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Morphological Studies and Arterial Supply of the Pharynx in the Goat (*Capra hiracus*)

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ABSTRACT

The present work was carried out to give complete information about the anatomy and histology of pharynx in the goat which may be helpful for further studies to both under graduate and post graduate studies. The morphological studies of the pharynx entailed the collection of twenty-four heads together with first two cervical vertebrae from apparently healthy adult goats of both sexes from the Giza governorate. The results showed that the pharynx in goat was an irregular funnel shaped structure. It extended from the caudal end of the horizontal lamina of the palatine bone, extended caudoventrally up to the level of the caudal border of the wing of atlas. The pharyngeal fornix was smooth and concave and divided by the septum pharyngis into two deep narrow cavities. The pharyngeal opening of the auditory tube was crescent shaped slit situated at the caudodorsal part of the lateral wall of the nasopharynx. It was covered medially by a thin mucosal fold (salpingo-pharyngeal fold, contained hyaline cartilage in lamina propria). Both the Tonsilla pharyngea and the Tonsilla tubaria observed only microscopically. The oropharynx was short, wide and dilatable. The palatine tonsil was located on the caudal third of the lateral wall of the oropharynx. The pharynx of the goat received its arterial blood supply via the ascending pharyngeal, ascending palatine arteries, and the pharyngeal branches of the cranial thyroid, cranial laryngeal and Rr. musculares of the lingual artery. The soft palate is vascularized through lesser palatine artery, in addition to the branches of the pterygoid artery of the maxillary artery. The results obtained were discussed with the available literature in different animals.

Key words: Goat; Nasopharynx, Oropharynx, Palatine tonsil, Tubal tonsil, Blood supply.

INTRODUCTION

Goats were the first farm animals to be domesticated. As indicated by the archaeological evidence, they have been associated with man in a symbiotic relationship for up to 10,000 years (Ensminger and Parker, 1986).

In the last few decades, the anatomy of the goat has attracted the attention of several veterinary anatomists. . . The goat is used for many purposes including biomedical research, meat and milk production.

In Egypt, there are more than three million heads of goats raised primarily in three regions; Upper Egypt, Nile delta and in the desert range-lands (Faostat, 2011).

The importance of the pharynx as an organ disposed between two important systems. Food and air cross through the pharynx in their way to the oesophagus or larynx and also during regurgitation of food in ruminant's pharynx plays an important role in directing them to their right way and prevent chocking (Wally, 1989).

The pharynx could also be attributed to the presence of tonsils and solitary lymph nodules, which perform an essential defense mechanism against the ingested or inhaled pathogenic microorganism (Bahgaat, 1991).

MATERIALS AND METHODS

The morphological studies of the pharynx entailed the collection of twenty-four heads together with first two cervical vertebrae from adult apparent healthy goats of both sexes from Giza governorate. Eight heads were washed with normal saline (0.9%) through the common carotid artery, then injected using formalin solution (10%) and left for 4 days before manual dissection. Four heads were sawed into two lateral halves to investigate the pharyngeal cavity and soft palate. Eight heads were injected with 60% gum milk latex colored red with Rotraing Ink for study the arteries of the pharynx. Four heads were sectioned in median plane, Tissue pieces were collected from different regions of the pharynx and soft palate then fixed in 10 % neutral buffered formalin. Samples were trimmed and processed by dehydration and 5-6µm thick tissue sections

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were cut by rotatory microtome and fixed to glass slides. The sections were stained by 1-Haematoxylin and Eosin as a general examination staining method for histological evaluation, (Bancroft and Gamble, 2008). The nomenclature was adopted according to the Nomina Anatomica Veterinaria (NAV) (2012). The Institutional Animal Care and Use Committee Vet. Cu. IACUC approved the protocol (VetCU06202019056).

RESULTS

Topography

The pharynx of the goat (Fig. 1) had an irregular funnel shaped structure, it extended from the caudal end of the horizontal lamina of the palatine bone on a level with the last molar tooth caudoventrally up to the caudal border of the wing of the atlas opposite to the caudal border of the cricoid cartilage. The length of the pharynx ranged from 6-8. 5cm. as measured from the choanae to the auditus oesophagi.

The pharyngeal cavity (Fig. 1/C) was wide rostrally measuring about 3-4 cm in height as it connected to the nasal and oral cavities. It is reduced towards the isthmus pharyngis reaching about 1. 4 to 1. 7 cm., then rapidly narrowed to 0. 5-0.7 cm. at the auditus oesophagi.

