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Arterial Vascularization of the Uropygial Glands (Gl. Uropygialis) in the Japanese Quail (*Coturnix coturnix japonica*) and Silver Polish (*Gallus gallus domesticus*)

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With 5 figures

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Summary

This study focused on the morphological characteristics of the uropygial glands of the Japanese quail and silver polish, particularly the arterial nourishment. With this respect, coloured-latex injected animals were dissected and their glands and related arteries were observed. The gland in the Japanese quail was relatively longer than that in the silver polish. The first caudal segmental arteries in the Japanese quail were specialized as the uropygial gland artery while the fourth caudal segmental ones were continued as the uropygial gland artery in the silver polish. Branches from the second and third caudal segmental arteries and skin also contributed bilaterally to the vascularization of the gland in the Japanese quail. Observing the more complex arterial structure in the Japanese quail suggests more active uropygial gland in this species, when compared with the silver polish.

Introduction

The uropygial gland in avian species lies s.c. on the uropygium, comprising two separated lobes by an inter-lobar septum. It is an easily palpable component on the last sacral and first caudal vertebrae (Doğuer and Erencin, 1964; Nickel et al., 1977; Gezici, 2002). It is also occasionally found in some birds on the fourth caudal vertebra and pygostyl, lying on the lateral and levator caudae muscles (Zamojska, 1975; Aslan et al., 2000). The gland covered by an external connective tissue capsule comprises two lobes separated by an inter-lobar septum. It is like a hazel-nut in goose and duck, and resembles a pea in smaller birds (Doğuer and Erencin, 1964; Sisson, 1975; Nickel et al., 1977; King and Mclelland, 1984; Calislar, 1986).

The uropygial gland comprises a dorsal groove, a caudally projected papilla for each lobe, and one or two ducts terminating at an external opening for each lobe (Sisson, 1975; Nickel et al., 1977; Baumel et al., 1993). It is a specialized gland for lipid secretion (Kolattukudy and Rogers, 1978; Gutierrez et al., 1998). Some of the reported physiological functions of the gland are the followings: expels water, functions as a phenomena, prevents microbiological activity on the skin, and protects the physical nature of the feathers through lubrication (Gutierrez et al., 1998). It is also a source of vitamin D (Zamojska, 1975). Thus, it was reported to be one of the accumulation sources of the organochloride pesticides used for treatment (Hayes and Laws, 1991).

Studies on the morphological and chemical characteristics of the uropygial gland have been accumulating in various avian species (Zamojska, 1975; Tasbas, 1985; Aslan et al., 2000; Kürtül, 2002; Özcan et al., 2004) even though there are very few researches reported on exotic birds. With this in mind, this study aimed to reveal the morphological characteristics of the uropygial gland with emphasize on the arterial vascularization in the Japanese quail and silver polish which are unusual and beautiful breeds very famous for their attractive and shiny feathers and raised as fowl, and to compare the findings with the literature data on other avian species.

Materials and Methods

Twenty Japanese quails (*Coturnix coturnix japonica*) weighing nearly 185 g, and 5 silver polishes *(Gallus gallus domesticus)* with a mean weight of 1250 g were deeply anaesthetized by the combination of ketamine hydrochloride (60 mg/kg) and xylazine hydrochloride (6 mg/kg), (Flecknell, 1992; Samuel et al., 1997). The arterial system was then washed through the aorta using 0.9% salt water and coloured-latex (ZPK-582-G by Educational & Scientific Products Ltd, Rustington, West Sussex, UK) was injected by way of the aorta under constant pressure. They were later put in water to set the latex for 48 h, then were kept in 10% formaldehyde to protect from decay. Finally, the arteries related to the uropygial glands were dissected and observed. Sex was disregarded as literature reports and our gatherings in this study indicated no differences on the gross morphology of the gland (Özcan et al., 2004). Nomina Anatomica Avium (1993) was used for the anatomical nomenclature.

