominal fat Tłuszcz sadełkowy	Gizzard żołądek	Liver Wątroba	Heart Serce
C		24.9[b]	10.03	7.59[b]	0.87[b]	1.38	1.60	0.39
A	–stress	27.3[a]	10.7	8.67[a]	0.80[b]	1.34	1.58	0.34
T		25.6[b]	10.04	7.77[b]	0.98[a]	1.35	1.57	0.35
C		24.3[b]	9.70	7.76[b]	0.87[ab]	1.35	1.51	0.36
A	+stress	27.1[a]	9.70	8.57[a]	0.79[b]	1.40	1.52	0.37
T		24.9[b]	10.02	7.75[b]	0.90[a]	1.39	1.53	0.36
SEM		0.31	0.13	0.17	0.02	0.04	0.03	0.009
Additivs effect Wpływ dodatku (D)	C	24.6[b]	9.86	7.67[b]	0.87[b]	1.36	1.55	0.37
	A	27.2[a]	10.02	8.62[a]	0.79[c]	1.37	1.55	0.35
	T	26.2[ab]	10.03	7.76[b]	0.94[a]	1.37	1.55	0.35
Stress effect Wpływ stresu (S)	–stress	25.9	10.20	8.01	0.88	1.35	1.58	0.36
	+stress	25.4	9.80	8.02	0.85	1.38	1.52	0.36
D		**	ns	**	**	ns	ns	ns
S		ns	ns	ns	ns	ns	ns	ns
D × S interaction/ Interakcja D × S		**	ns	**	**	ns	ns	ns

[a, b] Means in the same column without common superscripts differ significantly at: * $p \leq 0,01$; ** $p \leq 0,05$; ns $p > 0,05$/ Wartości w kolumnach różnią się istotnie przy: * $p \leq 0,01$; ** $p \leq 0,05$; ns $p > 0,05$

Table 5. Chemical composition of muscles and liver of turkey hens (%)
Tabela 5. Skład chemiczny mięśni oraz wątroby indyczek (%)

Experimental factors Czynniki doświadczalne		Breast muscles Mięśnie piersiowe				Thigh muscles Mięśnie udowe				Shank muscles Mięśnie podudzia				Liver Wątroba			
		dry mater sucha masa	crude protein białko surowe	crude fat tłuszcz surowy	crude ash popiół surowy	dry mater sucha masa	crude protein białko surowe	crude fat tłuszcz surowy	crude ash popiół surowy	dry mater sucha masa	crude protein białko surowe	crude fat tłuszcz surowy	crude ash popiół surowy	dry mater sucha masa	crude protein białko surowe	crude fat tłuszcz surowy	crude ash popiół surowy
C		24.5^{b}	24.0	0.66^{b}	1.70^{b}	23.3^{b}	20.8	1.65^{b}	1.93	22.5^{b}	19.7	3.16	1.41	26.8^{c}	19.5^{a}	3.40	4.74^{b}
A	– stress	25.9^{a}	24.6	0.91^{a}	3.31^{a}	24.6^{a}	22.1	2.43^{a}	1.80	24.3^{a}	20.6	2.82	1.91	31.8^{a}	17.7^{b}	3.55	6.29^{a}
T		26.3^{a}	24.3	0.70^{b}	1.75^{b}	24.9^{a}	21.1	1.95^{ab}	1.77	24.6^{a}	20.9	3.0	1.44	29.9^{b}	19.8^{a}	3.15	4.01^{c}
C		24.9^{b}	23.6	0.68^{b}	1.41^{c}	23.5^{b}	20.7	1.64^{b}	1.88	22.8^{b}	19.8	2.90	1.32	26.4^{b}	19.7^{a}	3.42	4.07^{b}
A	+ stress	26.0^{a}	24.4	0.79^{a}	2.47^{a}	24.6^{a}	21.8	2.01^{a}	1.79	24.1^{a}	20.7	2.90	1.46	30.4^{a}	18.8^{b}	3.44	5.66^{a}
T		26.2^{a}	24.4	0.71^{ab}	1.77^{b}	24.7^{a}	21.1	1.88^{ab}	1.90	24.7^{a}	20.7	2.81	1.49	29.6^{ab}	19.9^{a}	3.32	3.92^{b}
SEM		0.18	0.15	0.02	0.15	0.16	0.22	0.06	0.07	0.20	0.19	0.07	0.07	0.41	0.20	0.07	0.19
Additive effect Wpływ dodatku (D)	C	24.7^{b}	23.5	0.67^{b}	1.55^{c}	23.4^{b}	20.7	1.64^{b}	1.90	22.6^{b}	19.7	3.03	1.36	26.6^{b}	19.6^{a}	3.41	4.40^{b}
	A	25.9^{b}	24.5	0.85^{a}	2.89^{a}	24.6^{a}	21.9	2.22^{a}	1.79	24.2^{a}	20.6	2.86	1.68	31.1^{a}	18.2^{b}	3.49	5.97^{a}
	T	26.2^{a}	24.3	0.70^{b}	1.76^{b}	24.8^{a}	21.1	1.91^{ab}	1.83	24.6^{a}	20.8	2.90	1.46	29.7^{ab}	19.8^{a}	3.23	3.96^{b}
Stress effect Wpływ stresu (S)	– stress	25.5	24.3	0.75	2.25	24.2	21.3	2.01	1.83	23.8	20.4	2.99	1.58	29.5	19.0	3.36	5.01
	+ stress	25.7	24.1	0.72	1.88	24.2	21.2	1.84	1.85	23.8	20.4	2.87	1.42	28.8	19.4	3.39	4.55
D		**	ns	**	**	**	ns	**	ns	**	ns	ns	ns	**	**	ns	**
S		ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	N s	ns	ns
D × S interaction Interakcja D × S		**	ns	ns	ns	**	ns	**	ns	ns	ns	ns	ns	**	**	ns	**

