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Original scientific article
Izvirni znanstveni prispevek

EFFECT OF SEX ON THE SHARE OF MAIN PARTS IN CARCASS AND TISSUES IN BREASTS OF TURKEYS

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ABSTRACT

A research on the influence of turkey sex on the share of main parts in carcass and tissues in breasts was carried out on 30 male and 30 female turkeys of heavy type Nicholas 700 provenience. After a 19-week long fattening period, 10 turkeys from each group were randomly selected for research. Differences in weights of carcasses between males and females were statistically highly significant ($P<0.001$). Male turkeys had statistically heavier ($P<0.001$) breasts than females. However, no statistically significant differences ($P>0.05$) between males and females were observed in the portion of breasts in carcasses. Statistically highly significant differences ($P<0.001$) were observed in weights of thighs, drumsticks, wing drumsticks**,** wings and necks of males and females. When compared to female turkeys, males had statistically higher weights ($P<0.001$) of breast tissue. More favorable portion of muscles in breasts was noticed in females. Differences in portions of muscles in breasts between sexes were statistically highly significant ($P<0.001$).

Key words: turkeys / meat / sex / carcass parts / breasts / muscular tissue

VPLIV SPOLA NA DELEŽ GLAVNIH DELOV KLAVNEGA TRUPA IN TKIV V PRSIH PRI PURAH

IZVLEČEK

Vpliv spola na delež glavnih delov trupa in tkiv v prsih so proučevali na 30 puranih in 30 purah težkega tipa provenience Nicholas 700. Po 19 tednih pitanja je bilo iz vsake skupine naključno izbranih po 10 živali. Razlike v masi klavnih trupov med purani in purami so bile značilne ($p<0,001$). Purani so imeli značilno težja prsa ($p<0,001$) kot pure. Delež prsi v klavnem trupu se med purani in purami statistično ni razlikoval ($p>0,05$). Med purani in purami je bila ugotovljena tudi značilna razlika ($p<0,001$) v masi stegen, beder, krajcev peruti, perutnic in vratov. V primerjavi s purami so imeli purani značilno težja prsa ($p<0,001$). Bolj ugoden je bil delež mesa v prsih pri purah in se je med spoloma značilno razlikoval ($p<0,001$).

Ključne besede: purani / meso / spol / klavni deli / prsi / mišično tkivo

INTRODUCTION

Turkeys are produced mainly because of their quality meat with high portion of proteins and low portion of fats. High portion of breasts in carcass is the most important characteristic of turkey production. Turkey breasts are known as a dietetic product, the production of which the heavy turkey type is especially convenient. The portion of main parts in carcasses and the portion of tissue in turkey breasts is the object of many researches, mainly because of the

economic and nutritional aspects (Brake *et al.,* 1995; Ferket, 2003; Isguzar, 2003; Roberson *et al.*, 2003; Veldkamp *et al.*, 2003). Factors that influence the breast muscle share are age, weight, sex, provenience and feeding regime (Wood, 1989). The extent to which these factors can influence the breast muscle share depends on the temperature in their environment (Halvorson *et al.*, 1991; Veldkamp *et al.*, 2003). Average final weight of turkeys at the age of 18 weeks increases each year for 0.194 kg (Ferket, 2003). In comparison with other domestic animals, turkey sex has higher influence on the weight gain. At the end of the fattening process, male turkeys are significantly heavier than females. Females reach their final weight faster than males and have more fats in carcass (Leeson and Summers, 1980; Hurwitz *et al.*, 1983). When considering the dressing percentage of carcasses in respect to sex, research of Hurwitz *et al.* (1983) did not show differences. Leeson and Summers (1980), and Brake *et al.* (1995) claimed that male carcasses had higher dressing percentage than female. Higher portions of drumsticks and of breasts are noticed in male turkeys by Leeson and Summers (1980). Zelenka *et al.* (2003) proved that the percentage of breast muscles in the carcass increases linearly ($P<0.01$) with ageing of birds of both sexes, while the increase of drumsticks with thighs does not correlate with ageing ($P>0,05$). The aim of this research was to investigate the influence of heavy hybrid turkey sexes to the share of main parts in carcass and to the share of tissue in breasts (muscular tissue, skin with fatty tissue and bones).

