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MUSCLES OF THORACIC LIMB OF AFRICAN OSTRICH (*STRUTHIO CAMELUS L.*)

Jerzy Wustinger, Dorota Jaśko, Dorota Dróźdź, Malwina Basińska, Norbert Pospieszny
Department of Veterinary Anatomy and Histology, Agricultural University of Wrocław, Poland

ABSTRACT

The objective of the study was to analyze the wing musculature of the African ostrich. The investigation was conducted on four three-day old chicks of the ostrich. The muscles were characterized by poor development due to a very young age, and no flight abilities.

The basic muscle units were described, the measurements of their length and width were taken and their mutual relation was calculated. All values were collected in a table. The photographic documentation was also prepared.

Key words: ostrich, muscles, wing.

INTRODUCTION

The African ostrich is a species more and more commonly used in breeding. At the same time, there is no professional literature on its musculature. Publications concerning ostriches and other flightless birds appear sporadically. The object of the study was constituted by wing muscles, strongly involuted for the reason of highly advanced reduction of patagium and, as a result, of all muscle units related to it directly or indirectly. Additionally, the observed involution was related to a very young age of the chicks, whose individual sub-units of the described muscles were not yet developed. Only one original research paper by Fowler [2] was found in the available literature as well as a general description of the ostrich by Horbańczuk [3] and general data concerning the avian anatomy by Komarek et al. [4] and Schummer [5]. The Polish anatomical nomenclature according to Kobryń et al. [6] was applied in this study.

MATERIALS AND METHODS

The investigations were conducted on four three-day old chicks fixed in 4% solution of formic aldehyde. The wings were subject to anatomical preparation with the use of a magnifying glass (10x). An electronic slide caliper was used for morphometric measurements. Each measurement was taken three times and its mean value was calculated.

EXAMINATION RESULTS

The following muscle groups were distinguished and described:

1. **Wing elevators:**

- muscle latissimus dorsi (*musculus latissimus dorsi*)
It is a muscle with two edges: one directed towards the forearm bones and the other towards the backbone; it includes a cranial part (*pars cranialis*) and a caudal part (*pars caudalis*). Due to considerable patagium reduction, no part stretching patagium was found (*pars metapatagialis*), which in flying birds ends at the posterior part of the humeral bone.
Initial attachment: spinous process of the last two thoracic vertebrae.
Terminal attachment: crest of lateral tuberculum of the humerus.
- rhomboid deep muscle (*musculus rhomboideus profundus*)
Initial attachment: frontal part of spinous processes of the last cervical vertebra and from the first to the fifth thoracic vertebra.
Terminal attachment: dorsal – medial scapula margin.
Precisely speaking, this muscle elevates only scapula.

2. **Wing downward-shifting muscles:**

- coraco-brachial muscle (*musculus coracobrachialis*)
Initial attachment: all coracoidal bone and sternal ribs.
Terminal attachment: crest of lateral tuberculum of the humerus.

3. **Breathing adjunctive muscles:**

- superficial rhomboid muscle (*musculus rhomboideus superficialis*)
Initial attachment: lateral part of the last cervical vertebrae and the first thoracic vertebrae.
Terminal attachment: initial part of the clavicle.
- superficial serrate muscle (*musculus serratus superficialis*)
The division into cranial part (*pars cranialis*) and caudal part (*pars caudalis*), which is distinct in older individuals, is not visible.
- cranial part (*pars cranialis*)
Initial attachment: first sternal ribs.
Terminal attachment: abdominal scapula margin at 2/3 of its length.
- caudal part (*pars caudalis*)
Initial attachment: external surface and uncinat processes of the last sternal ribs.
Terminal attachment: 1/3 of the abdominal scapula margin.
- deep serrate muscle (*musculus serratus profundus*)
Initial attachment: transverse processes of the last cervical vertebrae and two first ribs.
Terminal attachment: medial surface of scapula.

4. **Patagium stretching muscles:**

- a part stretching patagium of the superficial serrate muscle (*musculus serratus superficialis pars metapatagialis*)
Initial attachment: external surface and uncinat processes of sternal ribs.
Terminal attachment: patagium between the shoulder and arm.