The rostral part of the pharyngeal cavity was divided by the soft palate (Fig. 1C/23) into a dorsal Pars nasalis and a ventral Pars oralis while the narrow caudal portion is called Pars laryngea.

The nasopharynx (Fig. 1C/18) presented the longest part of the pharynx. It ranged from 5. 2-6. 4cm. in length measured from the choanae to the end of the pharyngeal recess (Fig. 1C/21). The mucous membrane become folded in the caudal part and on the dorsal surface of the soft palate The nasopharynx communicated with the nasopharyngeal meatus via the choanae (Fig.1C/17), the latter are two long narrow openings; bounded dorsally by the vomer and the presphenoid bones,, ventrally by the caudal border of the horizontal part of the palatine bone,, laterally by the perpendicular part of the palatine bone, both are separated completely by the well-developed pharyngeal septum. The septum pharyngis (Fig. 1C/i,2A/ps) represented the membranous continuation of the nasal septum. It was wide rostrally than caudally. In height it ranged from 1. 2 cm. and decreased gradually to terminate by pointed narrow end. The pharyngeal fornix (Fig. 2A/pf) is smooth and concave and divided by the septum pharyngis into two deep narrow cavities.

The pharyngeal opening of the auditory tube (Fig. 1C/19) was a crescent slit-like structue situated at the caudodorsal part of the lateral wall of the nasopharynx about 3. 5-4 cm from the choanae. It was covered medially by a thin mucosal fold (salpingo-pharyngeal) (Fig. 1C/20). Histologically, it had hyaline cartilage in the lamina propria (Fig. 4/E).

The pharyngeal recess (Fig. 1C/21) represented by the narrow caudal extension of the nasopharynx beyond the opening of the auditory tube. It is bounded medially by the caudal end of the pharyngeal septum and laterally by the auditory tube.

The pharyngeal tonsil (Fig. 4/C, D) located at the caudolateral wall of the nasopharynx and in the caudal part of the nasal septumand The tubal tonsil (Fig. 4/B) located in the medial and lateral laminae of the Ostuim pharyngea tubae auditivae both were not observed macroscopically and histologically appeared as a diffuse lymphocytic infiltration in the lamina propria.

Histologically, the nasopharynx (Fig. 4) is lined by pseudo stratified columnar epithelium with goblet cells (E), supported by collagen fibers (C.f) and containing lymph nodules (L.N)

The oropharynx (Fig. 1C/25) was short, wide and dilatable extending from the initial part of the palatoglossal arch to the base of the epiglottis. It communicated with the oral cavity via the isthmus faucium (Fig. 3/A, A') which appeared as a narrow oval to rounded orifice, bounded dorsally by the soft palate, ventrally by the root of the tongue and laterally by the palatoglossal fold. The palatine tonsil projected into its cavity. Its mucous membrane was folded.

The palatine tonsil (Fig. 2/D) was located on the caudal third of the lateral wall of the oropharynx. It was composed of numerous irregular follicles differing in shape from oval, rounded to elliptical. . . Each follicle opened at its apex by one or more rounded to elongated slits. Histologically, it appeared as a tonsil with crypt lined by stratified squamous non keratinized epithelium supported by collagen fibers and containing lymph nodules.

The paraepiglottic tonsil (Fig. 5/E) observed only microscopically in 25% of examined specimens as an aggregations of lymph nodules in the lamina propria.

The laryngeopharynx (Fig. 3D, Lp) constituted the narrowest and shortest part of the pharyngeal cavity. It extended from the pharyngeal isthmus caudally above and around the auditus laryngis to be terminated at the auditus oesophagi dorsal to the cricoid cartilage. It communicated with the larynx via auditus laryngis which bounded by the epiglottis cartilage cranially and by the corniculate cartilage caudally and laterally by the aryepiglottic fold.

The piriform recess (Fig. 3B/40) was narrow shallow passage between the oropharynx and oesophagus bounded medially by the aryepiglottic fold and laterally by the palatopharyngeal fold.

Histologically, the oropharynx (Fig. 5) was lined by stratified squamous non keratinized epithelium (E), supported by collagen fibers(C) and containing lymph nodules (L. N),

The auditus oesophagi (Fig. 3C'/41) represented by a nearly rounded opening, lined by numerous longitudinal folds (Fig 3C'/42), located dorsal to the caudal border of the cricoid lamina.