Results

The uropygial gland (Figs 1, 2, 3, 4, 5), a paired lipid gland in outline a heart-like structure, in both species consisted of two active lobes, lying on the lateral and levator caudae muscles. It was an oval, slightly and dorsally compressed gland in the silver polish, its excretory ducts pointing caudally (Figs 3b and 5b). Its approximate craniocaudal length was 0.80 cm and width 1.15 cm. The gland in the Japanese quail had a very deep septum between the lobes and its width, 1.0 cm, was shorter than its length, 1.60 cm, hence its excretory ducts pointing

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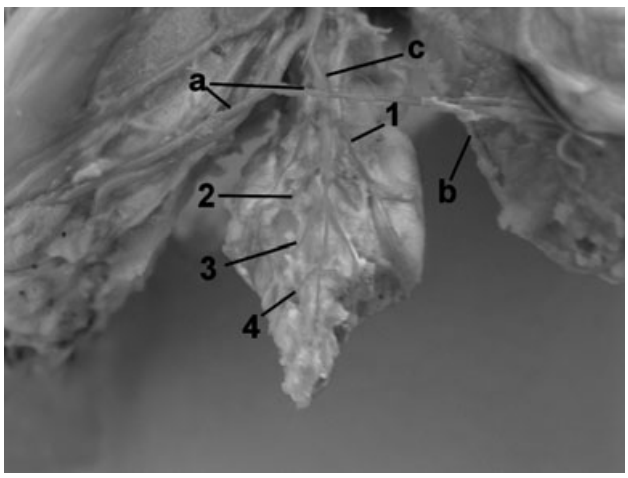

Fig. 1. Ventral view of the uropygial gland in Japanese quail. (a) The internal iliac artery, (b) the pudendal artery, (c) the median caudae artery, 1 – the first caudal segmental artery (the glandula uropygial artery), 2 – the second caudal segmental artery, 3 – the third caudal segmental artery, 4 – the fourth caudal segmental artery.

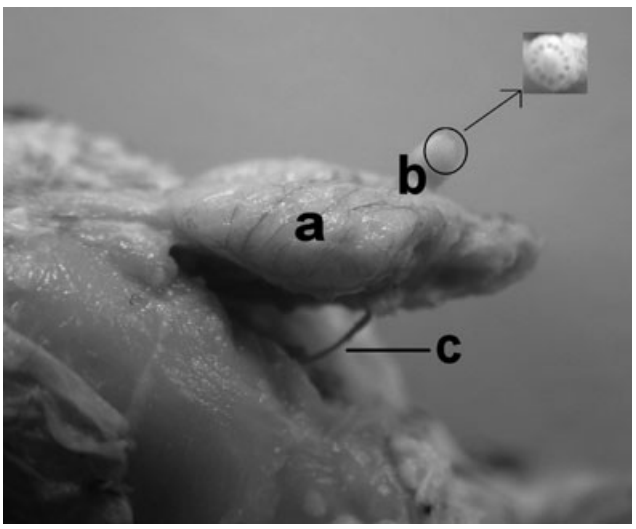

Fig. 3. Lateral view of the uropygial gland in quail. (a) The uropygial gland, (b) the uropygial duct, (c) a smaller branch from the skin.

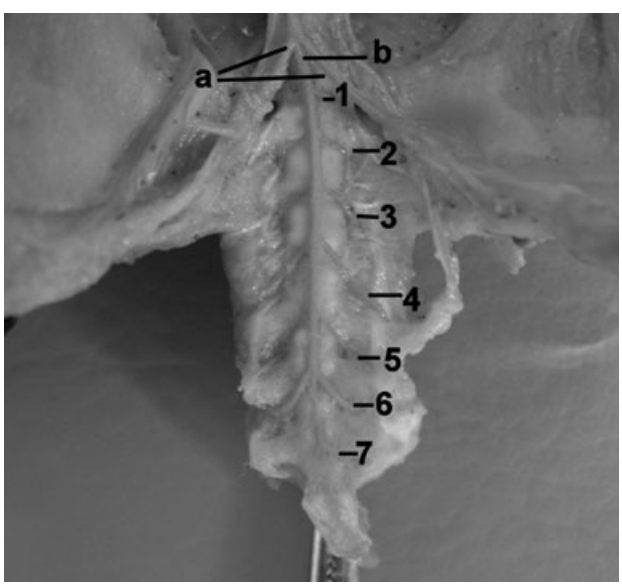

Fig. 2. Ventral view of the uropygial gland in Silver Polish. (a) The internal iliac artery, (b) the median caudae artery, 1 – the first caudal segmental artery, 2 – the second caudal segmental artery, 3 – the third caudal segmental artery, 4 – the fourth caudal segmental artery, (the glandula uropygial artery), 5 – the fifth caudal segmental artery, 6 – the sixth caudal segmental artery, 7 – the seventh caudal segmental artery.