MATERIALS AND METHODS

This research included 30 male and 30 female turkeys of heavy hybrid Nicholas 700 provenience. During the experiment, turkeys were fed with commercial forage mixtures (Table 1).

After a 19-week-long fattening period, 10 turkeys of each group were randomly selected. After 12 hours without food, turkeys were slaughtered. For the purpose of this research, turkey carcasses were cut in a classic way, according to the Regulations on quality of poultry meat (Službeni list, No. 1/81 and No. 51/88). Carcasses were cut into main parts (breasts, thighs with drumsticks, wings, wing drumsticks, backs with pelvis and necks). Abdominal fat was carefully taken out of carcasses and weighted. Shares of main parts are shown in absolute (g) and relative (%) values in relation to carcass. Breasts were divided to muscular tissue, skin with subcutaneous fatty tissue and bones. Portion of tissue is shown in absolute (g) and relative (%) values in relation to breasts and carcass. Research results are shown as calculation of arithmetic means ($\bar{x}$), standard deviation (s), standard error in the arithmetic means ($s_{\bar{x}}$) and variation coefficient (K_v). Differences between males and females are determined by t-test at three significance levels (5% $P<0.05$, 1% $P<0.01$ and 0.1% $P<0.001$), using Statistica for Win v.6.0.

RESULTS AND DISCUSSION

Table 2 presents values of final weights, weights of cooled carcasses and main parts according to sexes. Male birds had 28.33% higher final weight than females. Differences in carcass weights between females and males were statistically highly significant ($P<0.001$). When compared to standard recommended by the Nicholas Company (http://www.nicholas-turkey.com/include.asp?sec=505&con=888), for its hybrid (18.33 kg for male and 11.72 kg for female turkeys), lower values were obtained in this research, which can be explained by high temperatures and tropical conditions, which is in accordance with the literature. Negative effect of high temperatures on the final weights was pointed out by Halvorson *et al*. (1991), and particularly by Veldkamp *et al.* (2003), who stated that turkeys kept at 15 °C from 6th to 20th

week of fattening reached the weight of 19.18 kg, while turkeys kept at 30 °C weighed 13,40 kg. Slightly higher weight of male and female turkeys (15.84 kg and 11.79 kg, respectively) was determined by Isguzar (2003). In the research of Roberson *et al.* (2003) turkeys reached the weight of 17.1 kg at the end of 18th week of fattening. Lehmann *et al.* (1996) investigated turkeys that weighed from 17.81 do 18.45 kg in the 20th fattening week. At the end of a 17-week-long experiment of Noble *et al.* (1996), average weight of turkeys was from 13.70 to 14.52 kg, while the experiment of Brenoe and Kolstad (2000) proved the weights of 13.06 kg for males and 9.57 kg for females. At the end of an 18-week long fattening period, turkeys used for research of Kidd *et al.* (1997) weighed from 11.68 kg to 12.76 kg.