5. **Humeral joint flexors:**

- deltoid muscle (*musculus deltoideus*) is divided into the bigger part (*pars major*) and the smaller part (*pars minor*).
Initial attachment: scapula, clavicle, coracoidal bone.
Terminal attachment: crest of lateral tuberculum of the humerus.

6. **Elbow joint extensors:**

- triceps muscle of the arm (*musculus triceps brachii*)
Initial attachment: long head on the scapula neck.
Terminal attachment: olecranon.
The muscle is divided into two units:
- scapular – triceps muscle (*musculus scapulothriceps*)
Initial attachment: scapula neck.
Terminal attachment: olecranon tuberculum and posterior surface of the ulnar bone.

- brachial – triceps muscle (*musculus humerotriceps*)
Initial attachment: internal head surface and medial tuberculum of humeral bone.
Terminal attachment: olecranon.
7. **Elbow joint flexors:**
- biceps muscle (*musculus biceps brachii*)
Initial attachment: coracoid bone, clavicle, proximal part of the humerus.
Terminal attachment: proximal part of radial bone ulnar bone.
 - brachial muscle (*musculus brachialis*)
Initial attachment: distal part and medial condyle of the humerus.
Terminal attachment: proximal part of the ulnar bone.
8. **Wrist joint extensors:**
- radial extensor of wrist (*musculus extensor carpi radialis*)
Initial attachment: lateral epicondylus of the humerus.
Terminal attachment: extensor condylus of metacarpal bones I.
 - ulnar extensor of wrist (*musculus extensor carpi ulnaris*)
Initial attachment: lateral epicondylus of the humerus.
Terminal attachment: lateral margin of metacarpal bones II.
9. **Wrist joint flexors:**
- radial flexor of wrist (*musculus flexor carpi ulnaris*)
Initial attachment: medial epicondylus of the humerus.
Terminal attachment: ulnar carpal bone.
10. **Digit extensors:**
- common extensor muscle of the digits (*musculus extensor digitorum communis*)
Initial attachment: lateral epicondylus of the humerus.
Terminal attachment: proximal part of digit I and II.
 - dorsal interosseous muscle (*musculus interosseus dorsalis*)
Initial attachment: margins of metacarpal interosseous space.
Terminal attachment: dorsal surface of bones of digit II.
Precisely speaking, this muscle straightens digit II.
11. **Flexors of digit II:**
- deep flexor muscle of digits (*musculus flexor digitorum profundus*)
Initial attachment: proximal part of palmar surface of the ulnar bone.
Terminal attachment: joins with the tendon of superficial flexor muscle of the digits (*musculus flexor digitorum superficialis*) and ends at medial and distal part of digit II.
 - dorsal interosseous muscle (*musculus interosseus ventralis*)
Initial attachment: margins of metacarpal interosseous space at the dorsal side.
Terminal attachment: dorsal surface of the bones of digit II.
12. **Wing abductors (of digit II):**
- wing abductor muscle (*musculus abductor allulae*)
Initial attachment: radial wrist bone and metacarpal bone.
Terminal attachment: proximal part of digit II.
13. **Wing folding muscles (of digit II):**
- long wing extensor muscle (*musculus extensor longus allulae*)
Initial attachment: antebrachial fascia and ulnar wrist bone.
Terminal attachment: proximal or medial part of digit II.
14. **Supinators:**
- supinator muscle (*musculus supinator*)
Initial attachment: lateral epicondylus of the humerus.
Terminal attachment: dorsal surface of the radial bone.

15. **Pronators:**

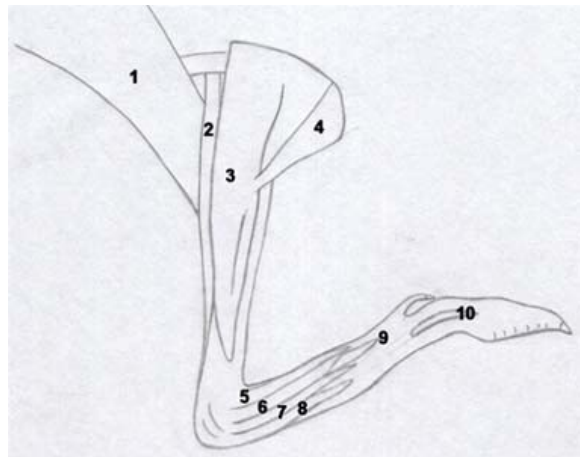
- superficial pronator muscle (*musculus pronator superficialis*)
Initial attachment: medial epicondylus of the humerus.
Terminal attachment: medially on the lateral pat of the radial bone.
- deep pronator muscle (*musculus pronator profundus*)
Initial attachment: medial epicondylus of the humerus.
Terminal attachment: 1/3 lateral part of the radial bone.
These muscles cross with each other in their course.

