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Original Contribution

SLAUGHTER YIELD AND QUALITY OF MEAT FROM WILD TURKEY (*MELEAGRIS GALLOPAVO SILVESTRIS VIEILLOT*) REARED IN HUNTING RESERVE IN SOUTH BULGARIA

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ABSTRACT

A total of 6 wild turkeys *Meleagris gallopavo silvestris Vieillot* (3 males, 3 females) at 16 weeks of age were investigated after the species has been imported from Canada in the Hunting reserve of Trankovo, Stara Zagora region. The birds were reared in aviaries and occasionally, let free for hunting tourism. The birds were reared according to conditions adopted in the reserve, fed standard compound feeds according to their category. After 12-hour feed withdrawal, the birds were stunned and slaughtered. The slaughter analysis and meat chemical analysis were conducted at the Meat and meat products unit, Faculty of Agriculture, Trakia University – Stara Zagora. After 24-hour cooling storage at 0-4 ºC the carcasses (without the neck and edible offal) were cut up in commercial parts. Twelve slaughter parameters were determined after evisceration and weighing of internal organs: liver, gizzard, proventriculus, heart, intestines (g). They were used for calculation of slaughter yield. Samples of breast and thigh muscles were collected 24 hours after slaughter and prepared for determination of water, proteins, fat and ash content. Fatty acid composition of triglycerides red and white meat was determined. Triglyceride quantity and quality were assayed by gas chromatography with metal column with Supelcoport 100/200 mesh as stationary phase. The amino acid content was determined by ion-exchange column chromatography. Water holding capacity (WHC, %) was determined on the 24th h post slaughter on samples from *m. Pectoralis superficialis*, *m. Pectoralis profundus* and *m. Femorotibialis*. The slaughter analysis showed higher body weight and higher carcass weight in male birds, although the slaughter yield of female was higher than that in males turkeys 67.13% and 66.87% respectively ($p>0.05$). The differences in protein and fat content of breast and thigh meat in both turkey genders were not significant. The content of the essential amino acid methionine in the breast meat of wild turkeys was 2.61g in males and 2.50g in females. Lysine concentrations ranged between 9.58% and 9.69%. The eicosatrienoic omega-3 fatty acids was found only in the meat of male turkeys. Breast meat of female birds did not contain eicosatrienoic and arachidonic fatty acids. There were no differences in the content of macrominerals and trace elements in the meat of both genders wild turkeys.

Keys words: *turkey, meat composition, water-holding capacity, amino acids, fatty acids*

INTRODUCTION

The turkey (*Meleagris gallopavo*) is a domestic bird from the Phasianidae family. It originates from North America; it is domesticated in Europe and now is a source of highly dietetic and valuable meat (1). Meat productivity of turkeys is evaluated not only by the live weight, growth performance, feed conversion, but mainly on the basis of its slaughter traits: slaughter yield, weight of edible parts (2, 3). The demands for dietetic meat with low fat and cholesterol content are continuously increasing as a results of the new healthy nutrition habits. In Mexico (4) Mexican turkeys (Meleagris gallopavo Linnaeus) are used as alternative source of dietetic meat. In experiments with Mexican turkeys (5) male birds attained peak growth at 15.7 weeks of age with weekly weight gain of 259.3 g, whereas the respective values in females were 12.4 weeks of age and 112.0 g/week.

Many researchers (6-9) demonstrated high slaughter traits in turkeys along with high yield of edible parts. In experiments with broiler turkeys Hristakieva P., (10) reported high

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relative weight of the carcass without offal, head, neck and metatarsus (70.27% - 71.95% in males and 71.92% - 73.94% in females). Roberson et al., (6) have investigated three lines of turkeys and established slaughter yield of 75.9%, and breast meat proportion - 28.6%. Having studied the growth performance of BUT-9 turkey broilers, (2) reported average daily weight gain of 140.3 g in 10-week-old male birds.

Turley meat is characterised with high protein and mineral content, low fat content and good dietetic and flavour traits. According to the genotype, Hristakieva P., (10) reported meat protein content in turkey broilers from 24.72%- 25.71%, and fat content within 0.31%- 0.90%. Benkova et al. (11) found out a high content of high-quality protein in turkey meat (23.06- 23.60%) which contained the main essential amino acids - lysine, leucine, arginine and valine. It was also rich in potassium, calcium, magnesium, iron and phosphorus. Ribarski, S. et. al (12) also reported protein content up to 26.7% and fat content up to 0.18% in breast meat of two different turkey breeds. This makes it a desirable and valuable source of nutrients for those who eat healthy. In the study of López P. E. Et al. (4) the chemical composition of autochthonous Mexican turkeys was similar to that of improved breeds and hybrids. There were statistically significant differences ($p < 0.05$) in dry matter content and crude protein in breast muscles, thigh and leg meat with age (7 and 12 months of age) and gender.

