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INFLUENCE OF FEEDING WITH NON-GREASED FEED MIXTURES DURING THE FIRST WEEKS OF YOUNG SLAUGHTER TURKEYS' LIVES ON THEIR PERFORMANCE UNDER SUBSEQUENT EXTENSIVE REARING CONDITIONS

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Abstract. The aim of the research was to compare the effects of rearing slaughter turkeys fed with non-greased (N-G) and greased (G) full-portion feedstuff mixtures in their first 8 wks of life and then maintained extensively from 9th to 20th week of rearing. From 9th wk of rearing the birds from both groups where moved inside a building with access to fowl-runs and fed with limited balanced mixtures as well as crushed wheat, wheat bran, green forage and steam potatoes. Differences in average body weight were statistically significant for turkey-cocks from the 7th and for turkey-hens from the 11th week to the end of rearing. The birds fed with mixtures without dietary fat were significantly heavier. During the whole rearing period N-G groups showed less FCR than G groups. Better livability of these birds during the initial period of rearing was noticed. European Efficiency Index estimated for turkey-hens and turkey-cocks was significantly better in N-G groups than in G groups. Considerably bigger share of abdominal fat pad in body weight of G group of birds could result from the its more intensive operation connected with fat additive. Additionally, dietary fat administered during the initial rearing period may contribute to carcass fatness, what is confirmed by bigger proportion of abdominal fat pad in birds of G than in N-G groups. The unequivocal differentiation in case of the proportion of particular carcass elements depending on feeding and birds' sex was not observed. The presented investigations show that dietary fat addition to full-portioned feedstuff mixtures at the beginning of rearing should be limited if subsequent fattening is held with the use of farm fodders.

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Key words: slaughter turkeys, dietary fat, farm fodders, production effects

INTRODUCTION

Turkey meat available on the Polish market comes mainly from birds reared in intensive systems and fed with balanced fullstuff mixtures. However, there is a group of consumers who, except for the price, are driven by other criteria, such as the quality of the product, followed by its origin and security [Castellini et al. 2002, Fanatico et al. 2006]. This has resulted in the development of alternative farming systems of poultry, including turkeys, although in the case of extensive rearing poults, due to their high mortality, it constitutes a costly problem for farmers. Many farmers who want to meet the market demand, decide to buy turkeys reared under intensive conditions to the 5–6 weeks of age, and then allocate them to extensive system [Batkowska and Brodacki 2012]. This combination of two extremely different husbandry systems makes it necessary to device a method of feeding turkeys in the early stage of rearing, which will allow to obtain better liveability of birds and optimal body weight during the farm fodders feeding period [Ferket and Gernat 2006].

The liveability of turkey poults depends on many farming, environmental and infectious factors, acting alone or in the interaction [Bell 1989]. One of the causes of turkeys mortality in the early rearing period may be insufficient development of the digestive tract. At the same time intensive growth rate of birds increases their demand for energy. However, the amount of feed that can be consumed is limited due to a small capacity of the gastrointestinal tract. Therefore, in poultry nutrition it is necessary to use feedstuff with increased amount of dietary fat [Selvaraj and Purushothaman 2004, Baião and Lara 2005]. Greased feed mixture gives better nutritional effects, manifest in better use of nutrients and reduced feed conversion ratio, as well as shorter fattening period. Fat is the most condensed and also most available form of energy for animals (source of essential fatty acids) [Crespo and Esteve-Garcia 2002, Rondelli et al. 2004]. It does not concern all age groups and largely depends on its physical properties. Fullstuff mixtures are normally greased, however, chicks digest fats poorly, in comparison to adult birds. It is more often to meet an opinion that 1-day-old birds should not be fed with greased feed because their digestive tract is still immature. It still has a deficiency of proper intestinal microflora, gastrointestinal motility and enzymes' secretion, especially for fat digestion [Crew et al. 1972, Mossab et al. 2000, Azman et al. 2005]. High energy content in feed used at very early stage of birds' life may have negative consequences not only for the digestive but also the circulatory, respiratory or excretory systems.