Table 1. Content of peleted forage mixtures fed from 1st to 133rd day

Ingredients, %	Prestarter from 0 until 3rd weeks	Starter from 4th until 6th week	Grower 1 from 7th until 9th week	Grower 2 from10th until 13th week	Finisher from 14th week until end of fattening
Corn	32.07	34.25	44.50	48.35	51.44
Extruded soybean	20.64	25.13	21.39	16.23	22.41
Soybean meal, 46%	29.19	19.26	13.94	16.24	11.61
Fish meal, 64%	3.50	4.88	5.00	3.00	-
Yeast, 52%	5.00	5.00	5.00	5.00	5.00
Phosphonal	2.62	2.38	1.93	1.66	2.62
Methionine	0.25	0.22	0.20	0.19	0.21
Lysine	0.01	0.01	0.03	0.02	0.04
Salt	0.22	0.21	0.21	0.20	0.20
Lignobond (fixer)	0.50	1.00	1.00	1.00	1.00
Ground limestone	3.00	2.66	0.94	1.09	0.47
Premix	1.00	1.00	1.00	1.00	1.00
Fat, BF	2.00	3.00	3.36	4.72	3.00
Pigozen	-	1.00	1.50	1.30	1.00
Total	100.00	100.00	100.00	100.00	100.00
Calculative forage mixture composition					
Crude protein. %	28.00	26.00	23.50	21.50	19.50
Fat, %	7.57	9.50	9.50	10.00	10.00
Crude fibres, %	4.03	3.66	3.42	3.15	3.43
Ash, %	9.55	9.82	7.46	6.83	6.22
Lysine, %	1.85	1.75	1.70	1.45	1.45
Methionine, %	0.70	0.65	0.60	0.55	0.50
Triptophane, %	0.39	0.36	0.32	0.29	0.26
Arginine. %	2.04	1.87	1.62	1.52	1.40
Ca, %	1.40	1.30	1.20	1.10	1.05
P utilised, %	0.63	0.61	0.54	0.45	0.55
Na, %	0.15	0.16	0.17	0.17	0.17
Linoleic acid, %	2.62	3.04	2.79	2.63	3.09
ME MJ kg^{-1}	11.91	12.33	12.75	13.17	13.20

In our research, better dressing percentage was obtained in female turkeys (81.34±3.74%) than in male ones (79.96±1.58%), although these differences are not statistically relevant ($P>0.05$). Breasts of males were for 1164.9 g heavier than those of females ($P<0.001$). Statistically highly significant differences between sexes ($P<0.001$) are noticed also in weights of drumsticks, thighs, wing drumsticks and necks. When compared to females, males had statistically higher weights ($P<0.01$) of backs with pelvis, and statistically higher weight ($P<0.05$) of abdominal fats. Slightly higher average values of dressing percentage in carcass of male turkeys were determined by Lehmann *et al.*, 1996 (83.56%–84.46%, having the weights of

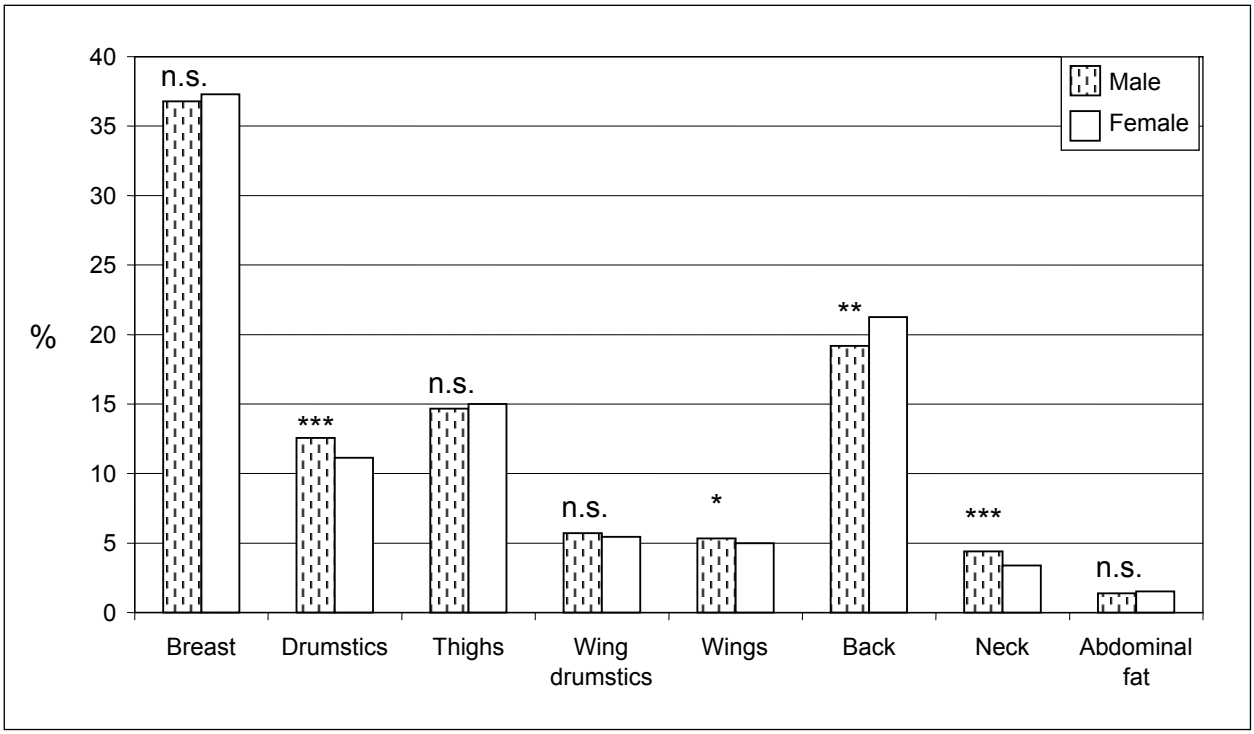
liver, heart and stomach included) and Isguzar, 2003 (82.7% for females and 81.90% for males). Lower values for males (79.16%) were stated by Kidd *et al.* (1997). Weight of drumsticks and thighs in the research of Barbor and Lilburn (1996) was 1478.0 g and 1381.2 g. In the research of Kidd *et al.* (1997) and Veldkamp *et al.* (2003) breasts of males weighed on average 2766 g and 3300 g, drumsticks 1699 g and 2050 g, thighs 1371 g and 1560 g, and wings 1155 g and 1310 g. In comparison to our research, Noble *et al.* (1996) determined less abdominal fat in male carcasses (136.7 g).