The lack of detailed information on wild turkey meat quality was the main incentive of the present study - to investigate and describe some slaughter and meat chemical parameters of Meleagris gallopavo silvestris vieillot farmed in our country.

MATERIAL AND METHOD

A total of 6 wild turkeys *Meleagris gallopavo silvestris Vieillot* (3 males, 3 females) at 16 weeks of age were investigated after the species has been imported from Canada in the Hunting reserve of Trankovo, Stara Zagora region. The birds were reared in aviaries and occasionally, let free for hunting tourism. The birds were reared according to conditions adopted in the reserve, fed standard compound feeds according to their category.

The slaughter yield and meat chemical analysis were conducted at the Meat and meat products unit, Faculty of Agriculture, Trakia University – Stara Zagora. The birds were weighed before the slaughter (after the 12-hour feed withdrawn. At slaughter, edible offal (liver, heart, and gizzard) were removed after the feet, feathers and heads. After 24-hour cooling at 0-4 ºC the cleaned carcasses without the neck and edible offal, carcasses were cut up in commercial parts. Twelve slaughter parameters were determined after evisceration and weighing of giblets (liver, gizzard, heart), intestines and proventriculus (g). They served for calculation of the slaughter yield.

Samples for physico-chemical analyses of breast and thigh muscles for determination of water, proteins, fat, ash were collected 24 hours after slaughter as per Pojarskaia, L. (13). Fatty acid composition of triglycerides of red and white meat samples was determined after extraction of lipids by the method of Bligh, E. G. and W. J. Dyer (14). Triglycerides were separated by means of thin-layer chromatography on silica gel and mobile phase diethyl ether as per Dimov V., G. and Dimitrov (15). Fatty acids were methylated in 2% sulfuric acid and anhydrous solution as per Angelov, A. (16). Triglyceride quantity and quality were assayed by gas chromatography with metal column with Supelcoport 100/200 mesh as stationary phase. The amino acid content was determined by ion-exchange column chromatography as per Moore Stanford and William H. Stein (17). Trace elements and macroelements were assayed by atomic absorption spectrophotometry (18).

Water holding capacity (WHC, %) was determined by the 24th post slaughter on samples from *m. Pectoralis superficialis*, *m. Pectoralis profundus* and *m. Femorotibialis*. The analysis was performed by the classical method of Graw, W. R. and R. Hamm (19), described by Zahariev Z., Pinkas, A (20) and modified by Petrov J. (21).

The analysis of results was performed by ANOVA, EXCEL 2010. The obtained results were statistically processed and the reliability criteria for the arithmetic mean as obtained by Nikolov G.and Ts. Yablanski (22).

RESULTS AND DISCUSSIONS

Table 1 presents data from the slaughter analysis of wild turkeys from both genders. Males attained a body weight of 2.18 kg at 16 weeks of age, and females - 1.70 kg ($p<0.001$). The numerical values of carcass weights were proportional to live weights. Preslaughter and carcass weights of 1.48 kg and 1.16 kg in both genders were not compatible to results obtained in fattened hybrids. These values were closer to experiments with Mexican turkeys of Pérez-Lara, M. A (5), where males

attained 6 kg at 40 weeks of age and females – 3.6 kg at 35 weeks of age.

Oblakova (2) reported that the fattened BUT-9 broiler turkey attained slaughter weights of 9666 g (males) and 7300 g (females) with respective carcass weight of 7225 g and 5711 g and higher slaughter yields in female birds (78.24%) than in males (74.74%) on the 16 week of slaughter. The carcass weights in the different genotypes of broiler turkeys under industrial production systems are various. At 16 weeks of age, weights between 5361.67 g and 4996.67 g were reported in different groups (10). In our experiment, females exhibited insignificantly higher slaughter yield (67.13% vs 66.64% in males).

Slaughter yield varied within a wide range depending on the animal species and breed and the fattening extent. In turkeys it varies from 85% to 87% (23).

The detailed slaughter analysis suggested that aforementioned results were applicable to all carcass cuts. The most specific differences between genders were encountered with respect to the heart, gizzard, intestines and thighs.