[a, b] Means in the same column without common superscripts differ significantly at: * $p \leq 0,01$; ** $p \leq 0,05$; ns $p > 0,05$/ Wartości w kolumnach różnią się istotnie przy: * $p \leq 0,01$; ** $p \leq 0,05$; ns $p > 0,05$

DISCUSSION

A rapid response of an animal to stress stimuli requires the mobilization of all defense forces of a body, and this increases the demand for energy even several times compared to normal conditions [Ognik and Sembratowicz 2012]. The increased concentration of corticoids circulating in blood that occurs under stress condition contributes to the inhibition of body protein synthesis and enhanced proteolysis because these hormones evoke mainly catabolic effects. This results in muscle mass decrease and in the case of young organisms in growth retardation [Lin *et al.* 2006]. Results of the conducted experiment demonstrate that the introduction of a stress factor in the form of simultaneous crowding and changes in temperature and lighting conditions had no significant effect on body weight gains of turkey hens. However, body weight gains of the birds exposed to stress were slightly slower in the entire experimental period and their final body weight was lower by ca. 4.7%, compared to the birds not exposed to stress. About the impact of the stress above treatments provide the results of an earlier experiment on turkey hens, who used the same way stress in the birds (time and type of stress factors) [Truchliński *et al.* 2007]. As a response to stress there was an increase in classical indicators of stress, by increasing the content of corticosterone in the blood, and heterophil/lymphocyte ratios (H/L). In this experiment, however, did not analyze the effects of the stress on production parameters of poultry. Results of experiments in which birds were exposed to heat stress, i.e. were kept at a temperature lower than the optimal one, demonstrate that it caused a significant decrease in body weight of birds. This was due to the fact that birds were consuming a significant part energy derived from feed mixtures for heat production in order to keep an appropriate body temperature [Ipek and Sahan 2006]. Also a high air temperature has a negative impact on rearing effects of poultry, which was demonstrated in ample experiments [Temim *et al.* 2000, Abu-Dieyeh 2006], as it causes diminished appetite and, thus, lower feed intake by birds. In chickens exposed to stress by the application of corticosterone, a highly significant decrease was observed in production parameters including both body weight gains and feed conversion ratio [Lin *et al.* 2004]. Results of our experiment demonstrate that the applied stress factors did not have any negative impact on feed conversion ratio of the birds. Investigations on the effect of transport stress on production effects of chickens showed that it was inducing considerable losses including reduced body weight as well as increased infection and death rates [Pijarska *et al*. 2006, Wójcik *et al.* 2001, Kannan *et al.* 1997]. The administration of the aloe preparation to the non-stressed and stressed turkey hens did not contribute to any significant changes in production parameters, but significantly improved the feed conversion ratio. No impact on production results of the turkey hens receiving the preparation containing an extract from aloe with the addition of chokeberry juice – Bioaron, was also noted by Sembratowicz *et al.* [2004b]. In turn, the same authors when administering a Biostymina preparation (a water extract from aloe) to birds observed a tendency for slightly better body weight gains. The analysis of production effects of the turkey hens administered the 5-oxo-1,2,4-triazine derivate showed that this compound was significantly stimulating body weight gains, especially between the 63rd and the 77th day of birds life. By using this supplement, the negative impact of stress on weight gain turkey hens has been minimized, because at the end of fattening turkey hens receiving a derivative of 5-oxo-1,2,4-triazine weighed about 9.8% more than in stressed birds and

