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ANATOMICAL PARTICULARITIES OF THE COCCYX IN OSTRICH (*STRUTHIO CAMELUS*)

Florina DUMITRESCU, Iulian DUMITRESCU, Cristian BELU, Diana LICSANDRU, Petronela ROȘU, Gabriel PREDOI

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
Faculty of Veterinary Medicine, 105 Spaiul Independenței, District 5, Bucharest, Romania

Corresponding author email: dumitrescu_florina@yahoo.com

Abstract

This study, made on adult ostrich specimens, has the purpose of identifying the main characteristics of the pelvic belt at this bird and was motivated by the desire to complete existing data and to present anatomic elements using the terminology recommended by the Nomina Anatomica Avium. A very strong connection has been noticed between the ilium and the sacrum, strengthened by the forging in the medial plane of the preacetabular parts of the ilium. This aspect is very different from the ischium, which turns from a wide bone at the rest of the species, into a strong long bone at the ostrich that, with the exception of the cranial extremity, is separated through a wide space from the ilium. The absence of well-known anatomical features of birds from other orders was noticed, such as : the ilio-caudal fossa, the iliac oblique crest, the infracristal cavity, etc while observing the existence of some specific features like an unique type of pubic symphysis.

Key words*: ostrich, cooccyx, antitrochanter, pubis.*

INTRODUCTION

This species, by the scientific name of *Struthio camelus*, is the biggest living bird. It is valuable for feather production, egg production, as well for its skin and red meat with a very low fat content. (5). The domestic ostrich *(Struthio camelus domesticus)* is the result of over 100 years of selective cross-breedings, in the arid regions of South Africa, conducted with the purpose of improving this species' economical features. Although it does present some common characteristics of the locomotory system of other bird species (2, 6), the ratite have a series of anatomical differences determined by the loss of flight capacity but also by their size, being the largest representatives of their class.

In specialty literature, data regarding the skeletal system in ostrich is relatively brief (1,4,5) and doesn't include the recommended terminology of the Nomina Anatomica Avium (1,4,7,8), reason for which we have conducted a detailed study of the pelvic girdle at this species, seeking to complete the knowledge regarding the anatomy of this species.

MATERIALS AND METHODS

The study material was represented by parts from 10 adult specimens of different sexes, with weights between 70 and 85 kg, some corpses coming from zoos or private owners, brought to the Faculty of Veterinary Medicine of Bucharest in view of necropsy. Other specimens were provided from slaughterhouses. The bones were prepared through classic methods (maceration, manual cleaning, washing, degreasing, whitening and drying) then measurements were made, as well as describing the features and acquiring photographs. The identification, description and the certification of the formations were carried out according to the Nomina Anatomica Avium – 1993.

RESULTS AND DISCUSSIONS

At the ostrich, the ilium is a massive bone, composed of a shorter and wider preaceabular part (*Ala preacetabularis ilii*) and a very long and almost completely independent of the ischium, postacetabular part (*Ala postacetabularis ilii*) [Fig. 1(1,2)]. The ratio between the length of the preacetabular part and

the postacetabular part (taking as a landmark a vertical plane that crosses through the center of the acetabular hole) is 1 : 2.

On the dorsal side (*Facies dorsalis*), the dorsal iliac fossa (*Fossa iliaca dorsalis*) has the appeareance of an almost plain surface, strongly ventrally inclined and marked for the most part by lines and coarse crests.

The dorsal iliac crest (*Crista iliaca dorsalis*) [Fig.1(5)], rectilinear in its middle third, is united with the one on the opposite side, forming a median elongated relief that becomes progressively thicker at the cranial extremity. In the caudal part, the dorsal iliac crest will separate from her symmetrical one, recurving laterally to end through a prominence oriented towards the dorsal margin of the antitrochanter from which it is separated by a large incisure.

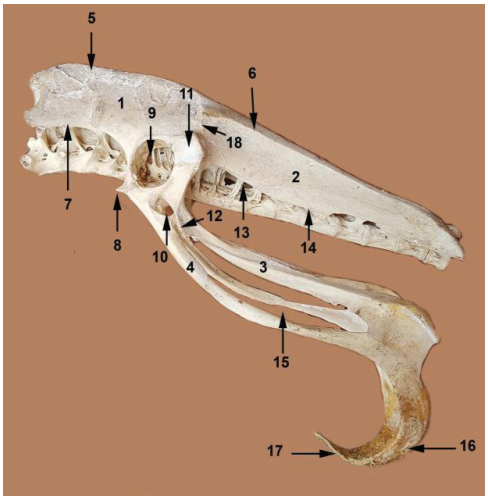

Fig. 1. The coccyx of the ostrich – lateral view (original)
1-the preacetabular part of the ilium; 2-the postacetabular part of the ilium; 3-ischium; 4-pubis; 5-the dorsal iliac crest; 6-the dorso-lateral crest of ilium ; 70- the lateral iliac crest ; 8-the preacetabular tuber (pectineus) ; 9-the acetabular hole; 10-the obturator hole; 11-the antitrochanter; 12-the obturator process; 13-the transverse processes of the sinsacrum's vertebrae; 14-the infracristal blade; 15- the ischio-pubic hole; 16-scapus pubis; 17-the apex of the pubis

The lateral iliac crest (*Crista iliaca lateralis*) [Fig.1(7)] is convex in the cranial half and concave in the caudal one, oriented in ventro-lateral direction. At a small distance from the cranial margin of the acetabular hole it extends ventrally reaching the preacetabular tuber (pectineal process) [Fig.1(8)].