The aim of this study was to determine the effect of the resignation of greasing full-portion feedstuff mixtures used in the initial period of rearing (up to 8th wks) on the performance (body weight, feed conversion ratio, liveability), the efficiency of rearing (expressed in the European Efficiency Index), dressing percentage, proportions of carcass and parts (%) and giblets of young slaughter turkeys reared extensively from the 9th week of life.

MATERIAL AND METHODS

A total of 2000 one-day-old medium-weight BUT-9 turkeys divided according to their sex were used in this study. On the first day of birds' life the sexes were divided into two groups: experimental (N-G) and a control (G). All birds were individually marked by wing clips. The size of each group was 1,000 birds with 5 replication subgroups (100 males and 100 females) in each. At the beginning of the experiment all birds were reared under the same environmental conditions. Birds were kept on deep litter according to technological requirements for slaughter poultry [Regulation of the Minister of Agriculture and Rural Development of 28 June 2010]. In all groups *ad libitum* feeding was used.

Up to 8 weeks of rearing, experimental groups were fed with balanced mixtures without greasing, while control groups were fed with standard mixtures (containing dietary fat). Complete feed mixtures were greased with soya oil (Prestarter and Starter) as well as oil and lard (Grower 1). Instead of fat for groups receiving non-greased mixtures the crushed corn in identical amounts was added. The compound composition for all experimental groups was the same (Table 1). They were prepared at the same time from the same batch of raw materials. The content of basic nutrients and minerals was determined by AOAC standard procedures [2000].

At the age of 8 weeks, 100 males and 100 females (20 birds subgroup replication), which were representative in terms of body weight, were randomly selected from each group and transferred to the open building with access to the grassy chicken runs. The stock density per 1 m^2 was 0.2 birds on run area and 3 birds in the building. Birds were transferred between buildings in May and they were reared until mid-August. For the first few days the turkeys were gradually acclimated to the natural light sources and to the use of green runs in rainless days. The outdoors area was divided with an adjustable fence to prevent all replication groups from mixing with each other. Part of each run was overshadowed with a shelter to protect birds against the sun. At the same time birds could use the building all the time. Turkeys reared under intensive system conditions to the end of life were kept in stock density of 4 birds per 1 m^2 in the building without the windows. The lighting program of 16 hrs of light/8 hrs of darkness per day was used.

Table 1. The composition and nutritive value of basal diets applied in the experiment

Tabela 1. Skład surowcowy oraz zawartość składników pokarmowych w mieszankach pełnoporcjowych stosowanych w doświadczeniu

Ingredients, % – Składniki, %	Feed mixture – Mieszanka		
	Prestarter 0–3 weeks 0–3 tyg.	Starter 4–6 weeks 4–6 tyg.	Grower 1 7–9 weeks 7–9 tyg.
Wheat + enzyme – Pszenica + enzym	49.545	54.685	55.695
Wheat brans + enzyme – Otręby pszenne + enzym	–	–	2.100
Soyabean meal (47% CP) – Śruta poekstrakcyjna sojowa (47% CP)	38.700	34.900	30.700
Fish meal (60% CP) – Mączka rybna (60% CP)	6.500	5.400	4.700
Lard – Smalec wieprzowy	–	–	1.500
Soya oil – Olej sojowy	1.000	1.300	1.100
Calcium phosphate – Fosforan 1-wapniowy	1.950	1.250	1.590
Limestone – Kreda pastewna	0.550	0.850	1.000
Lysine (99%) – Lizyna (99%)	0.510	0.390	0.390
Rhodimet	0.360	0.310	0.290
Threonine (99%) – Treonina (99%)	0.130	0.140	0.140
NaCl	0.160	0.150	0.200
Sour sodium carbonate ($NaHCO_3$) – Kwaśny węglan sodu ($NaHCO_3$)	0.070	0.070	0.070
Lutamix IB-1 BASF	0.500	0.500	0.500
Bio-Feed Wheat	0.025	0.025	0.025
Ronozyme P	–	0.030	–
Nutritive value – Składniki bilansowane			
Metabolic energy, MJ · kg^{-1} – Energia metaboliczna, MJ · kg^{-1}	11.78	12.07	12.36
Total protein, % – Białko ogólne, %	28.09	26.05	24.14
Lysine, % – Lizyna, %	1.802	1.600	1.476
Methionine, % – Mationina, %	0.677	0.615	0.570
Met + Cys, %	1.127	1.048	0.975
Tryptophan, % – Tryptofan, %	0.322	0.303	0.280
Linoleic acid, % – Kwas linolowy, %	1.002	1.173	1.210
Calcium, % – Wapń, %	1.352	1.311	0.632
Available phosphorus, % – Fosfor przyswajalny, %	0.767	0.684	2.025