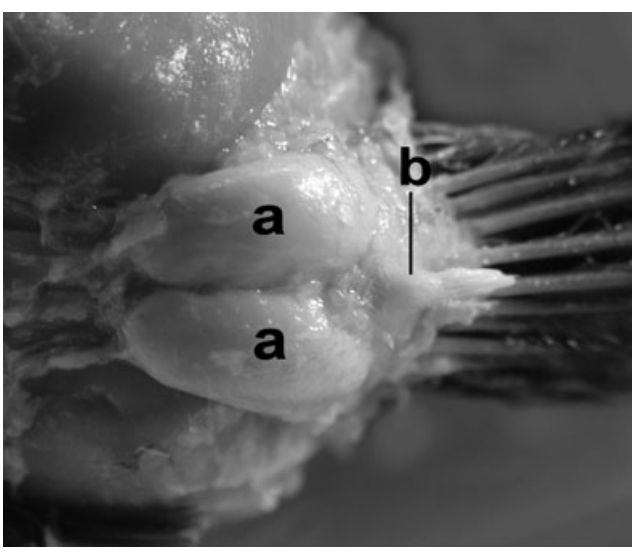

Fig. 4. Dorsal view of the uropygial gland in quail. (a) The uropygial gland and (b) the uropygial duct.

caudodorsally (Fig.3b). Its cranial and caudal edges also ended very sharp. The unimportant numerical variation acquired on sex and species differences were due to the quantity of the secretion the gland contained.

The main arterial source of the gland in both species was the median caudal artery (Figs 1c and 2b). The median caudal artery gave four-paired caudal segmental arteries in the Japanese quail and seven in the silver polish. The first caudal segmental arteries in both sides of the Japanese quail were specialized as the uropygial gland artery (Fig. 1/1) while the fourth caudal segmental branches of the median caudal artery were continued as the uropygial gland artery (Fig. 2/4) in the silver polish. Branches from the second (Fig. 1/2) and third (Fig. 1/3) caudal segmental arteries were also seen to contribute bilaterally to the vascularization of the gland in the Japanese quail. Thus, a branch from the pudendal artery, which was also originated from the lateral caudal artery of the internal iliac artery, and smaller branches from the skin (Fig. 3c), thus joined the nourishment of the gland in this species. Branches from the fifth caudal segmental arteries (Fig. 2/5) in the silver polish were also joined the vascularization of the gland.

The uropygial gland artery in the Japanese quail bilaterally left the median caudal artery, sent the muscular ramus to the lateral and levator caudae muscles and descended dorsolaterally at caudal direction, and its smaller branches

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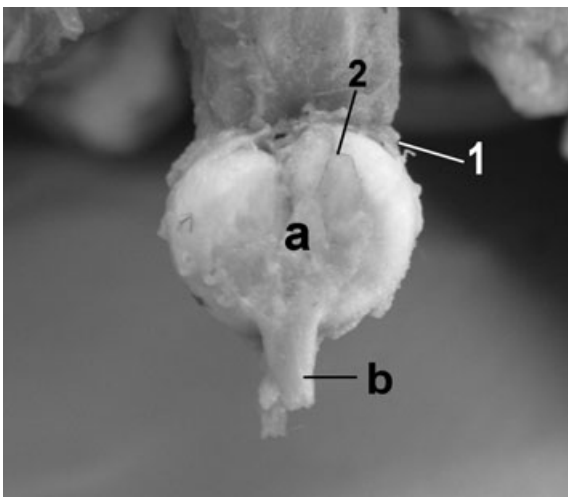

Fig. 5. Dorsal view of the uropygial gland in silver polish. (a) The uropygial gland, (b) the uropygial duct, 1 – the lateral ramus, 2 – the medial ramus.

scattered on the lateral surface of the gland. It later entered into the gland without dividing into main sub-branches. The branches of the second and third caudal segmental arteries advanced caudally, arrived at the caudal one-third of the gland, and vascularized this area. The branch of the pudendal artery joining to the vascularization was observed to reach and nourish the lateral surface of the gland. The smaller branches from the skin came particularly from the ventral and lateral aspects, thus joining the nourishment of the gland. Frequent anastomoses between the sub-branches and entrances into the gland by the vessels were demonstrated in this species.

