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AGE WEIGHT AND MORPHOMETRICAL PARAMETERS OF THE BRONZE TURKEY'S (*MELEAGRIS MELEAGRIS GALLOPAVO*) INTESTINES

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Abstract

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The aim of the study was to determine the age related development of the bronze turkey small and large intestines, in order to present standard actual values of the intestinal metric parameters. Ruler, graph paper and automatic weighter investigated the small and large intestines of sixty healthy clinically bronze turkeys (thirty males and thirty females) metrically. The birds were distributed in ten age related groups at the 1st, 7th, 14th, 28th, 35th, 49th, 56th, 90th, 120th and 240th days of age. Each group consisted of six turkeys. The absolute and relative weight and length were studied. During the investigation period the absolute weight of the duodenum, jejunum, ileum, caeca and rectum in bronze turkeys increased respectively by 75, 104, 135, 147, 68 times. The relative weight of the small intestinal structures reached peak values at the 7th day of age, contrary to the same morphometrical dimension of the rectum and caeca, whose highest values were observed at 14th and 28th day of age respectively. The relative length of the small intestines was highest at the 7th day of age and this of the large intestines–at the 1st day of age. The obtained results gave a motivation to make the conclusion that the development of the bronze turkey's intestines was more intensive than the body weight of the birds through the early growing period. The small intestines weight and length were higher than the same of the large intestines from hatching to the sexual maturity.

Key words: bronze turkey, intestines, morphometrical parameters

Introduction

Bird digestive tract develops quickly following hatching. The intensity changes in length, weight and circumference of the gut is affected by genetic and environmental factors. Many studies have been carried out to study the impact of various factors of the two groups, alone and in combination with each other on the structure and morphometric parameters of the intestine in different species. Many authors (Mihailov et al., 2008; Liu et al., 2010) carry out the study of small and large intestines development in age and gender aspect in quails, broiler chickens, and geese.

Gastrointestinal tract in birds acts as a reservoir of food, secretion of digestive juices and nutrients absorption. It is found that the volume of the alimentary canal is a limiting factor in food intake and subsequent absorption (Nitsan et al., 1991).

Balanced diet during the first week after hatching has a decisive role in the normal chicken's development (Murakami et al., 2007).

Many scientists, working in the region of Veterinary Medicine and Agricultural Sciences, use statistical methods to obtain detailed and reliable results in their studies. Such are the investigations, concerning macromorphometric parameters (length, width and weight) of thyroid gland in young goat and the mean values of craniometric indexes in marten (Dimitrov et al., 2003; Yonkova et al., 2003).

Some researchers (Mihailov, 2006; Działa-Szczepańczyk, 2008; Liu, 2010; Kasperska, 2012) conducted many studies on the development of the gastrointestinal tract in quails, chickens, ducks, geese and guinea fowl. Objective results for the growth of bird's digestive organs are obtained via statistical methods.

The organs of birds digestive system grow faster in weight, than bird body mass, and their relative weight reaches maximum values from 6 to 10 days after chickens hatching (Katanbaf et al., 1988); from 6 to 8 days in turkeys (Sell et

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al.,1991; Noy and Sklan, 1998) and from 7 to 14 days in quails (Mihailov et al., 2008).

To understand in general how the volume of the small intestine affects the absorption of nutrients, it is necessary to study in detail both intestinal morphological development, and changes in enzyme activity in age aspect. Increasing of the gastrointestinal tract weight plays a major role not only in the activity of its own enzymes, and for those with pancreatic origin. That is one of the most important factors for rapid increase of the body weight during the early growth period in ducks (Lu, 1999).

The aim of study is to determine the values of some morphometric parameters of the intestinal tract in Bronze turkey and to seek relations between the parameters of these organs and body weight of the birds in age aspect from 1 to 240 days post hatch. That could be a base to present standard actual values of the intestinal metric parameters in order to differentiate normal metric intestinal values from pathological conditions of turkeys gut.