about 3,6% more than the birds not subjected stress. The positive effects of amidrazones, i.e. derivative of 5-oxo-1,2,4-triazine and 1,2,4-triazole, on the improvement of rearing effects of turkey hens were demonstrated in a research by Sembratowicz *et al.* [2004a]. This could be linked with the positive effects of these compounds on gut microflora of birds, namely with growth inhibition of pathogenic flora and with growth stimulation of desirable bacteria. In the *in vitro* tests these compounds were exhibiting antibacterial, antiviral and antimycotic activity against many pathogenic strains of microorganisms [Modzelewska-Banachiewicz and Kamińska 2000].

Literature data indicate that effects of transportation-induced stress and pre-slaughter stress in poultry were alleviated by using mineral and vitamin preparations [Wójcik *et al.* 2001], antioxidants, such as vitamin C, E, flavonoids, and phenolics [Bagchi *et al.* 1999, Brisibe *et al.* 2009] as well as probiotics and prebiotics [Ghareeb *et al.* 2008]. Positive effects of these additives administration included, i.a., reduced body weight losses that usually occur during transportation and pre-slaughter handling. Pandurang *et al.* [2011] demonstrated that in the case of chickens negative effects of crowding could be effectively counteracted by the administration of a herbal mixture with adaptogenic, immunostimulatory and antioxidative activities. The herbs not only had a positive impact on rearing performance of the birds (body weight gains and feed conversion ratio), but also contributed to the normalization of biochemical and hematological blood parameters. Many works demonstrated that the stress stimuli the birds are exposed to during intensive fattening, and most of all during transportation and pre-slaughter handling, affect not only their rearing performance but also dressing percentage and quality of carcasses [Ali *et al.* 2008]. Results of our study demonstrate that the applied stress factors had no significant effect on slaughter traits of carcasses nor on the proximate composition of the analyzed muscles and livers of turkey hens. The addition of the aloe preparation affected a significant increase in the percentage content of breast and thigh muscles in the carcass. The application of Aloes plus preparation contributed to a significant increase of dry matter content in all analyzed tissues and of crude ash in breast muscles and liver in the case of both birds exposed and not exposed to stress. This preparation contributed also to an increased content of crude fat in breast muscles and thigh muscles, which is undesirable from the dietetic point of view. A study by Ognik and Merska [2012] demonstrated that the administration of Aloes plus resulted in decreased contents of dry matter and total proteins in leg muscles and liver as well as a decrease in crude fat content. Ample investigations have demonstrated that natural herbal additives might positively affect not only production parameters but also the quality of raw material, including improvement of its dietetic and flavor values [Jung *et al.* 2010, Cross *et al.* 2011]. In turn, scientific literature provides considerably less information on the effect of amidrazones and their derivatives on slaughter traits of carcasses and quality of poultry meat. A research by Ognik and Merska [2011] demonstrates that the administration of 5-oxo-1,2,4-triazine to turkey hens (in doses of 15-45 mg/kg BW) improved the dietetic value of meat as it contributed to a reduction in crude fat content of breast muscles and liver. Results of our experiment show that this additive caused an insignificant increase in the content of depot fat in carcasses and an increase in dry matter content in the analyzed tissues of turkey hens.

In summary, it may be concluded that the applied stress factor in the form of simultaneous crowding and changes in temperature and lighting conditions did not affect the production results, slaughter traits of carcasses nor chemical composition of the analyzed

tissues of turkey hens. The effects noted upon the administration of both analyzed additives were not dependent on stress stimuli. Advantages of the Aloes plus preparation application included an insignificant improvement in the feed conversion ratio, a significant increase in the yield of breast muscles and shank muscles as well as in increased contents of dry matter, crude ash in tissues. In turn, positive effects of applying a derivative of 5-oxo-1,2,4-triazine included stimulation of body weight gains and increased dry matter content of the muscles.

REFERENCES

Abu-Dieyeh Z.H.M., 2006. Effect of chronic heat stress and long-term feed restriction on broiler performance. Int. J. Poult. Sci. 5(2), 185–190.