After moving the birds, feeding farm fodders were included to the experimental groups except the balanced mixture. In the 9th week 10% of the mixture was withdrawn and crushed wheat, wheat bran and green forage (alfalfa, nettle, clover) in the proportion of 50:30:20 were given instead. In the next weeks, the proportion of wheat and bran increased, the use of complete feed was gradually reduced by 20, 40, 60% respectively in the 9th, 10th and 11th week. The intake of farm fodders amounted about 300–400 g/bird/day. From 15th week of rearing steamed potatoes were introduced to feeding in the amount 100–200 g/bird/day.

During the whole experiment the liveability, body weight gain and feed intake were registered. On the basis of them the feed conversion ratio (FCR) was estimated as well as European Efficiency Index (EEI) was calculated according to the formula: (final bird weight, kg × livability, %)/(age, days × feed conversion ratio × 100). At the end of the 20th week of rearing 10 males and females were randomly selected from each group. The birds were slaughtered, plucked and eviscerated. After cooling, a simplified dissection of carcasses was done [Hahn and Spindler 2002]. The carcass yield as well as proportions of particular carcass elements, percentage share of giblets and abdominal fat pad in the body weight were calculated as well.

All the data were analysed with the use of t-test and non-parametrical χ^2 test of SPSS 20.0PL [IBM 2011].

RESULTS AND DISCUSSION

The body weight of turkey males and females fed with greased (G) and non-greased (N-G) diet in particular periods of experiment is presented in Figure 1. Differences between mean body weight of males were statistically significant from 7th week to the end of rearing. The males fed with non-greased mixture were heavier. Finally, these birds reached an average body weight of 25.4 kg and were heavier by 1.3 kg than the males in control group. Significant differences in females body weight were noticed from 11th week of their life. birds fed earlier with non-greased mixture weighted more than G group. At the end of the experiment this difference was statistically highly significant and amounted about 1.2 kg, which constituted approx. 10% of the average body weight of females.

The dressing percentage of females was similar in both groups (Fig. 2) and amounted approx. 83%. However, in turkeys males it was diverse and depended considerably ($P \leq 0.05$) on the experimental factor used. The mean value of this parameter at a level 83.6% was reached by males in the control group, but lower (81.4%) by birds from the experimental group. Thus, it seems that the birds, dependently on sex, react in different ways to the addition of dietary fat. There were no differences in the proportions of the pectoral muscles, but turkeys which were fed with non-greased mixture reached higher share of thigh muscle (males and females) and the trunk (males) as well as the smaller of wings (females).

Figure 3 shows the proportions of particular giblets and abdominal fat pad in the body weight of turkeys. The share of liver was considerably higher in the control groups, fed with non-greased mixture, than in the experimental groups, regardless of birds' sex. This may indicate a greater load of this body organ and its intensive work related to dietary fat addition. Also bigger share of gizzard was stated in the body weight of G group males in comparison to N-G group, similar

but slight relations were observed in females. Both sexes from control groups demonstrated highly significantly bigger proportion of abdominal fat pad in body weight than in the control group. Thus, it appears that fat constituting the energy source in the early stages of rearing may contribute to bigger final carcass fatness.