The soft palate (fig. 1C/23) represented by a musclo-membranous fold projecting into the rostral portion of the pharynx dividing it into pars nasalis dorsally and pars oralis ventrally. It extended from the concave free border of the horizontal part of the palatine bone proceeded caudoventrally to terminate in front of the epiglottis cartilage.

The arcus palatinus (Fig. 3C/35) was concave, form the rostral margin of the intrapharyngeal opening. Both dorsal and ventral surfaces of the soft palate were folded and with numerous scattered lymph nodules (Fig. 3/B).

The palatoglossal fold (Fig. 2C,3C, C'/25) appeared as a short, thin fold extending from the lateral border of the initial part of the soft palate rostroventrally to the root of the tongue, it forms the lateral boundary of the Isthmus faucuim.

The palatopharyngeal arch (Fig.3B/39) constituted the caudal continuation of the lateral parts of the palatine arch on the lateral wall of the pharynx, they form the lateral boundary

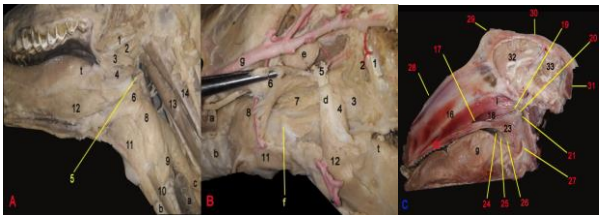

Fig. 1/A, B, C: showed the pharyngeal muscles and the pharyngeal cavity in the Goat.

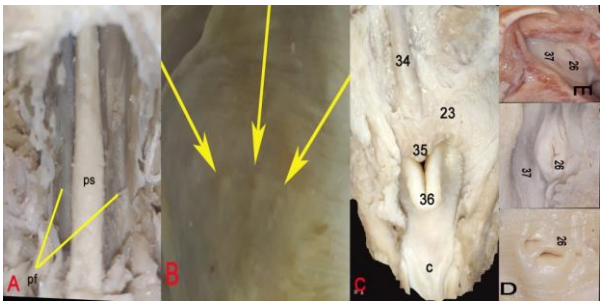

Fig. 2/A, B, C, D: A: showed A,showed the pharyngeal septum and the pharyngeal fornix of the Goat ,B: showed lymph nodules on the dorsal surface of the soft palate: C: showed the M. palatinus, D: showed the the palatine tonsil and the tonsillar sinus.

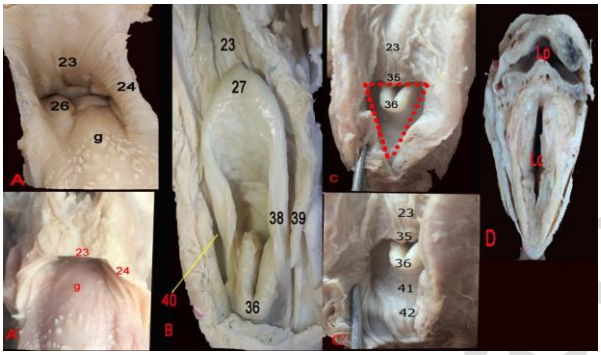

Fig. 3: A,A' showed the Isthmus faucuim,, B: showed the aditus laryngis, C,C': showed the intrapharyngeal opening, D: Pars laryngea pharynges: Legends from figures 1-3: 1) M. tensor veli palatini: 2) M.levator veli palatini: 3) M. pterygopharyngeus: 4) M. stylopharyngeus rostralis: 5) M. sytlopharyngeus caudalis: 6) M. hyopharyngeus (reflected): 7) M.palatopharyngeus: 8) M.thyropharyngeus: 9) M.cricopharyngeus: 10) M.sternothyroideus: 11) M.thyrohyoideus: 12) M.styloglossus: 13) M.longus colli: 14) M. longus capitis: 15) Raphe pharynis: 16) Septum nasi: 17) Choanae: 18) Pars nasalis pharynges: 19) Ostuim pharyngeum tubae auditivae: 20) Salpingo-pharyngeal fold: 21) Recessus pharyngeus: 22) Hard palate: 23) Palatum mole: 24) Arcus palatoglossus: 25) Pars oralis pharynges: 26) Tonsilla palatine: 27) Cartilago epiglottica: 28) Nasal bone: 29) Frontal bone: 30) Parietal bone: 31) Squamous part occipital bone; 32) cerebrum : 33) Cerebellum : 34) M.palatinus: 35) Arcus palatinus : 36) processus corniculatus: 37) Fossulae tonsillares: 38) Plica aryepiglottica: 39) Arcus palatopharyngeum: 40) Recessus piriformis: 41) Aditus oesophagus: 42) longitudinal fold of the oesophagus: a) Glandulae thyroidea: b)Trachea: c) oesophagea: d) Os stylohyoideum: e) Lnn.retropharyngei mediales: f) Thyrohyoideum: g) linguae: h) Arteria Carotis Communis.: i) Septum pharynges: Ps) Septum pharynges: Pf) Pharyngeal fornix: Lc)Cavum larynges: Lp)Pars laryngea pharynges.

of the piriform recess. Each proceeded caudomedially on the lateral wall of the laryngopharynx to meet its fellow of the opposite side at the auditus oesophagi.