Ali S., Kang G.H., Joo S.T., 2008. A review: influences of pre-slaughter stress on poultry meat quality. Asian Australas. J. Anim. Sci. 21(6), 912–916.

AOAC, 2000. Official Methods of Analysis. Association of Official Analytical Chemist, EUA.

Bagchi D., Carryl O.R., Tran M.X., Bagchi M., Garg A., Milnes M.M., 1999. Acute and chronic stress-induced oxidative gastrointestinal mucosal ingury in rats and protection by bismuth subsalicylate. Mol. Cell. Biochem. 196(8), 109−116.

Brisibe E.A., Umoren U.E., Brisibe F., Magalhäes, P.M., Ferreira, J.F.S., Luthria D., Prior R.L., 2009. Nutritional characterization and antioxidant capacity of different tissues of Artemisia annua L. Food Chem. 115(4), 1240−1246.

Cross D.E., McDevitt R.M., Acamovic T., 2011. Herbs, thyme essential oil and condensed tannin extracts as dietary supplements for broilers, and their effects on performance, digestibility, volatile fatty acids and organoleptic properties. Br. Poult. Sci. 52(2), 227–237.

Faruga A., Jankowski J., 1996. Chów i hodowla indyków. PWRiL, Warszawa.

Ghareeb K., Awad W.A., Nitsch S., Abdel-Raheem S., Bohm J., 2008. Effect of transportation on stress and fear responses of growing broilers supplemented with prebiotics or probiotics. Int. J. Poult. Sci. 7, 621–625.

Ipek A., Sahan U., 2006. Effects of cold stress on broiler performance and ascites susceptibility. Asian-Aust. J. Anim. Sci. 19(5), 734–738.

Jung S., Choe J.H., Kim B., Yun H., Kruk Z.A., Jo CH., 2010. Effect of dietary mixture of gallic acid and linoleic acid on antioxidative potential and quality of breast meat from broilers. Meat Sci. 86(2), 520–526.

Kannan G., Heath J.L., Webeck C.J. Souza M.C.P., Howe J.L., Mench J.A., 1997. Effects of crating and transport on stress and meat quality charecteristics in broilers. Poult. Sci. 76, 523–529.

Lin H., Decuypere E., Busse J., 2006. Acute heat stress induces oxidative stress in broiler chicken. Comp. Bioch. Physiol. Part A. 144, 11–17.

Lin H., Decuypere E., Buyse J., 2004. Oxidative stress induced by corticosterone administration in broiler chickens (Gallus gallus domesticus) 1. Chronic exposure. Comp. Bioch. Physiol. Part B., 139, 737–744.

Modzelewska-Banachiewicz B., Kamińska T., 2000. Synthesis and biological action of 5-oxo-1,2,4-triazyne derivatives. Pharmazie 54, 503–505.

Normy żywienia drobiu, 2005. PAN IFiZZ, Jabłonna.

Ognik K., Merska M., 2011. Influence of amidrazones -5-oxo-1,2,4-triazyne derivative addition on the level of biochemical blood markers and chemical composition of turkey hens tissues. Annales UMCS, sec. EE, Zootechnica 29(3), 35–46.

Ognik K., Merska M., 2012. Effect of aloe preparation on the level of biochemical indices of blood and tissue composition of female turkeys. Annales UMCS, sec. EE, Zootechnica 30(1), 33–45.

Ognik K., Sembratowicz I., 2011. Influence of a newly-synthesised 5-oxo-1,2,4-triazyne derivative on antioxidant indices of blood and performance of turkey hens. South Afr. J. Anim. Sci. 41(4), 403-412.

Ognik K., Sembratowicz I., 2012. Effect of Aloe plus preparation supplement on hematological and immunological blood parameters of and performance of turkey hens. Turk. J. Vet. Anim. Sci. 36(1),1–8.

Ognik K., Sembratowicz I., Czech A., Kulak E., Merska M., 2015 Effect of an aloe preparation and 5-oxo-1,2,4-triazine on the redox profile of the blood of turkey hens subjected to stress. Ann. Anim. Sci. 15(1), 93–105.

Pande C.B., 2002. Herbal formulation as a promising adaptogenic, antistress and immunomodulator-A review. Poult. Fortune 4, 32–35.

Pandurang L.T., Kulkarni G.B., Gangane G.R., More P.R., Ravikanth K., Maini S., Deshmukh V.V., Yeotikar P.V., 2011. Overcrowding stress management in broiler chicken with herbal antistressor. Iran. J. Anim. Sci. 1(1), 49–55.

