

EVALUATION OF THE AGE WEIGHT AND SOME MORPHOMETRICAL PARAMETERS OF THE GLANDULAR STOMACH AND GIZZARD BRONZE TURKEY (*MELEAGRIS MELEAGRIS GALLOPAVO*)

D. YOVCHEV, D. DIMITROV and G. PENCHEV

Trakia University, Department of Veterinary Anatomy, Histology and Embryology, Faculty of Veterinary Medicine, BG - 6000 Stara Zagora, Bulgaria

Abstract

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The aim of the study was evaluation of the age related development of the bronze turkey glandular stomach and gizzard. The obtained data gave information about the standard actual values of the metric parameters in the investigated organs. Ruler, graph paper and automatic scale studied the glandular stomachs and gizzards 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 determined. During the period the absolute weight of the bronze turkeys' glandular stomachs and gizzards increased respectively by 43 and 70 times. The relative weight of both organs was with highest values at the 7th day of age. Their relative length reached peak values at the 1st day. The obtained results gave a motivation to make the conclusion that the development of the bronze turkey gizzards' weight and length were higher than the same of the glandular stomachs from hatching to the sexual maturity. Both structures development was more intensive than the body weight of the birds through the early growing period.

Key words: birds, digestive system, morphometry, weight, length

Introduction

The bird stomach is composed of two parts- the upper part is called glandular stomach and the lower one is gizzard. Both organs vary in morphological and functional aspect. This is in connection to the bird species, specific habitats, weather conditions, hormonal factors, sex, age, diet relative amount and kind (Piersma et al., 1993; Strack, 1999).

There has been found correlation between body length and volume of avian alimentary tract's structures with nutrient composition and diet. The herbivorous birds have heavier gizzards than carnivorous species (Barnes and Thomas, 1987).

All digestive organs in ducks, except oesophagus reach peak levels of growth earlier than the body weight and they grow faster, regardless of their definitive weight's percentage (Gille et al., 1999).

Morphometric investigations in long-tailed ducks analysed the metric parameters of stomach-glandular stomach length

and weight, gizzard length, width and weight, both stomach combined length and weight with relation to the body weight, considering the age, sex and biological specificity of these birds (Szczepańczyk, 2005).

In Red-winged tinamou there has not being observed significant differences in glandular stomach and gizzard length and width determined by sex, contrary to the investigations with bustard, whose results presented differences in the metric parameters of glandular stomach in males and females (Bailey et al., 1997; Rossi et al, 2005).

In the common scotter has been found that the absolute breadth of the gizzard, its absolute weight and absolute length of the glandular stomach and gizzard achieved significantly higher values than ducks. The absolute breadth and weight of the gizzard were in positive correlation to body weight and body length. The absolute length of the glandular stomach and gizzard were altered proportional to the body weight. The absolute weight of the glandular stomach correlated positive-

ly to the gizzard absolute weight and breadth (Szczepańczyk, 2007).

In adult male guinea fowls the gizzard has been with higher weight, compared to female individuals. The gizzard proportion in adult birds differed significantly toward the total weight of body (Kasperska et al., 2012).

Statistical studies, carried out in pheasants determined that the digestive structures' length has been altered with the age. The percent weight of the pheasant glandular stomach reduced toward the slaughter body weight (Millán et al., 2003).

The scarce data, concerning the morphometric parameters of the glandular stomach and gizzard in the bronze turkeys and their alterations during different periods of their growing motivated us to perform the study.

Materials and Methods

For the particular study there were 60 clinically healthy bronze turkeys (30 female and 30 male). They were divided into ten groups, according to their age (one-day old, 7-days old, 14-days old, 28-days old, 35-days old, 49-days old, 56-days old, 90-days old, 120-days old, 240-days old). Each group consisted of six individuals. The birds were weighed via automated scale to the accuracy of 0.1 g. After the euthanasia the birds were eviscerated. The gizzards and the glandular stomachs were released from the content and washed with physiological saline. Both parts of the stomach were measured with linear measurements as well as plotted onto graph paper with accuracy of 0.1 g. The length of the glandular stomach and the gizzard were separately calculated toward 100 g body weight. The statistical analyses of the obtained data (mean values \pm 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 $P < 0.05$.

The experiments were done in strict compliance with the Institutional Committee of Animal Health Care at Trakia University, Stara Zagora, Bulgaria.

Results

Of the conducted macromorphometric study we determined the mean values of the absolute and relative weight of the glandular stomach and the gizzard of the bronze turkey (*Meleagris gallopavo*). Both stomach divisions have had maximum relative weight at the 7-th day. At the first 2 weeks after hatching, the glandular stomach and the gizzard have increased their absolute weight respectively 3 and 4 times.

The analysis of the data regarding the absolute weight of both stomach parts showed that the gizzard increases the weight with greater intensity, compared to the glandular stomach up to the 56th day. From the 56th day till the end of this research study there have been registered approximately close values of growth of the absolute weight of both stomachs. For the entire period the absolute weight of the glandular stomach have increased 43 times and the one of the gizzard- 70 times (Table 1).

Maximum values of the relative length of the glandular stomach and the gizzard of the broze turkey (*Meleagris gallopavo*) were determined at 1st day. Similar to the absolute weight, the absolute length of both compartments have grown with greatest intensity during the first two weeks of live of the newborn chicks, but despite the absolute weight, the rates of growth of the absolute length were with closer values in earlier stage of the bird development – at the 28th day. The absolute length of the glandular stomach and the gizzard of the bronze turkey of the entire period of the study grew 4.5 times, and the one of the gizzard – 5 times (Table 2).