The plain ventral face (*Facies ventralis*) is ventro-medially oriented towards the spinous or dorsal crest of the sinsacrum (*Crista spinosa synsacri*).

The sharp angle that forms with the median plan enables us to consider, from a topographic point of view, this face as a medial face rather than a ventral one.

Apart from this, between the ventral face and the spinous crest a wide space can be observed, with an almost triangular outline in a transversal section.

In the inferior part, this space is delimitated by the transverse processes of the last two thoracic vertebrae and the first three-four lumbar vertebrae that, through their apex, articulate with the ventro-median margin of this face while leaving very large spaces in the area of the intertransversary openings (*Fenestrae intertransversarie*) [Fig. 3(2)] at this species.

At young birds, where the joints between the ilium and the top of the transverse processes did not weld, the articular areas (*Arae articulares vertebrales*) that correspond to these processes can be observed.

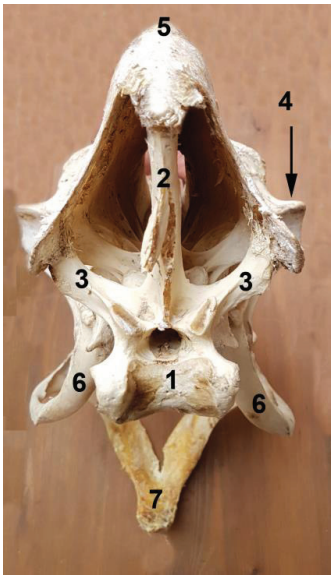

Fig. 2. The coccyx of the ostrich- cranial view (original)
1-the cranial terminal face of the second last thoracic vertebrae ; 2-the thorny crest of the sinsacrum; 3-the transverse processes of the second last lumbar vertebrae; 4-the antitrochanter; 5- the dorsal iliac crests united in a medial plan; 6-pubis; 7-the pubic symphysis.

The postacetabular part of the ilium also has three faces: a dorsal, a lateral and a ventral one.

Because of the totally different appearance of the coccyx in these ratite, the terms for these faces don't fully correspond to the topographic reality.

The dorsal face (*Facies dorsalis*) is separated by the lateral face through the dorso-lateral crest of the ilium (*Crista dorsolateralis ilii*) (indistinct at some anseriformes, for example).

The dorso-lateral crest is long, almost rectilinear (with the exception of the extremities) and is more prominent in the cranial half than the caudal one.

In the caudal part, the caudal crest thickens, becomes coarse and slightly orients ventro-laterally, ending through a sharp process that matches the dorso-lateral spina of the ilium (*Spina dorsolateralis ilii*).

Cranially, the crest is oriented latero-ventrally, connecting to the caudal extremity of the dorsal iliac crest, at the level of the tuber that is oriented towards the antetrochanter, a process reminded earlier that is not mentioned in specialty nomenclature.

The dorsal side of the postacetabular part is very long, transversally convex on its entire length.

A genuine iliocaudal fossa (*Fossa iliocaudalis*) is not identified. At the species at which it exists, this fossa is destined to the insertion the *levator caudal* muscle.

Taking into account the role of the tail in directing flight, the absence of this fossa in the ostrich would be due to the weak development of the tail musculature in ratite, birds without the capacity of flight.

Unlike the preacetabular part, the medial margin of this dorsal face is not in contact with the symmetric one and for most of its part it also remains separated from the sinsacrum through a large space.

The ilio-sacral suture (*Suture iliosynsacrala*) is present just in the posterior third of the bone.

The lateral face (*Facies lateralis*) of the postacetabular portion is vaster compared to the dorsal one. The ventral margin of the bone blade that constitutes this face (*Lamina infracristalis ilii*) is loose on its entire length and there is no ilio-ischiatic synchondrosis (*Syncondrosis ilioischiatica*) therefore the ilioischiatic hole doesn't form either (*Foramen ilioischiaticum*).

The infracristal cavity cannot be identified (*Cavitas infracristalis*), the reduced depression is situated caudally from the ilioischiatic hole and it is destined to the ischiofemuralis muscle.

However, this side is obliquely crossed in a cranio-caudal and ventro-lateral way by an obvious crest, not mentioned in literature.