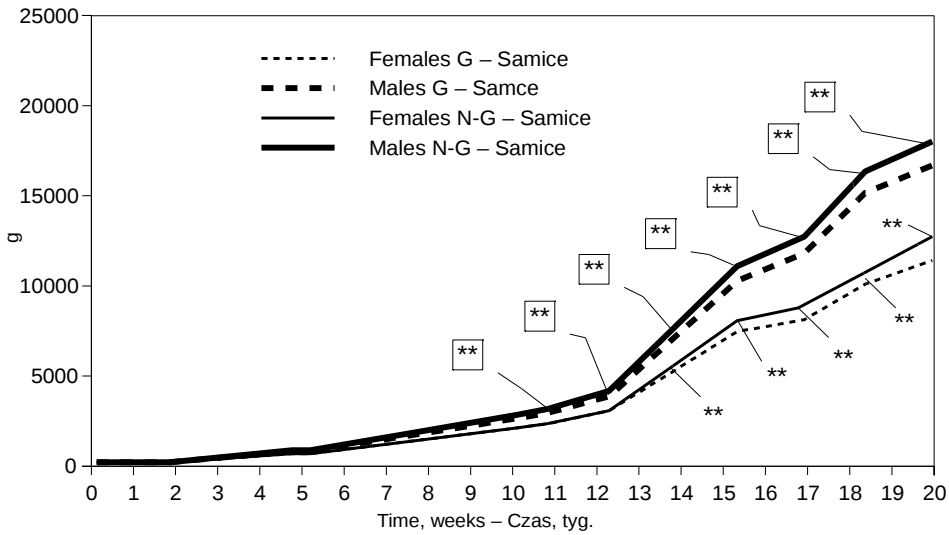

Fig. 1. The body weight of turkeys (males and females) in particular rearing weeks dependently on feeding method during initial feeding period (with or without dietary fat); ** average body weight of birds from G and N-G groups differ significantly ($P \leq 0.01$) within sex; N-G – non-greased feed (experimental group), G – greased feed (control group)

Rys. 1. Masa ciała indyków (samców i samic) w kolejnych tygodniach odchowu w zależności od sposobu żywienia w początkowym okresie odchowu (pasza natłuszczana lub bez dodatku tłuszczu) ** średnia masa ciała ptaków w grupach G i N-G różni się wysoko istotnie ($P \leq 0{,}01$) w obrębie płci; N-G – pasza bez dodatku tłuszczu (grupa doświadczalna), G – pasza natłuszczana (grupa kontrolna)

The results of the rearing efficiency of slaughter turkeys included in the trial are presented in Table 2. The liveability of birds was quite high, but in the first period of rearing it depended considerably on their sex. In the experimental turkey-cocks group significantly fewer birds died than in the control group ($p \leq 0.01$). Within females these differences were not statistically confirmed. Groups of males did not differ from each other in terms of the feed conversion ratio, however, from 9th to 20th weeks of rearing significantly lower values of this parameter was recorded for turkey-hens N-G than G. Significant differences in scores of European Efficiency Index (EEI) were also noted. The highest value, 540 pts, was reported in the second rearing period of males from the experimental group. Generally, in all comparisons birds fed with non-greased mixture turned out better, except for females up to 8 weeks of rearing.

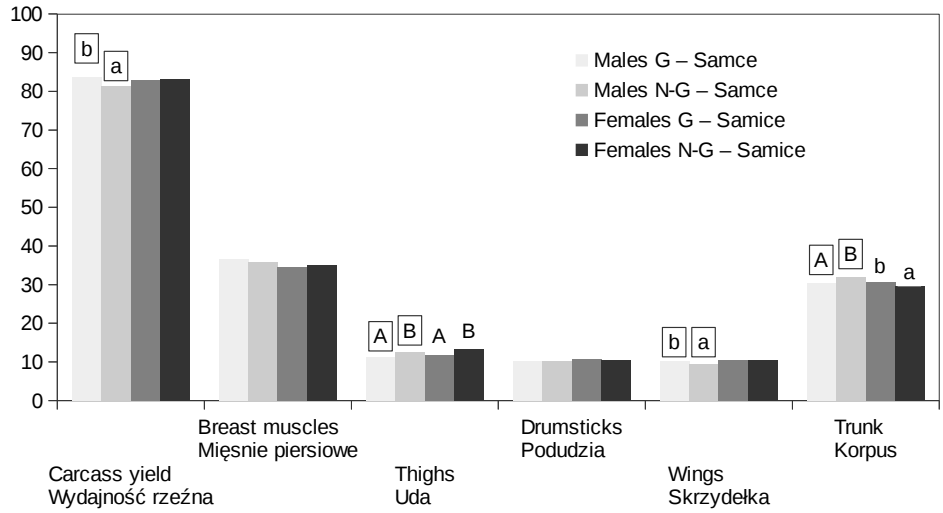

Fig. 2. Carcass yield of turkeys (males and females) dependently on feeding method during initial feeding period (with or without dietary fat); $^{A, B}$ groups G and N-G differ significantly ($P \leq 0.01$) within sexes, $^{a, b}$ groups G and N-G differ significantly ($P \leq 0.05$) within sexes, N-G – non-greased feed (experimental group), G – greased feed (control group)