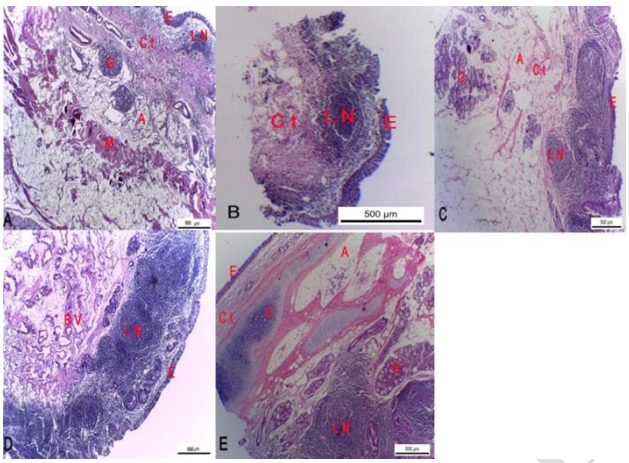

Fig. 4: showed different parts of the nasopharynx stained with H&E x-40: A) dorsal wall of the soft palate. . . B) Tubal tonsil (tonsil without crypt). C) lateral wall of the nasopharynx showing the pharyngeal tonsil. D) pharyngeal septum showing the pharyngeal tonsil. E) salpingo-pharyngeal fold that contain hyaline cartilage (c).

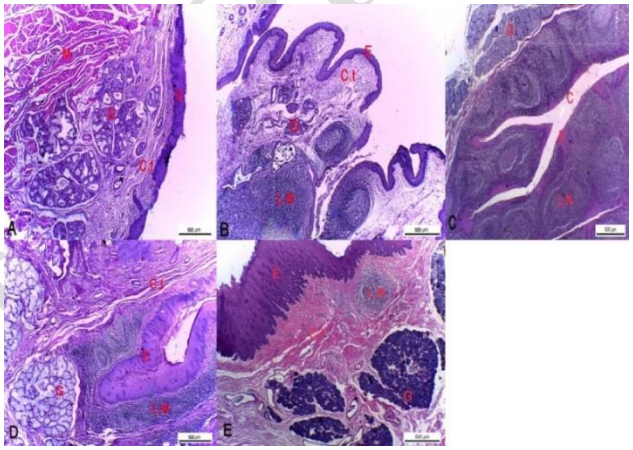

Fig. 5: showed different parts of the Oropharynx of the Goat stained by H&E x-40.

The intrapharyngeal opening (Fig. 3/C) had a triangular form bounded rostrally by the concave palatine arch and laterally and caudally by the palatopharyngeal arches. It presents just above and around the laryngeal prominence.

M. constrictores pharyngis rostrales

The pterygopharyngeal muscle (Fig. 1A, B/3) arose from the medial surface of the hamulus of the pterygoid bone and pterygoid process of the sphenoid bone located on the rostrodorsal part of the nasopharynx. It was related medially to the ventral portions of the Mm. tensor and Levator veli palatini. The fibers passed caudally crossing the ventral part of the levator veli palatini m. and then curved dorsally to be inserted into the rostral part of the pharyngeal raphe (Fig. 1C/15).

The palatopharyngeal muscle (Fig. 1, B/7) thin, flat muscle originated from the medial surface of the ventral end of the great cornu of the hyoid bone and the pharyngeal wall of this region covered by the M. hyopharyngeus. Its fibers proceeded caudally and slight dorsally under the hyopharyngeal muscle and stylopharyngis rostralis and its fibers are intermingled with those Mm. to the pharyngeal raphe (Fig. 1C/15).