The uropygial gland artery in the silver polish lied paramedially on the gland after bilaterally leaving the median caudal artery. It later gave the muscular ramus to the lateral and levator caudae muscles, and reached the dorsocranial edge of the gland, thereby divided into two main branches. The thinner one, the lateral ramus, further descended caudally, sending smaller branches throughout the lateral aspects of the gland while the thicker one, the medial ramus, advanced caudomedially, vascularizing the middle and cranial parts of the gland. The branches from the fifth caudal segmental arteries reached the ventral aspect of the gland, entered it, and scattered hereby.

Discussion

Researches (Floch et al., 1988; Asnani and Ramachandran, 1993) have documented the effects of the gonadal steroids and seasonal changes on the gland function. Yet, no significant differences were determined between the two sexes as far as the anatomical structures and numerical values were concerned, which had been also indicated by the literature (Özcan et al., 2004). As this literature has reported, the non-significant numerical variation in our study is thought to be due to the quantity of the secretion the gland contains. Additionally, the animals used in the study had been raised under optimum environmental conditions to regulate and optimize the changes of the seasonal activities seen in gross anatomical nature of the gland in the male and female species.

Studies have reported the number of the caudal segmental arteries to be four to five pairs in chickens (Zamojska, 1975) and goose and duck (Aslan et al., 2000), and six to seven pairs in rock partridge (Özcan et al., 2004). They additionally indicated the origin of the uropygial gland arteries to be the second pairs of the caudal segmental arteries in the chicken, goose and duck, and to be the third or fourth pairs in the rock partridge. Another study indicated the origin of the uropygial gland arteries to be the last solitary one of the caudal segmental arteries in the pigeon (Baumel, 1988). This study, on the other hand, found the number of the caudal segmental arteries to be four pairs in the quail and seven in the silver polish. Thus, the origins of the paired uropygial gland arteries were first caudal segmental arteries in the quail and fourth ones in the silver polish. It is very interesting to note on the caudal segmental arteries that their number in the quail, which is a *phasianidae* bird, is similar to that in the goose and duck which are *anatidae* birds. The number in the silver polish which is also a *gallus* bird displays the characteristics of the domestic chicken. Of course, it should also be mentioned that all of these birds belong to the *galliformes* order.

The classical pattern of the uropygial gland artery, which is that it is usually divided into the medial and lateral rami (Zamojska, 1975; Aslan et al., 2000; Özcan et al., 2004), was observed in the silver polish. The two median rami in this species got very close on the dorsal surface of the gland without displaying any anastomoses like observed in the rock partridge (Özcan et al., 2004). Zamojska (1975) in chickens and Aslan et al. (2000) in goose and duck, however, have showed clear anastomoses between the branches of the two rami on the dorsal surface of the gland. On the other hand, the uropygial gland artery in the Japanese quail was observed not to divide into the cranial and caudal rami. It sent smaller branches on the gland without any remarkable division and entered into the gland. The lateral aspect of the gland was nourished by the branch of the pudendal artery and branches from the skin.

Finally, the anastomoses usually observed in-between the terminal branches of the right and left medial rami, and in-between these branches and the branches ventrally coming from the skin and joining the vazcularization of the gland were intensely observed in the Japanese quail while no anastomose was determined in the silver polish. This might suggest that the Japanese quail possessing complex arterial fashion displays more active uropygial gland.

References

Aslan, K., S. Ozcan, and İ. Kürtül, 2000: Arterial vascularization of the uropygial glands (gl. uropygialis) in geese (anser anser) and ducks (anas platyrhynches). Anat. Histol. Embryol. **29,** 291–293.

Asnani, M. V., and A. V. Ramachandran, 1993: Roles of adrenal and gonadal steroids and season in uropygial gland function in male pigeons, *Columba livia*. Gen. Comp. Endocrinol. **92,** 213–224.