Table 2. Final weights, weight of cooled carcass and its main parts, g (n=10)

Indicator	Statistical parameter	Males	Females	Statistical significance
Final weight	$\bar{x}$	15173.30	10874.70	***
	S	1017.16	601.78	
	K_v	3.70	5.53	
	S_x	321.65	190.30	
Weight of cooled carcass	$\bar{x}$	12136.50	8852.00	***
	S	901.11	731.19	
	K_v	7.42	8.26	
	S_x	284.96	231.22	
Breast	$\bar{x}$	4467.70	3302.80	***
	S	449.18	339.78	
	K_v	10.05	10.29	
	S_x	29.49	107.45	
Drumsticks	$\bar{x}$	1776.20	1323.50	***
	S	104.33	117.48	
	K_v	5.87	8.88	
	S_x	32.99	37.15	
Thighs	$\bar{x}$	1522.20	986.10	***
	S	93.27	124.36	
	K_v	3.13	12.61	
	S_x	29.49	39.32	
Wing drumsticks	$\bar{x}$	689.50	481.70	***
	S	47.98	36.67	
	K_v	6.96	7.61	
	S_x	15.17	11.60	
Wings	$\bar{x}$	645.00	441.40	***
	S	39.78	44.66	
	K_v	6.17	10.12	
	S_x	12.58	14.13	
Back with pelvis	$\bar{x}$	2336.00	1885.00	**
	S	292.62	250.48	
	K_v	12.53	13.29	
	S_x	92.54	79.21	
Neck	$\bar{x}$	531.50	297.40	***
	S	51.92	28.34	
	K_v	9.77	9.53	
	S_x	16.42	8.96	
Abdominal fat	$\bar{x}$	168.40	134.10	*
	S	26.96	26.49	
	K_v	16.01	19.76	
	S_x	8.52	8.38	

* P<0.05; ** P<0.01; *** P<0.001

Figure 1 shows portions (in %) of main carcass parts according to sexes. Portion of breasts in female carcass was higher than in male (37.29%:36.77%, P>0.05). Male turkeys had statistically higher (P<0.001) portions of drumsticks and neck in carcass than females, while females had statistically higher (P<0.01) portion of back with pelvis than males. When compared to female turkeys, statistically higher portion of wings (P<0.05) was determined in male carcasses. Portion of abdominal fat was low both in males (1.38%) and in females (1.51%). Statistically significant differences in male and female carcasses (P>0.05) were not found in portions of thighs and wing drumsticks.