Fig. 1 a, b. Thoracic limb of the ostrich at dorsal side

1 – m. latissimus dorsi, 2 – m. triceps brachii (scapulothriceps), 3 – m. deltoideus, 4 – m. rhomboideus superficialis, 5 – m. extensor carpi radialis, 6 – m. supinator, 7 – m. extensor digitorum communis, 8 – m. extensor carpi ulnaris, 9 – m. extensor longus allulae 10 – m. interosseus dorsalis



a



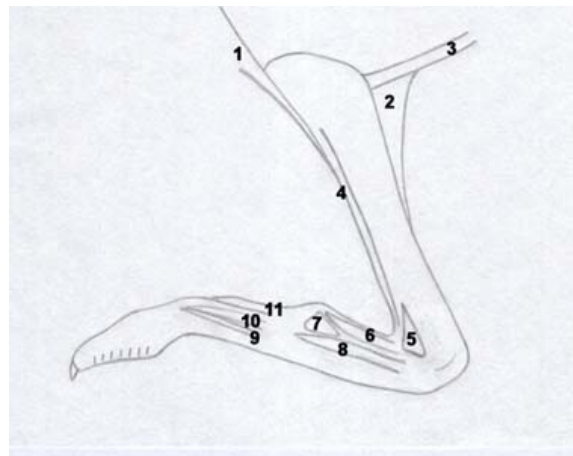
b

Fig. 2 a, b. Thoracic limb of the ostrich at abdominal side

1 – m. rhomboideus superficialis, 2 – m. latissimus dorsi, 3 – m. serratus superficialis, 4 – m. biceps brachii, 5 – m. brachialis, 6 – m. pronator superficialis, 7 – m. pronator profundus, 8 – m. flexor carpi radialis, 9 – m. flexor digitorum profundus, 10 – m. interosseus ventralis



a



b

Morphometry:

- 1) muscle length – from initial attachment to terminal attachment
- 2) muscle width – widest place of muscle belly
- 3) length to width ratio

Table 1. Morphometry of thoracic limb muscles of African ostrich

Name of muscle:	Length:	Width:	Length to width ratio:
<i>m. latissimus dorsi</i>	50.67	9.93	5.10
<i>m. coracobrachialis</i>	7.05	6.31	1.12
<i>m. rhomboideus superficialis</i>	34.33	18.17	1.90
<i>m. serratus superficialis</i>	18.52	5.75	3.22
<i>m. serratus profundus</i>	14.10	4.07	3.46
<i>m. deltoideus</i>	43.52	5.57	7.81
<i>m. humerotriceps</i>	18.80	1.21	1.54
<i>m. scapuloiceps</i>	42.72	1.81	23.60
<i>m. biceps brachii</i>	42.10	1.37	30.73
<i>m. brachialis</i>	4.83	1.9	2.54
<i>m. extensor carpi radialis</i>	14.35	2.15	6.67
<i>m. extensor carpi ulnaris</i>	15.14	2.40	6.31
<i>m. flexor carpi ulnaris</i>	14.08	2.14	6.58
<i>m. extensor digitorum communis</i>	13.01	0.90	14.45
<i>m. interosseus dorsalis</i>	11.43	0.90	12.70
<i>m. flexor digitorum profundus</i>	10.30	1.25	8.24
<i>m. interosseus dorsalis</i>	11.43	0.90	12.70
<i>m. abductor allulae</i>	4.31	2.02	2.13
<i>m. extensor longus allulae</i>	5.27	0.79	6.67
<i>m. supinator</i>	7.27	1.36	5.35
<i>m. pronator superficialis</i>	9.77	1.98	4.93
<i>m. pronator profundus</i>	4.89	1.46	3.35

DISCUSSION

A distinct involution of muscles was observed during the analysis of the ostrich wing musculature. This was a result of two aspects: reduction of patagium and the age of the chicks. However, it is difficult to define their influence on the degree of involution in a univocal way on the basis of the preparatory material. In order to do this, it is necessary to compare the musculature of the chicks and adult individuals. This will certainly become the object of future studies.