Rys. 2. Wydajność rzeźna oraz procentowy udział poszczególnych elementów w tuszkach indyków (samców i samic) w zależności od sposobu żywienia w początkowym okresie odchowu (pasza natłuszczana lub bez dodatku tłuszczu); $^{A, B}$ grupy G i N-G różnią się wysoko istotnie ($P \leq 0,01$) w obrębie płci, $^{a, b}$ grupy G i N-G różnią się wysoko istotnie ($P \leq 0,05$) w obrębie płci; N-G – pasza bez dodatku tłuszczu (grupa doświadczalna), G – pasza natłuszczana (grupa kontrolna)

The body weight of turkeys, regardless of their sex, was much greater than presented by Brenøe and Kolstad [2000] in BUT-9 turkey-hens and cocks fed ad libitum with identical balanced mixtures. In 17th week of rearing it amounted 9.57 and 13.1 kg for females and males respectively at the same age. The obtained average value of this parameter in females was also higher than that recorded in the work by Batkowska and Brodacki [2012] in 16th week of their age with the use of similar, combined rearing system. Another regularity was noticed by Blair and Potter [1988] giving turkeys mixtures with varied level of dietary fat. They found that bigger amount of added fat contributed to greater final body weight and lower feed intake and feed conversion ratio. Also Peebles et al. [1997] conducting research on broiler chickens showed significantly better production results (final body weight, carcass yield, proportion of pectoral muscle in the carcass) in birds which were initially fed with high (7%) share of dietary fat in relation to the groups fed with 0 and 3% fat additive, respectively. However, in this group the percentage

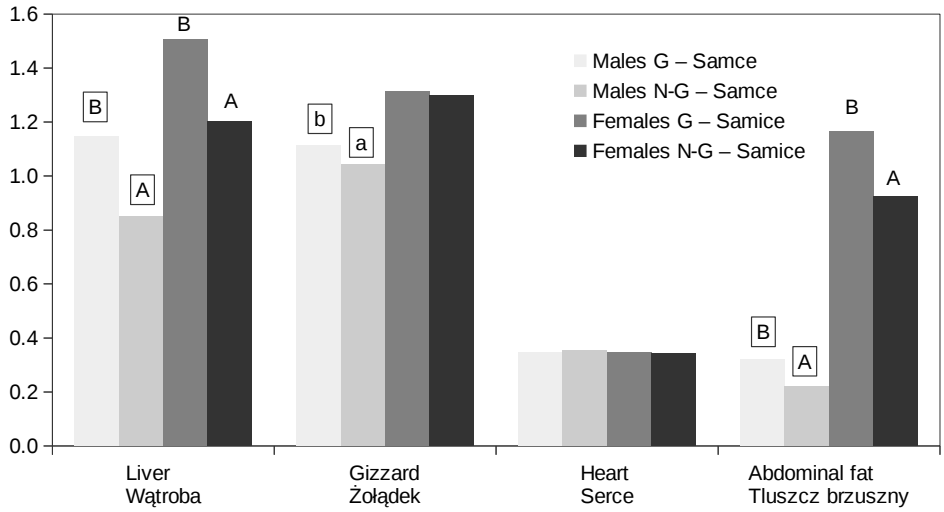

Fig. 3. Percentage share of giblets and abdominal fat in body weight of turkeys (males and females) dependently on feeding method during initial feeding period (with or without dietary fat); $^{A, B}$ groups G and N-G differ significantly ($P \leq 0.01$) within sexes, $^{a, b}$ groups G and N-G differ significantly ($P \leq 0.05$) within sexes, N-G – non-greased feed (experimental group), G – greased feed (control group)