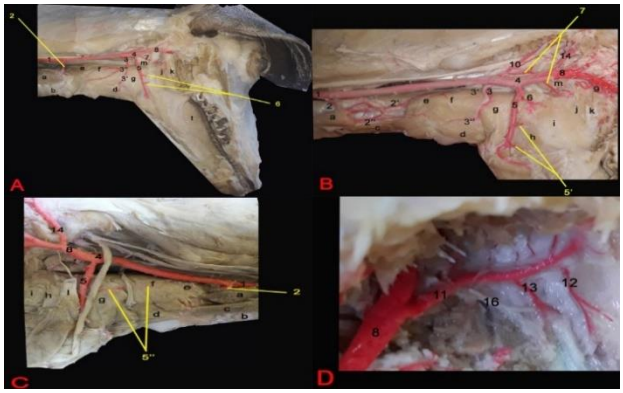

Fig. 6/A: showed the arterial blood supply of the pharynx: 1) ARTERIA CAROTIS COMMUNIS: 2) A. thyroidea cranialis : 2' Ramus pharyngeus : 2'' Ramus laryngis caudalis: 3) A. laryngea cranialis: 3'Ramus pharyngeusL: 3'' Ramus laryngeus : 4) ARTERIA CAROTIS EXTERNA : 5) A. lingualis : 5' Ramus muscularis : 5'' Ramus pharyngeus : 6) A. palatina ascendens : 7) A. pharyngea ascendens : 8) A. maxillaris : 9) Rami pterygoidei : 10) A. occipitalis : 11) A. palatina descendens : 12) A. palatina major: 13) A. palatina minor: 14) A. auricularis caudalisa) Glandulae thyroidea: b) trachea : c) M. Sternothyroid: d) M. thyrohyoid: e) M. cricopharyngeus : f) M. thyropharyngeus : g) M. hyopharyngeus : h) M. Stylopharyngeus rostralis : I) M. Pterygopharyngeus : j) M. Levator veli palatini : k) M. Tensor veli palatini : l) Os stylohyoideum : m) Medial retropharyngeal L. N : t) Tongue.

The rostral stylopharyngeal muscle (Fig. 1A, B/4) thin muscle originated from the rostral border and deep surface of the stylohyoideus bone, and the adjacent part of the lateral pharyngeal wall. It continued oblique caudodorsally to be inserted in the pharyngeal raphe caudal to pterygopharyngeal muscle.

M. constrictor pharyngis medius

The hyopharyngeus muscle (Fig. 1A, B/6) thin muscle originated from the lateral surface and caudal border of thyrohyoid bone. The fibers passed caudodorsal in front of the M. thyropharyngeus and caudal to the os-stylohyoideum, to be inserted at the pharyngeal raphe (Fig. 1C/15) in front of thyropharyngeal muscle.

M. constrictores pharyngis caudalis

The thyropharyngeus muscle (Fig. 1A, B/8) it was the largest of the constrictors muscles of the pharynx, arose from the lateral surface of the dorsal third of the lamina of the thyroid cartilage. The fibers passed craniodorsal and deviated medially to be inserted in the pharyngeal raphe caudal to the M. hyopharyngeus. It separated from the M. hyopharyngeus by the cranial laryngeal nerve and artery. It was covered partially by the medial retropharyngeal lymph node at its dorsal part. It was crossed dorsolaterally by the vagosympathetic trunk and common carotid artery.

The cricopharyngeus muscle (Fig. 1, A/9) was thin and short muscle originated from the lateral surface and the caudal border of the arch of the cricoid cartilage. It passed obliquely craniodorsal and medially to be inserted in the caudal part of the pharyngeal raphe (Fig. 1/C).

M. dilatores pharyngis

The caudal stylopharyngeal muscle (Fig. 1A, B/5) thin narrow muscle,,originated from the dorsal two third of the medial surface of the stylohyoid. The fibers ran rostroventral, then continued ventrally crossing the deep face of the M. stylopharyngis rostralis to be inserted at the rostroventral wall of the oropharynx.

The tensor veli palatini muscle (Fig. 1A, B/1) was flattened and thin, dorsally had a glistening tendon arose from the muscular process of the tympanic part of the temporal bone and the adjacent part of the sphenoid bone. It preceded ventro-rostrally medial to the M. pterygoideus medialis to be inserted in the rostral part of the lateral wall of the soft palate. It is covered partially by pterygoid process of pterygoid bone.

The levator veli palatini muscle (Fig. 1A, B/2) originated from the medial surface of the muscular process of the temporal bone. It passed rostroventrally, lateral to the auditory tube and nasopharynx and ventromedial to the tensor veli palatine muscle to be inserted at the dorsolateral wall of the soft palate ventral to the tensor veli palatine muscle and deep to the M. pterygopharyngeus muscle.

