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Short communication

COMPARATIVE MORPHOMETRIC INVESTIGATIONS OF INTRAORBITAL GLANDS IN JAPANESE QUAILS (*COTURNIX COTURNIX JAPONICA*)

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Summary

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The present investigation was performed on 80 intraorbital glands (40 lacrimal and 40 Harderian) obtained from 20 sexually mature clinically healthy Japanese quails (10 males and 10 females) of the Manchurian Golden and Pharaoh breeds. Prior to fixation, the weight and metric dimensions of glands were determined. In both quail breeds studied, a clear sexual dimorphism with regard to live body weight was observed with female birds being heavier than males. The body weight of birds did not correlate with the weight of either gland. There was neither a correlation between the three morphometric parameters and quails' sex and breed.

Key words: Harderian gland, Japanese quail, lacrimal gland, morphometry, weight

Japanese quails (*Coturnix coturnix japonica*) are the smallest representative of galliform birds reared for meat and egg production. One of the breeds gaining more and more popularity in Bulgaria for industrial scale egg production is the Manchurian Golden quail. Together with the Pharaoh quail, they are among the six Japanese quail breeds and strains registered in the International Registry of Poultry Genetic Stocks.

According to Kovalenko (2003), Manchurian Golden quails are created as a light egg-producing breed. As a result of domestication, a number of phenotype alterations have occurred (Genchev *et al.*, 2008), related to high egg and meat production traits. According to authors, the live body weight of female Manchurian Golden quails is by 15.5–18.7% higher than that of males. According to Marsh (1977), female Japanese quails are usually heavier than males with sex-related differences in body weight up to 20%.

All avian species possess intraorbital glands – the lacrimal gland and the third eyelid gland named Harderian after its discoverer. According to McLelland (1975), in birds, unlike mammals, the Harderian gland is better developed and of a greater size within the eye orbit. By now, the prevailing opinion about the

function of avian intraorbital glands is for their role in controlling the local orbital immunity (Burns, 1996; Shirama *et al.*, 1996). Only few morphometric studies report data about the weight or very rarely, about dimensions of some of these glands, without giving details about the breed or the age of the bird. There are no morphometric investigations on intraorbital glands in quails. The only report with metric data in quails provides data for some organs (head, neck, trunk and legs) of Manchurian Golden quails aiming to typization of exterior traits (Genchev *et al.*, 2008).

In previous studies of ours (Dimitrov, 1999; 2001; 2009; Dimitrov & Savov, 2009) we have investigated intraorbital glands in several gallinaceous bird species. The aim of this study was to determine the weight and dimensions of the lacrimal and Harderian glands in two Japanese quail breeds – Manchurian Golden and Pharaoh.

The study was carried out on 20 sexually mature clinically healthy Japanese quails (10 males and 10 females) from the stock hybrids Manchurian Golden (egg-type) and Pharaoh (meat-type) reared in the Poultry Breeding Unit of the Faculty of Agriculture, Trakia University – Stara Zagora. Until the beginning of the study, all quails were housed accordingly to the standards for the species and received feed and water *ad libitum*. Immediately prior to obtaining the material, every quail was weighed to determine its live body weight.

All stages of the study were performed as per the requirements of the University Animal Ethical Committee. After inhalation anaesthesia, decapitation and orbitotomy, one pair of Harderian and one pair of lacrimal glands (left and right) were obtained according to the method of Aitken & Survache (1976). The lacrimal glands were separated under a stereomicroscope (Technival, Carlzeiss Jena, Germany). After careful removal and cleansing of glands from the surrounding muscles and tissues, each of obtained 80 intraorbital glands (40 lacrimal and 40 Harderian) were weighed using an automated electronic balance ADAM–AAA100L (Danbury, USA), with a limit of precision 0.0001 g.

By means of a caliper and graph paper, the dimensions of each gland – length, width and circumference – were determined as per Avtandilov (1990). Afterwards, glands were fixed in 10% neutral formaldehyde and Bouin's and Carnoy's fixatives.

After processing using routine histological techniques, paraffin sections (5–7 μm) were cut on a Reichert microtome (Austria), stained with haematoxylin (Erlich)-eosin to obtain permanent histological preparations (Kiernan, 2008).

The identity of each gland was confirmed by light microscopy (Ergaval, Carlzeiss Jena, Germany).