Rys. 3. Procentowy udział podrobów jadalnych i tłuszczu okołojelitowego w masie ciała indyków (samców i samic) w zależności od sposobu żywienia w początkowym okresie odchowu (pasza natłuszczana lub bez dodatku tłuszczu); $^{A, B}$ grupy G i N-G różnią się wysoko istotnie ($P \leq 0{,}01$) w obrębie płci, $^{a, b}$ grupy G i N-G różnią się wysoko istotnie ($P \leq 0{,}05$) w obrębie płci; N-G – pasza bez dodatku tłuszczu (grupa doświadczalna), G – pasza natłuszczana (grupa kontrolna)

share of abdominal fat pad was the highest. Blair et al. [1988] demonstrated the relationship between body weight and the amount of abdominal fat in the carcass. Heavier birds were characterized by higher fat content in carcass than the light ones.

Azman et al. [2005] indicated that production effects of birds also vary depending on the type of used dietary fat. The best feed conversion ratio characterized birds fed with the addition of chicken fat, but the biggest daily body weight gains was observed in the group fed with mixture supplemented by beef tallow. Mossab et al. [2000] showed certain effect ($P \leq 0.05$) of various fat type (linseed oil vs. lard) on increase of pectoral muscles proportion in carcass. However, the significant content of abdominal fat pad should be noticed. Regardless of fat type used in birds' feeding it was 3 times bigger than in the present study, although turkeys were slaughtered at the age of 7 weeks. This may confirm a trend to increase carcass fatness under the influence of fat additive. Firman and Remus [1994] reported that the addition of corn oil to meat and bone meal improves digestibility of amino

acids in chickens (about 5.6 to 6%) and turkeys (5.5%), which may be important for limiting amino acids, such as lysine and methionine. Certain restrictions of the dietary fat amount was shown by Alparslan and Özdogan [2006]. The 2% addition of fish oil significantly improved body weight of broiler chickens, but already 4% additive decreased this parameter and raised the cost of feed.

Table 2. The evaluation of production effects (mean value) of turkeys (males and females) dependently on feeding method during initial feeding period (with or without dietary fat)

Tabela 2. Ocena efektywności tuczu indyków w zależności od sposobu żywienia w początkowym okresie odchowu (pasza natłuszczana lub bez dodatku tłuszczu)

Parameter Wskaźnik	Sex Płeć	Rearing time (weeks) – Okres odchowu (tyg.)						
		0-8		9–20		0–20		
		G	N-G	G	N-G	G	N-G	χ^2 *p-value*
Survival, % Przeżywalność, %	♂♂	93.7**	97.9**	100	100	93.2**	97.6**	*0.000*
	♀♀	97.6	97.4	100	100	97.3	97.2	*0.780*
								SEM
Feed conversion ratio (feed/ body weight gain, kg/kg) Zużycie paszy (kg/kg przyrostu)	♂♂	2.88	2.72	3.23	3.05	3.17	3.00	*0.015*
	♀♀	1.37	1.55	4.01^{b}	3.45^{a}	3.26	2.98	*0.022*
EEI (pts) EWW (pkt.)	♂♂	230^{A}	268^{B}	483^{A}	540^{B}	336^{A}	392^{B}	*1.727*
	♀♀	416^{B}	356^{A}	337^{A}	433^{B}	242^{A}	293^{B}	*1.469*

N-G – non-greased feed (experimental group), G – greased feed (control group), EEI – European Efficiency Index, ** mortality depends significantly on groups (G and N-G) at $P \leq 0.01$, $^{A, B}$ groups G and N-G differ significantly ($P \leq 0.01$) within sexes.

N-G – pasza bez dodatku tłuszczu (grupa doświadczalna), G – pasza natłuszczana (grupa kontrolna), EWW – europejski wskaźnik wydajności, ** śmiertelność zależy istotnie od grupy (G i N-G) przy $P \leq 0{,}01$, $^{A, B}$ grupy G i N-G różnią się wysoko istotnie ($P \leq 0{,}01$) w obrębie płci.