The palatinus muscle (Fig. 2C/34) was thin, rounded present below the dorsal mucous membrane of the soft palate. It originated from the concave free border of the horizontal lamina of the palatine bone. It proceeded caudoventrally along the entire length of the soft palate and terminated at the palatine arch.

2. Arterial blood supply

The pharynx of the goat received its arterial blood supply via the ascending pharyngeal, ascending palatine arteries, and the pharyngeal branches of the cranial thyroid, cranial laryngeal and Rr. musculares of the lingual artery. The soft palate is vascularized through lesser palatine artery in addition to pterygoid branch artery of the A. maxillaris.

The ascending pharyngeal artery (Fig. 6A, B/ 7) arose from the dorsomedial aspect of the common carotid artery just before its division into occipital and external carotid A. (In 20% of the specimens it arose from the occipital A). It proceeded ventro-rostral crossing the lateral surface of the medial retropharyngeal lymph node, detaching 1-2 fine branches to it and continued rostroventral giving several fine branches to the dorsal part of the M. pterygopharyngeus. Then divided into 2 branches distributed to the Mlevator veli palatini and M. pterygopharyngeus and continued to the lateral wall of the nasopharynx**.**

The ascending palatine artery (Fig. 6A, B/6) arose from the rostral aspect of the lingual artery. It passed rostrally on the dorsal part of the M. stylopharyngeus rostralis, M. pterygopharyngeus and terminated by dividing into two fine branches distributed to them and dip to the M. palatopharyngeus, palatine tonsils and palatoglossal fold. About 1cm. from its origin it detached a ventral branch which passed ventral and slightly rostral for a short distance (0. 5cm) before dividing into two branches distributed to the deep surface of the M. stylopharyngeus rostralis, and M. palatopharyngeus.

The cranial thyroid A. (Fig. 6A, B/2) arose from ventrolateral aspect of the common carotid artery; at first it passed rostrally for a short distance then curved caudoventral to enter the deep surface of the thyroid gland with the cranial thyroid vein. Before reaching the gland it gave rise to the pharyngeal and the laryngeal branch. The pharyngeal branch (Fig. 6A, B/2') proceeded rostrodorsal on the initial part of the esophagus, dorsal part of the

cricopharyngeal and thyropharyngeal muscles detaching several twigs to these structures and terminated by dividing into two fine branches anastomose with those of the of the cranial laryngeal artery. The laryngeal branch (Fig. 6A, B/2'') continued rostrally releasing muscular branches to the sternothyroid muscle, caudal parts of the cricopharyngeus, thyropharyngeus and thyrohyoid muscles.

The cranial laryngeal. artery (Fig. 6A, B/3) arose from the ventromedial aspect of common carotid A. at the level of occipital A, it descends along the lateral wall of the pharynx in a gap between M. hyopharyngeus cranially and M. thyropharyngeus caudally. It terminates as a laryngeal branch (Fig. 6A, B/3'') which divides into an external and an internal branch. The external branch passed on the dorsal aspect of the thyrohyoid supplying it and the cricothyroid muscle. The internal branch enters the thyroid notch between the M. hyopharyngeus, M. thyropharyngeus and M. thyrohyoideus with the cranial laryngeal nerve. During its course it detached several muscular branches to the later muscles in addition to the pharyngeal branch. The pharyngeal branch (Fig. 6A, B/3') continued caudally on the dorsolateral part of the M. thyropharyngeus supplying it and cricopharyngeus muscle then terminate by splitting into two branches anastomose with those of the R. pharyngis of the cranial thyroid artery. In 20% of specimens the cranial laryngeal artery is absent and its pharyngeal branch compensated by a branch detached from the caudal aspect of lingual A. which proceeded caudally on the lateral surface of the thyropharyngeus m. to which it detached several twigs before reaching the cricopharyngeus muscle and terminate by dividing into 2 fine branches anastomosed with the branches of the ramus pharyngeus of the cranial thyroid A.

The pterygoid branch (Fig. 6B/9) was given from ventromedial aspect of the A. maxillaris. It proceeded ventrally for about 1-3 cm then divide into several muscular branches distributed to the pterygoid muscle and detached several twigs to the muscles of soft palate and rostral portion of the nasopharynx and cranial constrictors of the pharynx.