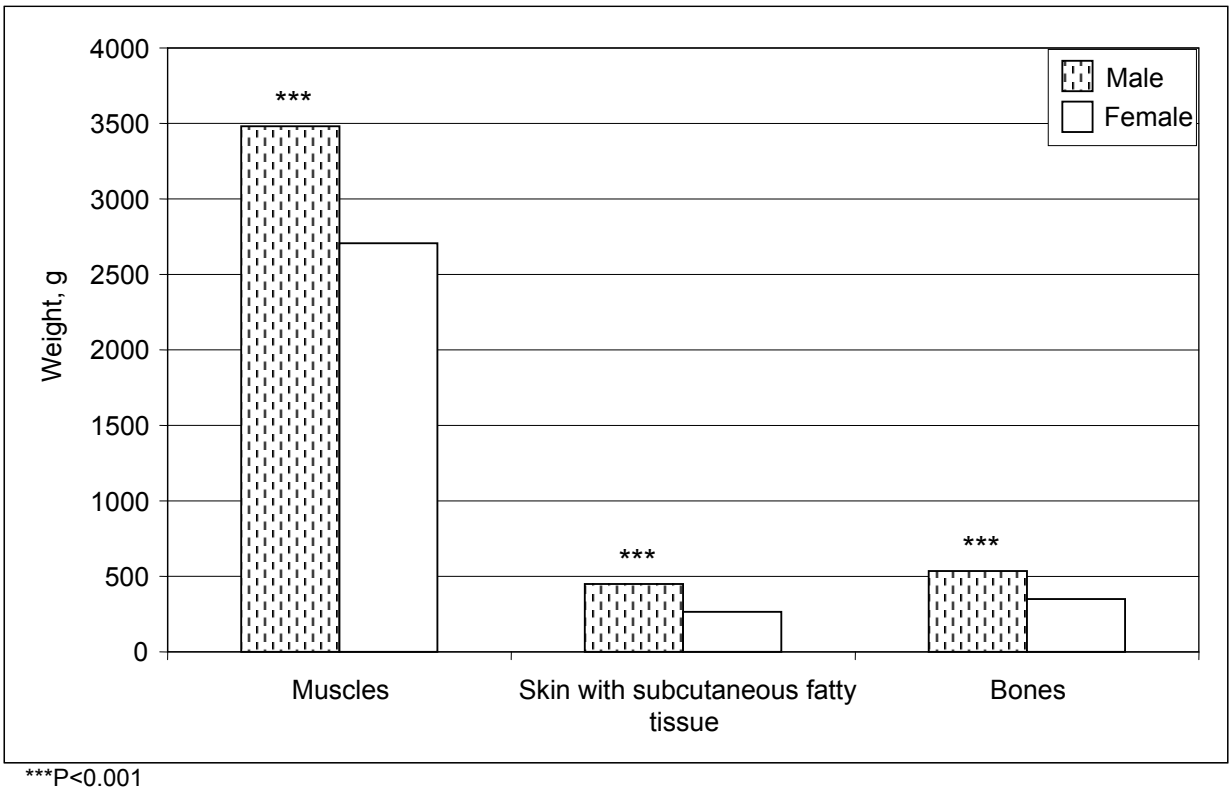


*P<0.05; ** P<0.01; *** P<0.001; ns = non significant

Figure 1. Portion of main parts in carcass, % (n=10).

Lower portion of breasts in male carcasses (34.59%, 28.17% and 31.10%) and higher portion of drumsticks (16.62%, 17.36% and 19.30%) and thighs (12.94%, 13.98% and 14.70%) were noticed by Lehmann *et al.* (1996), Kidd *et al.* (1997) and Veldkamp *et al.* (2003). Portion of wings in the experiments of Kidd *et al.* (1997) and Veldkamp *et al.* (2003) was 11.78% and 12.40%. In the researches of Lehmann *et al.* (1996) and Kidd *et al.* (1997), portion of abdominal fat in male carcasses was 1.77–2.34% and 2.12–2.50%. According to Brenoe and Kolstad (2000), portion of drumsticks, breasts and wings of live weight in males and females was 18.46% and 17.09%; 20.77% and 20.16%; and 7.01% and 6.45%, respectively. Statistically significant difference (P<0.05) between sexes was determined only in portion of wings.