Table1. *Slaughter analysis of wild male and female turkeys at 16 weeks of age*

Parameters (kg , g)	Female	male
1. Live weight before slaughtering, kg	1.70±0.11	2.18±0.11c
2. carcass weight, kg	1.16±0.08	1.48±0.12
3. carcass weight /after 24 h/,kg	1.14±0.79	1.46±0.11
4. % carcass yield	67.13±0.28	66.84±2.10
5. heart, g	9.37±0.33	12.93±0.18c
6. liver, g	40.93±7.77	50.30±1.43
7. proventriculus, g	4.57±0.10	6.43±0.46b
8. gizzard (full), g	49.00±1.20	65.10±4.40a
9. gizzard (empty),g	35.90±2.01	48.77±4.57
10.intestines, g	34.87±6.47	115.13±10.55b
11. head, g	51.77±1.09	64.70±2.22a
12. thigh, g	65.63±4.34	103.87±10.03c

Significatly at a $p<0.05$, b $p<0.01$, c $p<0.001$

Table 2 presents the results from the meat chemical analysis of male and female wild turkeys.

Table 2*. Chemical composition of turkey meat*

	n	Water %	Protein%	Fat%	Ash%
breast muscles					
Wild Turkey ♂	3	73.33±0.23	24.68±0.22	0.83±0.06	1.14±0.01
Wild Turkey ♀	3	73.31±0.21	24.65±0.35	0.91±0.14	1.16±0.01
Thigh muscles					
Wild Turkey ♂	3	73.40±0.35	21.71±0.24	3.69±0.60	1.19±0.04
Wild Turkey ♀	3	72.87±0.11	22.36±0.34	3.54±0.45	1.22±0.03

The chemical analysis of breast meat showed protein content of 24.68% in males and 24.65% in females. There were no differences between both sexes with respect to this parameter. The results differed from data reported by López P. E et al. (4) about higher protein content of breast muscles of wild turkeys in females – 21.8% vs 18.4% in males ($p<0.05$). Other sources reported variable results in breast meat of domestic turkeys from 21.8% (24), to 32.4% (25).

The lipid content of breast meat was slightly higher in females. Breast meat of wild turkeys had a low lipid content ($p<0.001$), only 0.91–0.83%. In female domestic NCB turkeys, breast meat fat content was 2.87% (26). Ash content o female breast meat was 1.16% ($p>0.05$ vs that of males). The presented data are comparable to the results of Werner, C. (27). In wild turkeys, this parameter was with higher values than those reported by López P. E. (4): 0.64% in female and 0.84% in male birds ($p<0.05$). Gender-related differences in the meat water content were not established.

Thigh meat protein content was higher – 22.36% in female wild turkeys and 21.71% in

male (p>0.05). López P. F., (28) reported values of 18.4% (male) and 19.6% (female). There were no differences in fat and ash contents. These data are in accordance with the reports of Vega Niño, López Pérez Elvia (29). Having studied the physico-chemical properties of skeletal muscles of two groups of turkeys – White Emperor and mini-turkey line, Ribarski, S., (12) reported high protein content in skeletal muscles of both breeds. Fat content was higher in the meat of mini-turkeys.

Water holding capacity of meat reflects its essential properties to bind water and is closely related to quality traits as tenderness, juiciness and colour. The analysis of meat showed that female wild turkeys had higher WHC% than males: 24.47% and 20.82%. In general, differences between genders were not found out. WHC% depends on a number of factors, for example preslaughter feeding – it increased from 25.49% in fasted to 32.31% in fed turkeys. Stress also resulted in high WHC% of turkey meat: it could increase from 26.92% to 30.82% (30).

Table 3 presents the total amount of amino acids in the breast meat of wild turkeys from both genders. Meat is a main source of proteins, providing all amino acids essential for human nutrition (31). Also, this meat is an excellent source of minerals, especially iron, zinc, selenium and phosphorus. The values of studied 17 amino acids suggested that among non-essential ones, glycine percentages, important for meat quality, were 4.69% in males and 4.61% in females. The gender differences were insignificant. A similar tendency was established with respect to meat proline contents 4.48% and 4.00 % ($p > 0.05$).

The differences in contents of some essential amino acids associated with the nutritional value of meat (methionine and lysine) were slight ($p > 0.05$). The proportions of lysine, important for muscle development, were 9.58% in male and 9.69% in female wild turkeys.

The essential amino acid methionine percentages in the breast meat of wild turkeys were 2.61% in males and 2.50 % in females, while in Nord Caucas Bronze 1.59% and 1.70% respectively (26). The share of lysine in wild male turkeys was 9.58 % and in females-9.69%. The comparison with meat of other species, the average contents of lysine (1.3 %) and leucine (1.4%) in Egyptian geese were lower than values in ostrich meat (1.8% and 1.6% (32).