Materials and Methods

For the purpose, sixty healthy clinically bronze turkeys (thirty males and thirty females) were used. The birds were bred voliery. They were distributed in ten age related groups at the 1st, 7th, 14th, 28th, 35th, 49th, 56th, 90th, 120th and 240th days of age. One group consisted of six turkeys. Each bird was weighed on automatic weighter with accuracy to 10 g. Turkeys were eviscerated, following euthanasia. The gut tract was used for morphometrical study. The intestines were exempted from fecal mass and mesenterial tissue was trimmed off, following washing with physiological saline. Ruler, graph paper and automatic weighter investigated the small and large intestines metrically. The absolute and relative weight and length were studied with electronic scale with accuracy to 0.1 g. The length and perimeter of small intestines, both ceca and rectum were measured with graph paper (Leopold, 1953). When measuring the length the intestines were in a straight line without loops and stretching. Total length of intestines and their segments was recalculated to 100 g body weight

The experiments were done in strict compliance with the Institutional Committee of Animal Health Care in Trakia University, Stara Zagora. The statistical analyses of the obtained data (mean values ± standard deviation (SD) in each age group) were processed with one-way ANOVA with statistical software StatView v. 4.53 for Windows (Abacus Concepts, Inc). Differences among mean values of the age groups were compared by LSD's multiple-range test. Differences were significant at $P < 0.05$.

Results

The total weight of the intestinal tract was increasing the most quickly from 1st to 28th day. After this period, a decreasing of its rates was observed, as they were the lowest from 56th to 240th day. The absolute weight of the duodenum, jejunum, ileum, caeca and rectum in bronze turkeys increased respectively by 75, 104, 135, 147, 68 times during the studied period. The relative weight highest levels of small and large intestines (g/100g BW) were found at 7th and 14th days. Regard the ceca, their relative weight was with close values at 7th and 14th days. Jejunum increased the most quickly its weight, compared to the duodenum and ileum during the first two weeks after hatching. During the same period rectum 3-fold increased its weight, and caeca-1.5 times. Duodenum, jejunum and ileum weight as a proportion of body weight was the greatest at 7th day for all of the studied age groups (Table 1).

The length of the small and large intestines increased 3 and 1.5 times approximately, from 1st to 14th day respectively. The values were greater than these obtained from 14th to 28th day. The relative length of the small intestines was greatest at 7th day and this of the large intestines-at 1st day. The duodenum increased its length at least, during the studied period-5 times. Ileum increased by 6-fold, jejunum and both ceca-7-fold and rectum-3-fold. Duodenum was the shortest segment of small intestines, and jejunum-the longest (Table 2).

Discussion

The intestinal parts increased in weight and length with quicker rates toward body weight during the early post hatching development of the turkey poults.

Objective results of the present study motivated us to conclude that statistical methods find application in the researches of organs and systems in different animal and bird species, as it is confirmed by some authors (Dimitrov et al., 2003; Yonkova et al., 2003).

The small and large intestines of bronze turkeys grew faster in weight, than whole body mass. Their relative weight reached maximum values from 7th to 14th day of age, which is in agreement with the results, concerning the same morphometric index in quails (Mihailov et al., 2008).

The results of the present study corresponded to data of many authors (Sell et al., 1991) that the weight of the whole intestinal tract in turkeys increased the most intensively from 1st to 28th day and had lowest rates of development after 56th day.

The obtained data of our study were similar to those of other researchers (Shih et al., 2004) for white roman geese intestines. The white roman geese small and large intestines reach peak values of relative weight at 11th to 14th days respec-

Table 1
Absolute and relative weight of bronze turkey small and large intestines from 1st to 240th day