King and Fitzpatrick [1989b] wrote that the proportions of turkey carcass elements depend on many factors, including the type of hybrids, sex of birds and their age at the time of slaughter, the method of slaughtering and finally nutritional modification of diet. The same authors [King and Fitzpatrick 1989a] attribute significant differences in the dissection results of turkeys fed with dietary fat additive primarily to the birds' sex (the percentage share of abdominal fat pad is bigger in females than in males) and their age (older birds have bigger carcass yield than younger) but not the type of added fat. Leeson et al. [1997] also showed no effect of fat type of slaughter turkeys production results.

CONCLUSIONS

Both, turkey-hens and cocks, fed with balanced mixture without additive of dietary fat up to 8th week of age and farm fodders from 9th to 20th reached a significantly bigger body weight than birds which were given greased mixture and then farm fodders. Considerably better liveability characterised turkey males fed with non-greased mixture than standard fullstuff feed (containing soya oil and lard). Considerably bigger percentage share of abdominal fat pad in body weight of G group of birds could result from the more intensive operation connected with fat additive. Additionally, dietary fat administered during the initial rearing period may contribute to carcass fatness, what is confirmed by bigger proportion of abdominal fat pad in birds of N-G than in G groups. The unequivocal differentiation in case of the proportion of particular carcass elements dependently on feeding and birds' sex was not noticed. The greasing of full-portioned feedstuff mixtures used in the initial period of turkey rearing was not proved if subsequent fattening is held with the use of farm fodders.

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Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi z dnia 28 czerwca 2010 w sprawie minimalnych warunków utrzymywania gatunków zwierząt gospodarskich innych niż te, dla których normy ochrony zostały określone w przepisach Unii Europejskiej, DzU 2010 nr 116 poz. 778 [Regulation of the Minister of Agriculture and Rural Development of 28 June 2010 on minimum conditions for keeping livestock species other than those for which protection standards are set out in the regulations of the European Union. The Journal of Laws, 2004, No. 116. Pos. 778]. [in Polish]

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WPŁYW NATŁUSZCZANIA MIESZANEK PASZOWYCH NA WYNIKI PRODUKCYJNE INDYKÓW RZEŹNYCH ODCHOWYWANYCH EKSTENSYWNIE OD 9 TYGODNIA ŻYCIA

Streszczenie. Celem badań była ocena efektów produkcyjnych indyków rzeźnych, żywionych do 8. tygodnia życia mieszankami pełnoporcjowymi bez natłuszczania (N-G) lub natłuszczanymi (G), a następnie utrzymywanych i żywionych ekstensywnie od 9. do 20. tygodnia odchowu. W dziewiątym tygodniu ptakom udostępniono wybiegi i żywiono ograniczając stosowanie mieszanek paszowych, a wprowadzając śrutowaną pszenicę, otręby pszenne, zielonkę oraz parowane ziemniaki. Różnice w masie ciała były statystycznie istotne dla indorów od 7., a dla indyczek od 11. tygodnia do końca odchowu. Istotnie cięższe były ptaki żywione mieszanką nienatłuszczaną. Podczas całego okresu odchowu ptaki z grupy N-G wykazywały lepsze wykorzystanie paszy na kilogram przyrostu masy ciała niż G. Odnotowano także lepszą przeżywalność tych ptaków w początkowym okresie odchowu. Europejski Wskaźnik Wydajność szacowany dla indyczek i indorów był znacznie wyższy w grupie N-G niż w grupie G. Istotnie większy udział wątroby w masie ciała ptaków z grupy G mógł wynikać z jej intensywniejszej pracy w związku z dodatkiem tłuszczu w paszy. Ponadto tłuszcz podawany w początkowym okresie odchowu może przyczyniać się do późniejszego otłuszczenia tuszek, na co wskazuje większy udział tłuszczu okołojelitowego w grupie G niż N-G. Nie odnotowano jednoznacznego zróżnicowania proporcji poszczególnych elementów w tuszkach w zależności od sposobu żywienia i płci ptaków. Przedstawione badania wskazują, że natłuszczanie mieszanek paszowych stosownych w pierwszym okresie odchowu nie znajduje uzasadnienia, jeżeli dalszy chów prowadzony jest w oparciu o pasze gospodarskie.

Słowa kluczowe: indyki rzeźne, tłuszcz paszowy, pasze gospodarski, efekty produkcyjne

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