The data were statistically processed. Statistical relationships between studied parameters were determined by Pearson's regression analysis (StatMost for Windows, Data Most Co., 1994).

Data about the body weight of birds showed that female Manchurian Golden quails were heavier than males by 61.40 g on the average (246.90±2.95 g vs 185.50±5.44 g). Pharaoh quails exhibited similar sex dimorphism with regard to body weight with a difference of 25.83 g between females and males (223.13±5.62 g and 197.30±2.78 g, respectively). Manchurian Golden females were heavier than Pharaoh females by 23.77 g whereas Pharaoh males were heavier than Manchurian Golden males by 11.80 g.

Intraorbital gland morphometry car-

ried out in both quail breeds did not show differences of the same extent as for live body weight. The lacrimal gland of heaviest birds – Manchurian Golden females – was by 1.5 mg lighter than that of males from the same breed whereas the lacrimal gland of female Pharaoh quails was heavier by 3.2 mg as compared to males (Table 1).

The comparison of lacrimal gland weight in both breeds showed that it was heavier by 7.2 mg in Pharaoh female quails compared to heavier female Manchurian Golden quails. Male Pharaoh quails had heavier lacrimal glands (by 2.6 g on the average) than those of male Manchurian Golden quails.

There was no correlation between body weight of quails and the weight of the other studied intraorbital gland. Lighter male Manchurian Golden quails had a heavier Harderian gland – by 6.2 g than the average gland weight in females. In the Pharaoh breed, the gland was heavier by 1 g only in males than in females.

Inter-breed comparison revealed than female Pharaoh quails had heavier Harderian glands (by 12.4 mg) than female Manchurian Golden quails, whereas in Pharaoh males it was by 5.6 mg lighter than that of males from the other breed.

Morphometry of the two intraorbital glands showed that glands' dimensions depended upon the body weight of the bird. The lacrimal gland length in heavier Manchurian Golden females was only by 0.7 longer as compared to respective males. The length of Harderian gland of female Manchurian Golden quails exceeded that of males by 3 mm. Although female Pharaoh quails were heavier than males, they had shorter lacrimal and Harderian glands (by 0.74 and 1.9 mm, respectively).

There was no statistically significant difference between breeds with regard to intraorbital gland lengths. Manchurian Golden females had a longer lacrimal gland (by 0.64 mm only) than Pharaoh females, whereas in Manchurian Golden males it was shorter by 0.8 mm compared to Pharaoh males. A similar relationship was observed for the Harderian gland: for female quails it was longer by 2.4 mm in the Manchurian Golden breed and shorter by 2.5 mm in the Pharaoh breed compared to males from the same breed.

The intra- and inter-breed differences in the other two dimensions – width and circumference – were very small for both

Table 1. Some morphometric parameters of intraobital glands in Japanese quails from the Manchurian Golden and Pharaoh breeds (mean ±SEM, n=20)

	Lacrimal gland		Harderian gland	
	male	female	male	female
Manchurian Golden				
Weight, mg	5.6585±0.0083	2.0012±0.0068	2.0463±0.0178	1.0321±0.0116
Length, mm	4.4000±0.3912	5.1000±0.2459	7.5000±0.3600	10.5000±0.6712
Width, mm	3.0000±0.2721	2.9000±0.1892	4.1000±1.8920	3.5000±0.1756
Circumference, mm	4.7000±0.0749	4.9000±0.1892	5.9000±0.2918	5.7000±0.3865
Pharaoh				
Weight, mg	1.5731±0.0109	8.9591±0.0141	2.0505±0.0234	1.9565±0.0240
Length, mm	5.2000±0.3784	4.4545±0.3113	10.0000±0.7027	8.1000±0.8951
Width, mm	3.5000±0.2357	3.4000±0.1721	4.2000±0.2108	3.6000±0.2330
Circumference, mm	5.0000±0.3513	5.2000±0.2689	6.4000±0.3583	6.5000±0.4230

intraorbital glands (Table 1). No statistically significant correlations were either observed.

On the basis of our results, it could be concluded that there was a clear sexual dimorphism between Manchurian Golden and Pharaoh quail breeds with regard to the live body weight as confirmed by Marsh (1977) and Genchev *et al.* (2008). The lacrimal and Harderian glands of Pharaoh quails were heavier than those of Manchurian Golden quails. The various dimensions of glands (length, width and circumference) showed no correlation with the breed, sex or body weight of quails ($r<0.300$).

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