Age, days	Item	Intestines				
		Duodenum x ± SD	Jejunum x ± SD	Ileum x ± SD	Both ceca x ± SD	Rectum x ± SD
1	Weight (g) Weight:BW(g/kg)	0.40±0.02 0.76±0.02	0.34±0.01 0.65±0.02	0.27±0.01 0.53±0.02	0.25±0.36 0.40±0.04	0.19±0.02 0.37±0.02
7	Weight (g) Weight:BW(g/kg)	1.22±0.11 1.57±0.18	1.71±0.12 2.23±0.12	1.47±0.10 1.91±0.1	0.26±0.01 0.51±0.02	0.31±0.01 0.41±0.01
14	Weight (g) Weight:BW(g/kg)	1.69±0.09 1.34 ± 0.09	1.98±0.06 1.57±0.06	1.72±0.10 1.36±0.07	0.43±0.01 0.52±0.03	0.66±0.04 0.53±0.04
28	Weight (g) Weight:BW(g/kg)	3.83±0.15 1.14±0.11	6.81±0.09 1.96±0.09	4.35±0.14 1.25± 0.11	1.49±0.01 0.42±0.02	1.19±0.03 0.34±0.02
35	Weight (g) Weight:BW(g/kg)	5.81±0.18 1.05±0.14	6.99±0.06 1.76±0.05	5.92±0.09 1.14±0.07	1.89±0.08 0.38±0.02	1.35±0.03 0.32±0.03
49	Weight (g) Weight:BW(g/kg)	6.65±0.07 0.95±0.08	8.94±0.07 1.23±0.06	6.89±0.12 0.98±0.09	2.04±0.03 0.34±0.02	1.67±0.03 0.29±0.02
56	Weight (g) Weight:BW(g/kg)	10.83±0.42 0.87±0.07	19.14±0.91 0.84±0.01	12.32±1.10 0.85±0.02	4.00±0.67 0.32±0.06	2.84±0.18 0.26±0.01
90	Weight (g) Weight:BW(g/kg)	17.95±0.65 0.74±0.04	26.08±0.33 0.62±0.03	26.11±0.40 0.54±0.09	9.46±0.24 0.29±0.02	7.46±0.24 0.22±0.01
120	Weight (g) Weight:BW(g/kg)	22.96±1.52 0.45±0.04	37.98±1.34 0.54±0.02	36.10±1.05 0.45±0.05	12.90±0.50 0.25±0.02	8.15±0.55 0.17±0.01
240	Weight (g) Weight:BW(g/kg)	37.83±0.66 0.27±0.01	49.95±0.29 0.34±0.09	45.69±0.53 0.32±0.03	15.79±0.62 0.17±0.01	15.07±0.67 0.11±0.01

Table 2
Absolute and relative length of bronze turkey small and large intestines from 1st to 240th day

Age, days	Item	Intestines				
		Duodenum x ± SD	Jejunum x ± SD	Ileum x ± SD	Both ceca x ± SD	Rectum x ± SD
1	Length (mm) Length:BW(mm/kg)	70.33±2.25 138.00±3.45	104.83±7.70 206.50±4.50	107.83±3.06 212.64±4.70	41.00±2.68 80.70±4.70	36.00±3.52 70.5±5.60
7	Length (mm) Length:BW(mm/kg)	107.83±2.32 139.50±4.50	246.83±13.1 318.70±4.60	200.00±17.9 258.34±8.90	50.50±2.81 65.11±4.30	45.17±4.02 58.90±4.20
14	Length (mm) Length:BW(mm/kg)	126.33±3.67 100.74±5.20	313.17±11.6 249.71±7.80	236.33±8.26 188.74±9.20	71.00±4.77 56.91±7.10	53.33±1.21 42.51±3.90
28	Length (mm) Length:BW(mm/kg)	179.50±1.52 94.00±5.10	387.83±11.0 212.32±7.60	345.67±6.98 173.47±7.80	133.00±7.48 38.61±4.60	60.33±1.75 17.55±4.80
35	Length (mm) Length:BW(mm/kg)	190.33±4.93 85.54±4.60	422.33±9.85 198.31±4.60	425.50±6.16 140.58±6.90	156.83±3.87 36.92±7.20	63.50±1.22 14.55±2.10
49	Length (mm) Length:BW(mm/kg)	223.67±15.12 76.45±3.50	447.83±7.14 175.22±5.60	450.00±2.68 100.5±8.90	180.83±4.67 36.22±5.70	65.83±1.72 13.51±1.20
56	Length (mm) Length:BW(mm/kg)	239.67±5.99 54.58±4.80	529.00±14.9 112.81±11.2	549.33±20.9 87.41±5.50	185.00±10.4 31.50±5.20	73.50±3.02 12.50±1.20
90	Length (mm) Length:BW(mm/kg)	255.67±3.27 35.34±4.80	627.00±3.58 65.80±10.20	600.33±3.67 45.62±4.80	213.17±3.19 29.61±5.20	82.00±0.89 11.90±1.40
120	Length (mm) Length:BW(mm/kg)	302.00±6.90 21.54±7.80	680.33±11.7 43.51±9.20	620.33±4.84 34.51±7.80	261.33±3.44 25.51±4.80	93.50±1.38 10.51±1.20
240	Length (mm) Length:BW(mm/kg)	357.33±2.16 10.98±1.50	790.33±8.02 22.50±4.60	674.00±3.41 19.33±4.50	292.50±1.05 20.80±4.80	111.17±0.98 9.80±1.30

tively, and the same organs in bronze turkeys-from 7th to 14th days. The periods of intensive growth of the intestines in both species are close.

The length changes in the three small intestines segments in bronze turkeys corresponded to the standpoint of some authors (Liu et al., 2010) that this parameter in yangzhou goslings increases more to jejunum and ileum, compared to duodenum during the first two weeks post hatch.