The lesser palatine artery (Fig. 6D/13) is a small vessel originated from ventral aspect of the descending palatine artery during its course on the dorsal part of the lateral surface of medial pterygoid muscle. it proceeded rostroventrally on the lateral surface of the M. pterygoideus medialis accompanied by the homonymous nerve,, then curved around the rostral border of the medial pterygoid muscle and ramifies to the muscles, tonsils and mucous membrane of the soft palate during its course it gave several twigs to the lateral surface of the medial pterygoid muscle.

DISCUSSION

In the goat; the pharynx presented an irregular funnel shape. Similar result was observed in sheep (May, 1970), buffalo (Bahgaat, 1991), equines (Nickel *et al*, 1979) and canines (Dyce, 2010). In camel, it presented an irregular funnel shaped with two diverticulae (Wally, 1989). In ruminants (Nickel *et al.*, 1979) it was short and tubular.

The pharynx extended from the caudal end of the horizontal lamina of the palatine bone caudoventrally up to the caudal border of the wing of the atlas. Such result was reported by Bahgaat (1991) in the buffalo and Alsafy (2014) in the camel. In camel (Ibrahim, 1983 and Wally, 1989) it extended caudally up to the middle of the axis. In equines, Nickel *et al* (1979) and Dyce (2010) agreed that it does not exceed the level of the base of the skull. In the canines, Nickel *et al* (1979) reported that it extends caudally to the level of second cervical vertebrae.

In agreement with May (1970) in sheep, Nickel *et al*., (1979) in domestic animals and Smuts and Bezuidenhout (1987) in the camel, the nasopharynx presented the longest part of the pharynx.

Regarding the pharyngeal fornix in the goat, it was smooth, concave and divided by the septum pharyngis into two deep narrow cavities. The septum pharyngis represented the caudal continuation of the nasal septum. Such results were seen by May (1970) in sheep, Wally (1989) in the camel and Bahgaat (1991) in the buffalo.

Similar to that reported by May (1970) in the sheep, the nasopharynx was irregular in shape and comprising a main cavity and a dorsal recess. In the goat, the pharyngeal recess represented by the narrow caudal extension of the nasopharynx beyond the opening of the auditory tube. Similar description was recorded in the camel (Wally, 1989) and Buffalo (Bahgaat, 1991).

In the goat, the pharyngeal opening of the auditory tube was crescent slit like in shape. Similar observation was seen by May (1970) in sheep.

In agreement with Bahgaat (1991) in buffalo, the pharyngeal opening of the auditory tube is situated at the caudodorsal part of the lateral wall of the nasopharynx, On the other hand, it was located on the dorsolateral wall of the cranial compartment of the nasopharynx in the camel (Wally, 1989). In accordance with Bahgaat (1991) in buffalo, it was covered medially by a thin mucosal fold (salpingo-pharyngeal fold) which is supported by the extension of the cartilage of the auditory tube. The histological studies showed that the cartilage is of hyaline type.

In the present work, the pharyngeal tonsil not distinct macroscopically, histologically it appeared as diffuse lymphocytic infiltration in the lamina propria at the caudolateral wall of the nasopharynx and caudal part of the nasal septum. Similar results mentioned by Indu *et al*., (2017) in goat. In the buffalo, (Bahgaat, 1991) the Tonsilla pharyngea is represented by an oval prominence present just ventral to the caudal end of the septum pharynges, while in the camel, (Wally, 1989) it was represented by numerous scattered small irregular lymph nodules at the caudal portion of the dorsal and lateral aspects of the nasopharynx.

In agreement with Bahgaat (1991) in buffalo, the tubal tonsil could not be observed macroscopically. On the other hand, Indu *et al*., (2015) in goat, reported that it appeared as diffuse lymphocytic infiltration in the lamina propria. Such result was observed in the present work.

The oropharynx in the goat as that of other ruminants (Nickel *et al.*, 1979) and in the buffalo (Bahgaat, 1991) was short, wide and dilatable extending from the initial part of the palatoglossal arch to the base of the epiglottis. In Sheep, May (1970) added that the ventral part of the pharyngeal cavity can be further subdivided into oral and laryngeal parts.

In agreement with Bahgaat (1991) in buffalo, Dyce (2010) in ruminants and Kalus (2010) and Miller (2013) in

the dog, the lateral wall of the oropharynx presented the palatine tonsil which projected into its cavity.

In the present work, the palatine tonsil appeared as oval, rounded to elliptical structure composed of numerous irregular lymph follicles. It was triangular in the camel (Wally, 1989) and elongated oval in buffalo (Bahgaat, 1991).