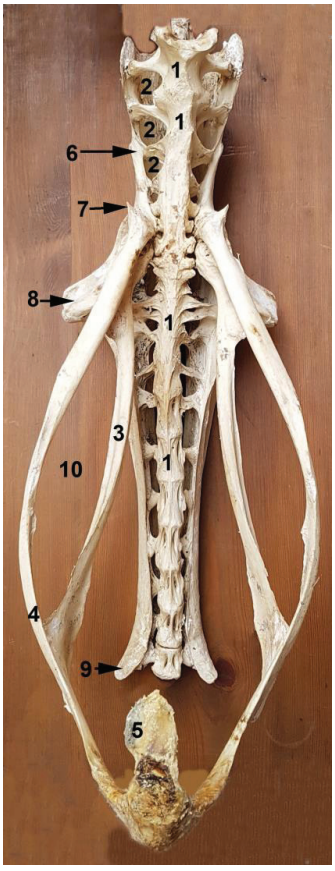

Fig. 3. the coccyx of the ostrich – ventral view (original)
1-sinsacrum; 2-the intertransversal openings; 3-ischium; 4-pubis; 5-the apex of the pubis; 6-the lateral crest of the ilium; 7-the prepubic tuber; 8-the antitrochanter; 9-the dorso-lateral spina of the ilium; 10-ischio-pubic hole.

The ventral side of the postacetabular part orients itself in a medial direction and is articulated with the transverse processes of the vertebrae that compose the sinsacrum [Fig. 3(1)].

The caudal crest of the renal pits (*Crista caudalis fossae renalis*) is indistinguishable and so is the caudal recess of the pits (*Recessus caudalis fossae*).
The body of the ilium (*Corpus ilii*) represents the central part of the ilium, situated dorsally form the acetabular cavity. A formation corresponding to the oblic iliac crest (*Crista iliaca obliqua*) of other species could not be identified. The antitrochanter (*Antitrochanter*) [Fig. 3(8)] is prominent; it has an articular surface (*Facies articularis femoralis*) with a rectangular look and is well-defined dorsally by a wide antitrochanteric groove (*Sulcus antitrochantericus*). The preacetabular tuber (*Tuberculum preacetabulare (Processus pectinealis*) [Fig. 1(8)] is placed on the ventro-cranial margin of the acetabulum, and it is represented by a short and sharp spina. The acetabular hole (*Acetabulum*) [Fig. 1(9)] is large, with a circular contour and an approximate diameter of 65 mm.
The ischium [Fig. 3(3)] is considerably different from other species, being long and very narrow. The anterior extremity, which matches the body of the ischium (*Corpus ischii*) participates in the formation of the acetabular cavity and, through the ventral margin, at the formation of the foramen obturatum (*Foramen obturatum*) [Fig. 1(10)]. This hole has an ellipsoidal outline and estimated sizes of 20/30 mm in adults. It is caudally delimited by a short, obtruding process (*Procesus obturatorius*) articulated with the pubis on a length of 15 mm.
The rest of the ischium corresponds to the wing (*Ala ischii*) and is crossed on its entire surface by a prominent sharp crest.
Between the wing of the ischium and the postacetabular portion of the ilium there is no link, the margins of the two bones being separated on their entire length by a very large space.
The puboischiatic rift (*Fenestra ischipubica*) is very large and long and thus it articulates with the pubis just at its extremities.
The pubis is very long. Through the anterior extremity (*Corpus pubis*) it participates at the formation of the acetabular cavity.
The caudal portion (*Scapus pubis*) takes part in the delimitation of the puboischiatic rift, and it articulates with the caudal extremity of the ischium, caudally exceeding this extremity and recurving ventrally and slightly medially. The apex of every pubis (*Apex pubis*), unlike the rest of the domestic birds, welds with the symmetrical opposite forming a symphysis that is not found in any other birds species.

CONCLUSIONS

In contrast with other bird species, the ostrich's ilium is generally a massive bone, very well consolidated with the sinsacrum but still reduced in comparison to it.
It is a little extended laterally, forming, as a whole, a sharp angle with the vertical plane which makes the ceiling of the abdominal cavity appear relatively narrow.
As opposed to the rest of the bird species, in the ostrich, the dorsal iliac crest, rectilinear in its middle third, is united with the one from the opposite side, forming a median elongated relief, which progressively thickens at the cranial extremity.
At this species a genuine iliocaudal fossa is not identified for the insertion of the caudal levator muscle because it functionally correlates with a weak development of the tail of this species, the ostrich being a bird without flight capacity.
The ventral margin of the bone blade that forms the lateral face of the postacetabular portion of the ilium is loose along its entire length at distance from the ischium, an ilio-ischiatic synchondrosys being unidentifiable.
At the ostrich both the caudal crest of the renal pits and the caudal recess of the pits are indistinguishable. A process corresponding to the oblique iliac crest that is present on the ilium's body in other species could not be identified.
Compared with other bird species, in ostrich, the ischium is considerably different, being long and very narrow.
Unlike all domestic bird species, in the ostrich, the apex of every pubis welds with the symmetric forming a symphysis.

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