Data concerning the ostrich wing musculature are very sparse as can be observed on the basis of the review of literature. The literature [2, 3] did not include important information on the musculature of the African ostrich. As results from table 1, these muscles are very thin in relation to their length, which indicates an early stage of development.

Baumel [1] reports that we deal with superficial and deep serrate muscle (*musculus serratus superficialis et profundus*), while Schummer [5] states that this is a superficial abdominal serrate muscle and a deep serrate muscle (*musculus serratus ventralis superficialis et musculus serratus profundus*). The triceps brachial muscle (*musculus triceps brachii*), according to Baumel [1], has three sub-units: scapular – triceps muscle (*musculus scapuloiceps*), humeral – triceps muscle (*humerotriceps*) and coracotriceps muscle (*coracotriceps*), while Komarek et al. [4] provide a division into a long head and humeral head (*caput longum et caput humerale*).

At this stage, the investigation did not show the presence of coracotriceps part (*pars coracotriceps*). The subsequent muscles that the authors were not able to distinguish were the following: superficial digit flexor muscle (*musculus flexor digitorum superficialis*) and deep rhomboid muscle (*musculus rhomboideus profundus*).

CONCLUSIONS

1. Due to the lack of patagium (*patagium*), many sub-units of particular muscles are not present.
2. It is possible to distinguish the main muscles, but it is difficult to show the parts they divide into.
3. The ostrich, as a representative of ratite birds and in comparison to household birds, shows a significant reduction of thoracic muscles constituting the main musculature mass of the thoracic limb in *Carinatae*.
4. The reduction concerns both the structure and number of the occurring muscle units.
5. In spite of belonging to *Ratites*, the ostrich has traces of anatomical structures related to flight (*metapatagium i postpatagium*)

REFERENCES

1. Baumel J.J., 1993. Handbook of Avian anatomy Nomina Anatomica Avium. Cambridge Massachusetts.
 2. Fowler M.E., 1991. Comparative clinical anatomy of ratites. Jour of Zoo of Wildlife Med. 22: 204-227.
 3. Horbańczuk J.O., 2001. Strusie. [Ostriches.]. Warszawa. Zakład Wydawniczo-Reprodukcyjny Auto-Graf Sp.z.o.o. [in Polish].
 4. Komarek V., Malinovsky L., Lemez L., 1982. Anatomia avium domesticarum et embryologia galli. Priroda, Vydavatel'stvo Knih A Casopisov, Bratislava.
 5. Nickel R., Schummer A., Seiferle E. 1973. Lehrbuch der Anatomie der Haustiere [Physiology of domestic animals] Bd. V. Anatomie der Hausvogel. P. Parey Verlag in Berlin [in Germany].
 6. Kobryń H., Kobryńczuk F., 2004. Anatomia zwierząt T. III. [Animal Anatomy] Vol. III; PWN Warszawa [in Polish].
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Jerzy Wustinger
Department of Veterinary Anatomy and Histology,
Agricultural University of Wrocław, Poland
Kozuchowska 1-3; 51-631 Wrocław, Poland
phone: +48+71+3205746
email: jotwu@gen.ar.wroc.pl

Dorota Jaśko
Department of Veterinary Anatomy and Histology,
Agricultural University of Wrocław, Poland
Kozuchowska 1-3; 51-631 Wrocław, Poland

Dorota Drózdź
Department of Veterinary Anatomy and Histology,
Agricultural University of Wrocław, Poland
Kozuchowska 1-3; 51-631 Wrocław, Poland

Malwina Basińska
Department of Veterinary Anatomy and Histology,
Agricultural University of Wrocław, Poland
Kozuchowska 1-3; 51-631 Wrocław

Norbert Pospieszny
Department of Veterinary Anatomy and Histology,
Agricultural University of Wrocław, Poland
Kozuchowska 1-3; 51-631 Wrocław, Poland

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