Contrary to published results (Shih et al., 2004), that the relative length of geese small and large intestines reaches greatest values from post hatch to 3rd day, we found that in bronze turkey, the same organs were with peak of this parameter from 1st to 7th day.

Our data proved that the relative length and weight of bronze turkey small intestines reached greatest levels at 7th day post hatch. That corresponded to the results, concerning the relative weight and length changes in chicken small intestines (Sell, 1996; Noy and Sklan, 1998).

There were not significant differences in duodenal length of growing and adult bronze turkeys, as found in long-tailed duck (Działa-Szczepańczyk, 2008).

Our results for small and large intestines length in bronze turkey agreed with the investigations reported in broilers, mule duck and chickens (Katanbaf et al., 1988; Lu, 1999).

Conclusion

The development of the bronze turkey's intestines was more intensive than the body weight of the birds through the early growing period. The small intestines weight and length were higher than the same of the large intestines from hatching to the sexual maturity.

References

Dimitrov, R., D. Vladova, P. Yonkova, T. Dimova and E. Raichev, 2003. Basic craniometric indices in marten (*Martes Foina*). I. Mean values and variations. *Animal Sciences*, **1-2:** 94-97.

Dzi□a-Szczepańczyk, E., 2008. Gut morphometrics in the long-tailed duck *Clangula Hyemalis* wintering on the polish Baltic coast. *Zoologica Poloniae,* **53**: 37-47.

Kasperska, D., D. Kokoszyński, H. Korytkowska and M. Mistrzak, 2012. Effect of age and sex on digestive tract morphometry of guinea fowl (*Numida meleagris* L.). *Folia Biologica,* **60** (1-2): 45-49.

Katanbaf, M., E. Dunnington and P. Siegel, 1988. Allomorphic relationships from hatching to 56 days in parental lines and F1 crosses of chickens selected for high or low body weight. *Growth Development and Aging,* **52**: 11-22.

Leopold, A., 1953. Intestinal morphology of gallinaceous birds in relation to food habits. *J. Wild Manage*, **17**: 197-203.

Liu, B., Z. Wang, H. Yang, X. Wang, P. Hu and J. Lu, 2010. Developmental morphology of the small intestine in Yangzhou goslings. *African Journal of Biotechnology,* **9** (43): 7392-7400.

Lu, J., 1999. Development of protein digestive enzymes and effects of nutrient treatment on their activities in broilers and mule ducks. *Ph.D. Thesis,* National Taiwan University, Taipei, pp. 28-36.

Mihailov, R., 2006. Age particularities in the development of the digestive system of European quail (*Coturnix coturnix coturnix*) from one to sixtieth days of age. *Zhovotnov'dni Nauki,* **43**: 62-67.

Mihailov, R., A. Genchev and M. Kabakchiev, 2008. Metric and development of some organs from the digestive tract of Japanese quails (*Coturnix Japonica*) from hatching to maturity. *Zhovotnov'dni Nauki,* **45**: 63-71 (Bg).

Murakami, A., M. Sakamoto M. Natali, L. Souza and J. Franco, 2007. Supplementation of glutamine and vitamin E on the morphometry of the intestinal mucosa in broiler chickens. *Poultry Science,* **86**: 488-495.

Noy, Y. and D. Sklan, 1998. Metabolic responses to early nutrition. *The Journal of Applied Poultry Research*, 7: 437-451.

Sell, J., 1996. Physiological limitations and potential for improvement in gastrointestinal tract function of poultry. *J. Appl. Poult. Res.,* **5**: 96-101.

Sell, J., C. Angel, F. Piquer, E. Mallarino and H. Al-Batshan, 1991. Developmental patterns of selected characteristics of the gastrointestinal tract of young turkeys. *Poult Sci.,* **70** (5): 1200-1205.

Shih, B., B. Yu and J. Hsu, 2004. The development of gastrointestinal tract and pancreatic Enzymes in white roman geese. *J. Anim. Sci,* **18** (6): 841-847.

StatView™ v.4.53 for Windows (Abacus Concepts, Inc). Descriptive statistic. MacWeek, Morgenstem, David, 1995.Copyright® 1988 Mac Publishing, Michigan, USA.

Yonkova, P., R. Dimitrov, G. Kostadinov and D. Vladova, 2003. Anatomic topgraphic and biometric studies of goat thyroid gland. *Animal Sciences*, **1-2:** 91-93 (Bg).

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