In agreement with Indu *et al.*, (2018) in goat the histological investigation showed that the palatine tonsil was lined by a stratified squamous non keratinized epithelium with irregular finger-like projections in addition to the presence of the lymphocytic infiltration in the lamina propria.

Regarding the paraepiglottic tonsil it was described by Wally (1989) in the camel and Bahgaat (1991) in the buffalo as a follicular tonsil located on either sides of the base of the epiglottis. Such tonsil cannot be seen in the goat macroscopically. In 25% of cases the paraepiglottic tonsil appeared histologically as an aggregation of lymphoid nodules in the lamina propria such result was recommended by Casteleyn *et al.* (2011) who mentioned that the paraepiglottic tonsil can only be found in the minority of goat using histology.

Concerning the Ostium intrapharyngeum it was bounded rostrally by the palatine arch, laterally and caudally by the palatopharyngeal arches. This is in accordance with Wally (1989) in the camel and Bahgaat (1991) in buffalo. In agreement with Wally (1989) in the camel, the Ostium intraphryngeum was triangular in shape. While it appeared oval in domestic animals (Nickel *et al.*, 1979).

In the present work, the piriformrecess appeared as a narrow and shallow passage between the oropharynx and esophagus. . . On the other hand it was described as a deep passage in ox and pig (Nickel *et al*., 1979), camel (Ibrahim, 1983) and buffalo (Bahgaat, 1991).

In the present study, the cranial constrictor group include the M. pterygopharyngeus, M. palatopharyngeus and M. stylopharyngis rostralis Similar observations were reported in the camel (Wally, 1989) and buffalo (Bahgat, 1991).

In the goat, the M. constrictor pharyngis meduis was represented by the undivided M. hyopharyngeus. Similar result was seen by Bahgaat (1991) in the buffalo and Dyce (2010) in dog. While in the sheep (May, 1970) and camel (Wally, 1989) reported that the M. constrictor pharyngis meduis included the M. ceratopharyngeus and the M. chondropharyngeus.

Similar to other domestic animals (Nickel *et al.*, 1979), the M. dilatores pharyngis was represented by the M. stylopharyngeus caudalis. On the other hand, Wally (1989) in the camel added the presence of the M. atlantopharyngeus as a dilator muscle of the pharynx. Such muscle wasn't seen in the goat.

In the present study, the ascending pharyngeal artery was given from the common carotid artery (in 80% of the examined specimens). Similar origin was observed by Daghash (2007) in the same animal, May (1970) in sheep, Wilkens and Munster (1981) in domestic animals. On the other hand, it arose from the lingual artery in buffalo (Bahgaat, 1991), camel (Wally, 1989) and pig (Wilkens and Munster, 1981). The origin of the ascending pharyngeal artery from the cranial thyroid artery in equines (Popesko, 1979, Wilkens and Munster, 1981) or from the external carotid artery in dog (Evans and Delahaunta, 2004) could not detected in our work.

The ascending palatine artery arose from the lingual A. Similar origin was reported in the camel (Wally, 1989) and dog (Evans, 1993). On the other hand, it arose from the common carotid artery in sheep (May,1970) and small ruminants (Wilkens and Munster, 1981). While it originated from occipital A. in buffalo (Bahgaat, 1991) and large ruminant (Dyce *et al*., 2010) but it originated from the lingo facial trunk in equines, (Wilkens and Munster, 1981).

In the goat, the cranial thyroid artery arose from the ventrolateral aspect of common carotid artery. Similar observation was given by Wally (1989) in the camel and Bahgaat (1991) in the buffalo.

In agreement with May (1970) in sheep, Daghash (2007) in the goat, and Ghoshal (1975), Wilkens and Munster (1981) in domestic animals the cranial laryngeal artery arose from the ventromedial aspect of common carotid artery.

Regarding the R. pterygoideus, in the goat it arose from the ventromedial aspect of maxillary A. Similar origin was detected by Daghash (2007) in the same animal, May (1970) in sheep and Wilkens and Munster (1981) in domestic ruminants.

In the present work, the minor palatine artery arose from ventral aspect of descending palatine artery. Same origin was observed in sheep by May (1970), in small ruminants by Ghoshal (1975). On the other hand it arose from the greater palatine artery in 80% of the cases in buffalo (Bahgaat,1991) and in the ox (Ghoshal,1975). While it was originated from the maxillary artery in the domestic animal (Dyce *et al*., 2010).

Conclusions

The present study showed detailed anatomical and histological structure of the pharynx and soft palate in the goat. and their arterial blood supply.

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