Discussion

For completely conducted macromorphometric study there were two independent distinct complexes identified and determined of the stomach from the bronze turkey. The data matches the results of list of authors (Piersma et al., 1993; Strack, 1999), regarding the binary structure of the birds stomach, that is in relationship to their lifestyle, diet and the environment.

The macromorphometric examination mainly had concerned the changes of the relative and absolute values of the weight and the length of the glandular stomach and the gizzard of the broze turkey. The changes of those parameters in age aspect were not compared with the length of the body, despite the report of other authors (Barnes and Thomas, 1987).

The relative weight and length of the glandular stomach and the gizzard with the bronze turkey reached maximum values at earlier stages of the birds development. Those results are in accordance to the determined digestive organ values of the duct (Gille et al., 1999).

The conducted research of the morphometric parameters of both stomach divisions of the bronze turkey aimed to determine the rate of their growth, relative to the bodyweight of the birds and their age. Those parameters were not studied in intrasexual aspect, as with the difference to the studies of the same organs in long-tailed ducks (Szczepańczyk, 2005).

The results of the presents study correlate to the ones from the morphometric research of the glandular stomach and the gizzard of some grouse (Bailey et al., 1997) and are in

Table 1
Absolute and relative weight of bronze turtkey glandular stomach and gizzard from 1st to 240th day

Age, days	Item	Parts of stomach	
		Glandular stomach x ± SD	Gizzard x ± SD
1	Weight, g	0.27±0.02	1.31±0.06
	Weight: BW, g/kg	0.53±0.01	2.58±0.09
7	Weight, g	0.66±0.02	3.87±0.07
	Weight: BW, g/kg	0.85±0.02	4.99±0.10
14	Weight, g	0.82±0.01	5.31±0.08
	Weight: BW, g/kg	0.65±0.01	4.22±0.07
28	Weight, g	1.95±0.07	11.50±0.30
	Weight: BW, g/kg	0.56±0.03	3.31±0.08
35	Weight, g	2.24±0.06	14.48±0.31
	Weight: BW, g/kg	0.51±0.02	3.33±0.07
49	Weight, g	2.51±0.11	19.81±0.26
	Weight: BW, g/kg	0.51±0.01	3.78±0.08
56	Weight, g	4.39±0.57	40.04±2.55
	Weight: BW, g/kg	0.39±0.01	3.61±0.05
90	Weight, g	7.99±0.43	59.09±0.69
	Weight: BW, g/kg	0.32±0.03	2.37±0.06
120	Weight, g	9.58±0.66	72.47±1.68
	Weight: BW, g/kg	0.31±0.02	2.34±0.05
240	Weight, g	11.84±0.59	91.91±0.61
	Weight: BW, g/kg	0.24±0.02	1.85±0.09

Table 2
Absolute and relative length of bronze turtkey glandular stomach and gizzard from 1st to 240th day

Age, days	Item	Glandular stomach x ± SD	Gizzard x ± SD
1	Length, mm	11.50±0.55	16.17±1.83
	Length: BW, mm/kg	22.68±0.95	32.34±0.85
7	Length, mm	15.00±1.10	21.33±1.75
	Length: BW, mm/kg	19.37±0.84	27.7±0.70
14	Length, mm	18.17±0.98	29.17±1.33
	Length: BW, mm/kg	14.50±0.07	23.54±0.75
28	Length, mm	24.00±0.89	33.67±2.34
	Length: BW, mm/kg	6.91±0.45	9.65±0.45
35	Length, mm	29.00±1.55	38.50±0.84
	Length: BW, mm/kg	6.70±0.12	8.50±0.50
49	Length, mm	33.33±1.86	46.33±0.82
	Length: BW, mm/kg	6.80±0.15	7.92±0.50
56	Length, mm	37.00±1.10	58.33±0.85
	Length: BW, mm/kg	3.35±0.12	5.29±0.45
90	Length, mm	38.83±0.98	63.00±0.89
	Length: BW, mm/kg	1.55±0.09	2.50±0.35
120	Length, mm	43.83±1.47	75.83±1.47
	Length: BW, mm/kg	1.41±0.05	2.41±0.40
240	Length, mm	50.00±0.89	83.83±1.17
	Length: BW, mm/kg	1.01±0.05	1.68±0.30

counterweight to the data regarding the same organs in the bustards (Rossi et al, 2005). With all the studied birds (of male and female), there were not determined significant differences of the absolute and relative values of the weight and the length of both stomach compartments in age aspect.

The absolute length of the glandular stomach and the gizzard of the bronze turkey have grown proportional to the live bodyweight of the studied subjects. Those data are in unison with the determined for the same stomach compartments of the seal ducks (Szczeпаńczyk, 2007).

Reliability of the statistically calculated results, obtained from the present research study gave us the grounds to propose, that the statistical analysis have found broad application with the data summarizing the development of different organs not only in birds, but also in mammals (Dimitrov et al., 2003; Millán et al., 2003; Yonkova et al., 2003).

Conclusion

The absolute and the relative weight values and the length of the gizzard of the bronze turkey increased with greater intensity compared to the glandular stomach. Both compartments have been developing faster than the live bodyweight throughout the entire period (from the first day till the 240-th day).

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