***Table 3**. Total amino acids in breast muscles (%)*

amino acids	wild turkey ♂	wild turkey ♀
serine	1.75±0.09	1.67±0.07
aspartic acid	9.12±0.02	9.25±0.02
glutamic acid	18.31±0.07	18.33±0.29
proline	4.48±0.08	4.00±0.29
cysteine	0.86±0.04	0.72±0.19
glycine	4.69±0.09	4.61±0.13
alanine	6.02±0.03	6.04±0.06
tyrosine	2.59±0.06	2.50±0.09
threonine	3.24±0.07	3.14±0.06
valine	5.76±0.02	5.80±0.04
methionine	2.61±0.05	2.50±0.05
isoleucine	5.39±0.03	5.40±0.02
leucine	9.20±0.04	9.27±0.05
phenylalanine	4.32±0.16	4.60±0.02
histidine	5.72±0.03	6.03±0.09
lysine	9.58±0.04	9.69±0.05
arginine	6.32±0.06	6.41±0.09

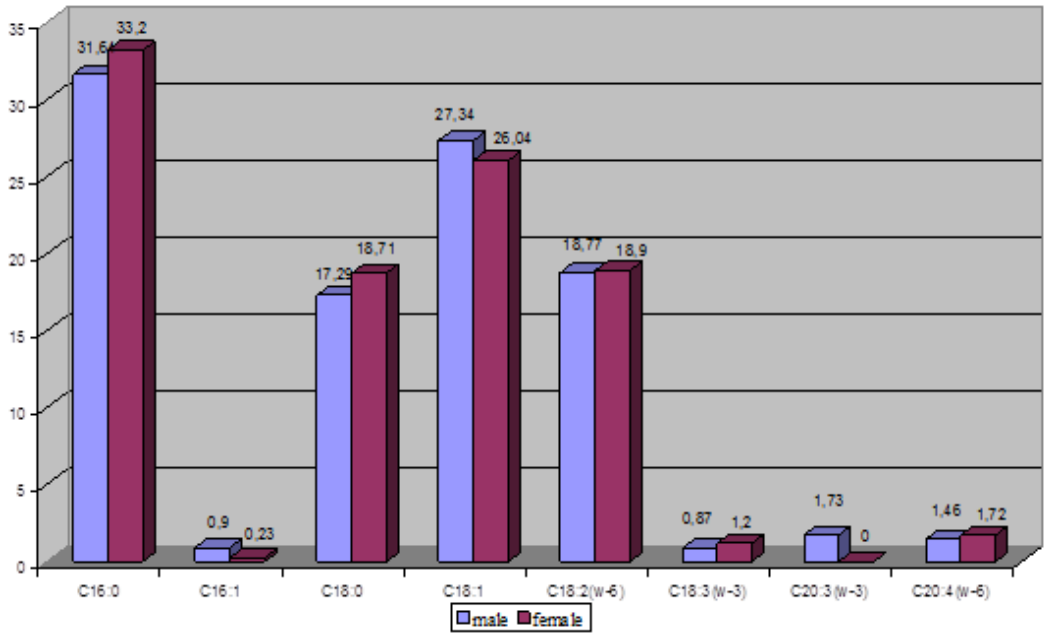

Figure 1. Fatty acid composition in breast muscles %

The fatty acid content of triglycerides in the breast meat of wild turkeys is presented on **Figure 1**. The palmitic (C16:0) and stearic (C18:0) acids had higher values in females - 33.20% and 18.71% than in males: 31.64% and 17.29% respectively. Both acids accounted for 51.91% of the total fat content of breast meat. In a study on the breast meat of Meleagris gallopavo Linn, (29) reported monounsaturated fatty acid contents of 43.30 and 38.41%, as well as 20.17% and 24.91% polyunsaturated fatty acids (PUFA) in two diets for turkeys. In our study, PUFA content was 23.73% in male and 22.05% in female. In female wild turkeys, there were no traces of the ω-3 eicosatrienoic acid C20:3, while its content in the breast meat of males was 1.73%. The contents of the monounsaturated oleic acid (C18:1) – 26.04% in female and 27.34% in male birds were impressive. According to (4) the breast meat of the local Mexican turkey had higher PUFA content in females than in males (27.6% vs 23.8%).

Numerous authors have studied the effect of various dietary animal and vegetable fats on the fatty acid composition of poultry meat. The lipids in broiler meat could be modified via supplementation of linoleic (LA) and linolenic (LNA) acids, vegetable oils, fish meal (33, 34). The amount of PUFA increased when diets were supplemented mainly with long-chain ω-3 FA [eicosapentaenoic (EPA), docosapentaenoic (DPA) and docosahexaenoic (DHA) fatty acids (35).