Baumel, J. J., 1988: Functional Morphology of the Tail Apparatus of the Piegon. Advance Anatomy Embryology and Cell Biology. Heidelberg: Springer Verlag.

Baumel, J. J., A. S. King, J. E. Breazile, H. E. Evans, and J. C. Vanden Berge, 1993: Nomina Anatomica Avium. Published by The Nuttall Ornithological Club. No: 23. Cambridge, Massachusets: Nuttal Ornithological Club.

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Calislar, T., 1986: Anatomy of domestic animals II. In: Dissection of Horse and Hen. Istanbul: Faculty of Veterinary Medicine, Istanbul University, pp. 281–282.

Doğuer, S., and Z. Erencin, 1964: Comparative Anatomy of Domestic Birds (A translation from 18th Publication of 'Handburch der Vergleichenden Anatomie der Haustiere' by Ellenberger V. Baum), 176. Ankara: Faculty of Veterinary Medicine, Ankara University, pp. 93–95.

Flecknell, P. A., 1992: Laboratory Animal Anesthesia. London: Academic Press Limited 24-28 Oval Road. p, 137.

Floch, J. Y., R. F. Morfin, J. Y. Daniel, and H. H. Floch, 1988: Testosterone metabolism and its testosterone-dependant activation in the uropygial gland of quail. Endocr. Res. **14,** 93–107.

Gezici, M., 2002: Skin and epidermoidal features. In: Anatomy of Domestic Birds (N. Dursun ed.) Ankara, Turkey: Medisan Publishing Company, No 49. p. 222.

Gutierrez, A. M., D. Montalti, G. R. Reboredo, A. Salibian, and A. Catala, 1998: Lindane Distribution and Fatty Acid Profiles of Uropygial Gland and Liver of Columba livia after Pesticide treatment. Pestic. Biochem. Physiol. **59,** 137–141.

Hayes, W. J., and R. R. Laws, 1991: Handbook of Pesticide Toxicology, **Vol. II**. New York: Academic Pres**s,** p. 791.

King, A. S., and J. Mclelland, 1984: Birds, Their Structure and Function, 2nd edn. London: Bailliere Tindall.

Kolattukudy, P. E., and L. Rogers, 1978: Biosynthesis of fatty alcohols, alkane1,2 diols and was esters in particulate prepations from the uropygial glands on whitecrowned sparrows (*Zonotrichia leucophrys*). Arch. Biochem. Biophys. **191,** 244–258.

Kürtül, İ., 2002: Comparative Macroanatomical Investigations on the Pattern and Branches of the Descending Aorta Among the Rooster, Drake, and Pigeon. Ankara, Turkey: Ankara University, Institute Of Health Science, p. 51.

Nickel, R., A. Schummer, and E. Seiferle, 1977: The Skin Anatomy of the Domestic Birds. Berlin: Verlag Paul Parey.

Nomina Anatomica Avium, 1993: International Committee on Avian Anatomical Nomenclature. A Committee of the World Association of Veterinary Anatomists, A Handbook of Avian Anatomy, 2nd edn, No.23. Cambridge, MA: The Nut tall Ornithological Club.

Özcan, S., K. Aslan, G. Aksoy, and İ. Kürtül, 2004: Arterial vascularization of the uropygial glands (Gl. Uropygialis) in the Rock partidge (*Alectoris graeca*) living in Turkey.. Anat. Histol. Embryol. **33,** 1–3.

Samuel, O. P., A. Sanches-Halman, and G. E. Goslaw Jr., 1997: Wing upstroke and the evolution of flapping flight. Nature **387,** 799–802.

Sisson, S., 1975: Aves sense organs. In: Sisson and Grosman's The Anatomy of Domestic Animals, **Vol. 2,** 5th edn. (R. Getty ed.), London: W. B. Saunders Company, pp. 2092–2093.

Tasbas, M., 1985: Comparative Veterinary Anatomy. Aesthesiologia. Ankara: Faculty of Veterinary Medicine, Ankara University.

Zamojska, D., 1975: Anatomical studies on the vascularization of the bursa fabricus and the uropygial gland in hens (*Gallus domesticus* L.). Part III. Blood vessels of uropygial gland. Zool. Pol. **24,** 503–521.

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