Figure 2 presents weight of muscular tissue, skin with subcutaneous fatty tissue and bones in breasts of male and female turkeys. Males had on average 775.2 g or 28.64% more muscular tissue in breasts than females (3481.80 g: 2706.60 g). Determined differences were statistically highly significant (P<0.001). Weight of skin with subcutaneous fatty tissue and bones was also statistically higher (P<0.001) in males than in females. In the research of Barbor and Lilburn (1996), male turkey breasts, after an 18-week long fattening period, weighed on average 3954 g.



***P<0.001

Figure 2. Weight of tissue in breasts, % (n=10).

Portions of tissue in breasts and in carcasses (%) according to sexes of heavy turkey hybrid are shown in Table 3. Female turkeys had 3.93% higher share of muscular tissue than male (81.90%:77.97%), and the difference was statistically highly significant (P<0.001). Almost one third of the whole female carcass was taken up by breast muscles (30.57%). Differences between sexes in relation to the portion of muscular tissue in carcass were statistically relevant (P<0.05). Portion of bones and skin with subcutaneous fatty tissue in breasts was statistically highly significant (P<0.001), i.e. statistically higher in male turkeys (P<0.01). Similar portion of breast muscles in male carcass (28.6%) was determined by Roberson *et al.* (2003), and higher one (from 30.62% to 31.79%) by Lehmann *et al.* (1996). Portion of skin with subcutaneous fatty tissue was higher in our research than in research carried out by Lehmann *et al.*, 1996 (from 2.80% to 3.04%).

CONCLUSIONS

The sex of heavy turkey type Nicholas 700 have significant effect on the share of main parts of carcass, and on the share of muscular tissue. This can be explained by the following conclusions:

- After completion of fattening process, male turkeys had for 28.33% higher final weight than female turkeys (15173.3±1017.16 g : 10874.7±601.78 g). Differences in weights of carcasses between males and females were statistically highly significant (P<0.001).
- Breasts of males were on average for 1164.9 g heavier than breasts of females (P<0.001; 4467.7±449.18 g: 3302.8±339.78 g). However, differences in portions of breasts in carcass were not statistically significant (P>0.05), although female turkeys had slightly higher portion (37.29%:36.77%).
- Statistically high differences (P<0.001) were also observed in weights of drumsticks, thighs, wing drumsticks, wings and necks between male and female turkeys.

- Male turkeys had on average 775.2 g or 28.64% higher weight of muscular tissue when compared to females, and stated differences were statistically highly significant (P<0.001).
- More favorable portion of muscular tissue in breasts was noticed in female turkeys. They had 3,93% higher portion of muscular tissue than male turkeys (81.90%:77.97%), and the difference was statistically highly significant (P<0.001).
- Based on this research, it is recommended to produce male turkeys for further processing of meat, while the production of female turkeys is encouraged for their breasts.

Table 3. Portions of tissue in breasts and in carcass, % (n=10).

Tissues	Statistical parameter	Males	Females	Statistical significance
Portions in breasts				
Muscles	$\bar{x}$	77.97	81.90	
	S	2.76	2.13	
	K_v	3.55	2.60	**
	S_x	0.87	0.67	
Skin and subcutaneous fatty tissue	$\bar{x}$	10.02	7.47	
	S	2.67	1.60	
	K_v	26.67	21.46	**
	S_x	0.85	0.51	
Bones	$\bar{x}$	12.01	10.63	
	S	0.74	0.72	
	K_v	6.18	6.78	***
	S_x	0.23	0.23	
Portions of breasts in carcass				
Muscles	$\bar{x}$	28.67	30.57	
	S	1.62	2.16	
	K_v	5.66	7.07	*
	S_x	0.51	0.68	
Skin and subcutaneous fatty tissue	$\bar{x}$	3.69	2.77	
	S	1.06	0.53	
	K_v	28.61	19.01	*
	S_x	0.33	0.17	
Bones	$\bar{x}$	4.41	3.95	
	S	0.21	0.20	
	K_v	4.65	5.16	***
	S_x	0.06	0.06	

* P<0.05; ** P<0.01; *** P<0.001

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