Pijarska I., Czech A., Malec H., Tymczyna L., 2006. Effect of road transportation of chicks on blood biochemical indices and productive results of broilers. Med Wet. 62(4), 408–410.

Quinteiro-Filho W.M., Rodrigues M.V., Ribeiro A., Ferraz-de-Paula V., Pinheiro M.L., Sá L.R., Ferreira A.J., Palermo-Neto J., 2012. Acute heat stress impairs performance parameters and induces mild intestinal enteritis in broiler chickens: role of acute hypothalamic-pituitary-adrenal axis activation. J. Anim. Sci. 90(6), 1986–1994.

Sembratowicz I., Ognik K., Truchliński J. Modzelewska–Banachiewicz B., 2004a. The influence of 1,2,4-triazole and 5-oxo-triazyne derivatives on some indices of blood and performance of turkey hens. J. Anim. Feed Sci. 13(2), 39–42.

Sembratowicz I., Ognik K., Truchliński J., 2004b. Wpływ Biostyminy oraz Bioaronu C na wybrane wskaźniki immunologiczne oraz produkcyjne indyczek. Annales UMCS, sec. EE, Zootechnica 42, 317–323.

StatSoft Inc., 2009. Statistica (data analysis software system) Version 9,0, www.statsoft.com.

Temim. S., Chagneau A.M., Tesseraud S., 2000. Chronic heat exposure alters protein turnover of theee different skeletal muscles in finishing broiler chickens Fed 20 or 25% protein diets. J. Nutr. 130, 813–819.

Toghyani M., Toghyani M., Gheisari A., Ghalamkari G., Eghbalsaied S., 2011. Evaluation of cinnamon and garlic as antibiotic growth promoter substitutions on performance, immune responses, serum biochemical and haematological parameters in broiler chicks. Livest. Sci. 138, 167–173.

Truchliński, J., Ognik, K., Sembratowicz, I., 2007. Influence of prolonged and interrupted stress in a form of crowding and cooling of turkey-hens on anti-oxidation indices of blood**.** Med Wet. 1, 95–98.

Wójcik A., Sowińska J., Iwańczuk-Czernik K., 2001. Influence of mineral-herbal mixtures on the level of micronutrient in the blood serum of calves. Folia Univ. Agric. Stetin. Zootech. 42, 169–174.

Streszczenie. Celem podjętych badań było stwierdzenie, czy wprowadzenie czynnika stresowego wpłynęło na efekty odchowu, wyniki analizy rzeźnej oraz skład chemiczny tkanek indyczek, a także czy zastosowane łącznie ze stresem dodatki, w postaci Aloesu plus oraz pochodnej 5-okso-1,2,4-triazyny, spowodowały złagodzenie ewentualnych niekorzystnych zmian badanych wskaźników. Doświadczenie przeprowadzono na 360 sztukach indyczek podzielonych losowo i równomiernie na sześć grup, liczących po 60 indyczek. Grupy C oraz C+stres stanowiły grupy kontrolne i nie otrzymywały żadnego dodatku. Ptakom z grup A oraz A+stres aplikowano preparat Aloes plus w ilości 0,70 ml/kg m.c./dzień. Indyczki z grup T oraz T+stres otrzymywały rozpuszczoną w niewielkiej ilości etanolu (ok. 2 ml) pochodną 5-okso-1,2,4-triazyny w dawce 30 µg/kg m.c./dzień. Czynnik stresowy w postaci jednoczesnego stłoczenia, zmiany temperatury oraz oświetlenia nie wpłynął na efekty odchowu, cechy rzeźne tuszek, jak również skład podstawowy oraz mineralny badanych tkanek indyczek. Efekty, jakie zanotowano w wyniku zastosowania testowanych dodatków, nie były zatem zależne od wprowadzonego stresu. Korzyści z podawania preparatu Aloes plus wyrażały się niewielką poprawą wskaźnika wykorzystania paszy, istotnym zwiększeniem wydajności mięśni piersiowych i mięśni podudzi, a także wzrostem zawartości suchej masy i popiołu surowego w tkankach. Natomiast do pozytywnych efektów zastosowania pochodnej 5-okso-1,2,4-triazyny można zaliczyć stymulację przyrostów masy ciała oraz zwiększenie zawartości suchej masy w mięśniach.

Słowa kluczowe: indyczki, aloes, pochodna 5-okso-1,2,4-triazyny, stres, tkanki