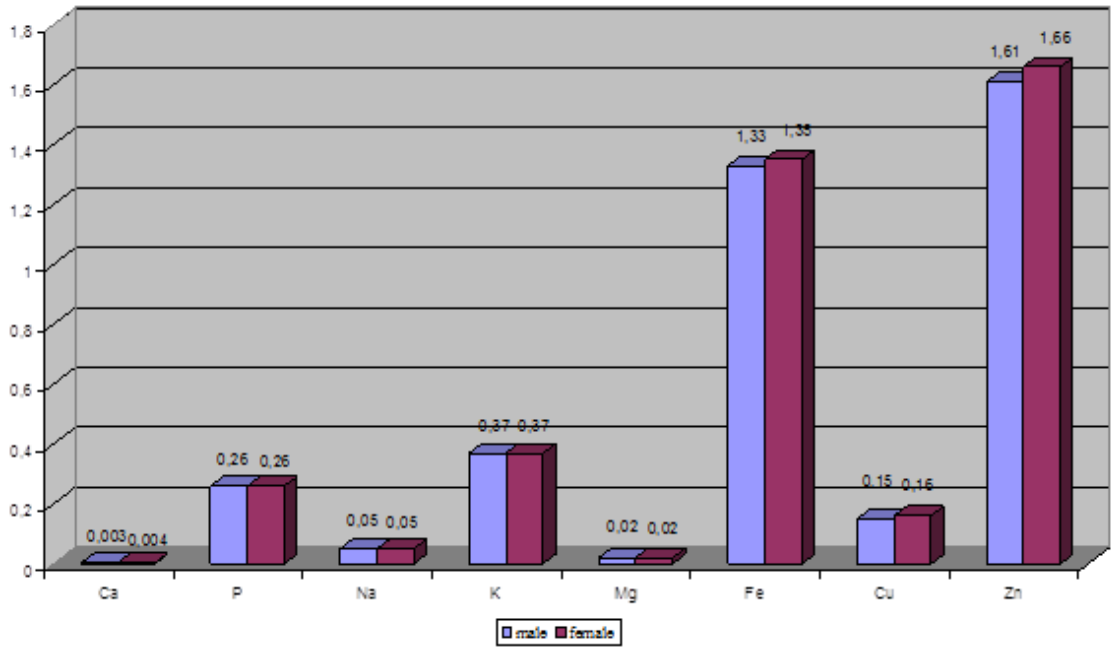

Figure 2. Contens of mineral nutriens in wild turkey breast muscles - %

The mineral content of breast muscles showed highest contents of *Zn* and *Fe* in both sexes **(Figure 2)**. The high content of these trace minerals in meat is important for human health. Geldenhuys et al. (36, 37) demonstrated that in the meat of Egyptian geese, phosphorus content was the highest, followed by potassium and magnesium, while Fe was 5.3%. This high Fe content was associated with metabolic capacity and fibrous structure of breast muscles as explained by. (36). In flying birds, this muscle is composed mainly by type IIa fast-twitch oxidative glycolytic fibres together with small proportion of type IIa fast-twitch glycolytic fibres (38, 39). The IIa fibres are aerobic so they have high myoglobin content for supply with oxygen. The Fe content in Egyptian geese breast meat is comparable to that of the ostrich M. iliofibularis and fat higher than values reported by (40). The average concentrations of Fe and Cu (0.4%) were also higher than respective values in beef, lamb, pork, poultry and turkey meat (41).

CONCLUSIONS

On the basis of presented results, the following conclusions on slaughter traits and meat chemical composition in wild turkeys could be made:

1. The slaughter analysis were indicative for higher live weight and clean carcass weight in male birds, although the slaughter yield of female wild turkeys was higher than that in males 67.13% and 66.87% respectively ($p>0.05$).
2. The chemical analysis of meat did not demonstrate significant differences in protein

and fat content of breast and thigh meat between both genders.

3. The content of the essential amino acid methionine in the breast meat of wild turkeys was 2.61 g in males and 2.50 g in females. Lysine concentrations in wild turkey meat ranged between 9.58% and 9.69%.

4. The eicosatrienoic omega-3 fatty acids was found only in the meat of male wild turkeys. Breast meat of female birds did not contain eicosatrienoic and arachidonic fatty acids.

5. There were no differences in the content of macrominerals and trace elements in the meat of both genders wild turkeys.

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