Histological Study on the Nasal Cavity of Black Iraqi Goat (Capra hircus)

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Received: 9/9/2018
Accepted: 18/12/2018
Publishing: 31/1/2019

Summary

The histological observations of this study which conducted on nasal cavity of black Iraqi goat revealed that the nasal cavity consisted of three regions (vestibular, respiratory and olfactory).The vestibular region was narrow zone, lined with (non keratinized) stratified squamous epithelium, and its propria submucosa contained serous glands and blood vessels.The respiratory region was lined with ciliated pseudostratified columnar epithelia with goblet cells. The vascular propria submucosa had mucous glands, which were positive to periodic acdic shieff and Alcian blue stains. The olfactory region was lined with thick pseudostratified columnar epithelium devoid of goblet cells and contained, the propria submucosa serous simple acinus Alcian positive glands (Bowman's glands) and numerous nerve bundles. The histological results concluded that the nasal cavity of black Iraqi goat was good adaptive tooled for hot dusty environment.

Keywords: Nasal Cavity, Goat , Histology , Vestibule .

Introduction

In mammals the nasal cavity is an intricate anatomical structure with wide differences in shapes، sizes, and functional roles (1 and 2). These differences have important influence in adaptation of animals with life style and environment (3). The animals with well-developed sense of olfaction had complex nasal cavity, like rodents and carnivores. Simple structured nasal cavity found in ungulate animals, in which the main function of nasal cavity is respiration while the olfaction in such animals was less important (4).

The elaborate network of nasal turbinate bones provides a large surface area and a convoluted, serpentine route for airflow. In all mammals there were two types of epithelia; non sensory (stratified squamous epithelium, pseudostratified columnar epithelium and transmission epithelium), and sensory neuroepithelium (5).The current study was planned to investigate the histological structure in black Iraqi goat which lives in hot dried dustyarea .

Materials and Methods

Six fresh heads collected from recently slaughtered, apparently normal and clinically healthy adult Black Iraqi goat (Capra hircus) of both sexes, which were obtained from local slaughterhouse in Baghdad. The mid sagittal section of each head was made by saw, and the nasal tissue samples were collect from the following regions; nasal vestibule, nasal septum, nasal turbinate's (dorsal nasal turbinates,ventral nasal turbinate's and ethno turbinate's (Fig.1).The collected tissues fixed in 10% formalin for 48 hours. After fixation, the tissues were decalcified by formic acid-sodium citrate for 10 days and processed for paraffin technique of light microscopy. Sections of 5-7 micrometers were stained with Harris hematoxylin and eosin stain (for general histological structures, periodic acidic shieff for detection of neutral mucopolysacharids and Alcian blue (pH 2.5) stain for acidic mucopolysacharids (6 and 7).

Results and Discussion

The current study revealed that the nasal cavity of Iraqi black goat had three histological functional regions arranged from the anterior end to the cribriform plate: vestibular, respiratory and olfactory regions according to the epithelium which lining of each region. The entrance of the nasal cavity (nostril) was lined by skin which extended for short distant (2.5±0.3cm). The next area of vestibule was coated by dark mucus membrane. The mucosal part was lined with stratified squamous nonkeratinised epithelium

rested on dense irregular fibrous connective tissue with serous glands (Fig.2).

The basal stratum was irregular characterized by papillary projection.This histological and structural arrangement was true in many animal species, such as in mice, (8)Rat (9 and 10), in goat, (11) in sheep, (12) in buffalo, (13) in horse, (14) in camel,(15) and in pigs, (16). This was in agreement with (4) who stated that in most mammals the nasal cavity lined with four types of epithelia. Stratified squamous, respiratory epithelium, olfactory epithelium, and transmission epithelia. The mucosal part was lining with stratified squamous nonkeratinised epithelium rested on dense irregular fibrous connective tissue with serous glands. (17 and 18) mentioned the same observations in sheep, and (19) who found that the type of vestibular region epithelium was stratified squamous non-keratinized epithelia. The stratified squamous non-keratinized epithelia changed to pseudostratified ciliated columnar after narrow area of transition in which, stratified columnar epithelia could be noticed (Fig.3). This type of epithelia noticed by (13) in buffalo nasal cavity, (17) in Saudi Arabia sheep and by (20) who found that the area between vestibular and respiratory in goat nasal cavity covered with stratified columnar epithelium and termed as transitional area, other researchers (14) mentioned that the transitional epithelia was different than what was mentioned above. They noticed presence of stratified cuboidal epithelium in horse nasal vestibule.

The present study suggested that the existence of stratified squamous and stratified columnar epithelia in goat nasal vestibule was of great value in protect the deep tissues and cells of respiratory organs against damaged which might result from air flow forces and changing in air temperature. Caudal to the transitional area the respiratory region of nasal cavity was included almost all the remaining nasal cavity except a narrow posterior zone of olfactory region, this region occupied by rostral, middle and most of the caudal parts of dorsal, ventral nasal, ethmoid turbinate's and the nasal septum. The respiratory region was lining with ciliated pseudostratified columnar epithelium with goblet cells (respiratory epithelium) (Fig.4). This finding come in agreement with (18 and 20) in goat whom recorded that, the most of the nasal cavity structures were coated with respiratory epithelium. The goblet cells were positive for PAS and Alcian blue stains (Fig.5). The mucosa of respiratory region was divided into an outer and an inner surface by thin bone plate. The surfaces were lined with respiratory epithelium. The epithelium of outer surface was thick with cylindrical goblet cells, the lamina propria sub-mucosa contained highly vascular connective tissue with numerous sub-epithelial glands the epithelium of inner surface was thin with rounded goblet cells, other researchers (21 and 22) mentioned that the reaction and concentration of goblet cells secretion changed from neutral to acidic, as a reason to chronic irritation or infection.

The lamina propria sub-mucosa had less vascular connective tissue with few sub-epithelial glands (Fig.6). The alveolo-tubular sub-epithelial glands were positive to PAS and Alcian blue stains (Fig.5). The mucosa of respiratory region of the nasal septum showed similar histological structure of the conches (Fig.7). This results was also reported by (23) in goat,(12) in sheep (24)in buffalo, (25)in dog, (19) in camel and (14)in horse. The secretion of nasal septum and conchae glands play great role in mucociliary action, homeostasis and in defense against inhalation of irritant agents as reported (26 and 27).

The presence of cilia and goblet cells with neutral and acidic mucopoly saccharides secretion in the respiratory epithelium, which lining the major portion of the nasal cavity of black goat. it, Nasal cavity for the black goat are very efficient for filtration and air conditioning of inhaled air before it reach the delicate lower respiratory organs, also the presence of glandular vascular connective tissue lamina sub mucosa in the nasal cavity of black goat act as important role in thermoregulatory mechanism. This fact proved the finding of (28 and 29). The current study suggests that The nasal cavity of black goat which lives in arid places could work as air conditioning organ. This result was in parallel with result of (4) who found that the nasal cavity was very important adaptable mechanism in the survival of mammals living

in extreme environment, such deserts where camels live. the nasal mucosa covered by a film of mucous secretion(Fig.4) goblet and sub epithelial gland participate in production of this secretion that make the nasal cavity efficient defense apparatus to trapping the inhaled, neutralization of xenobiotic. This observation was reported by (30) and (31).

The olfactory region was narrow and small zone. It was localized in the caudal portion of the dorsal nasal turbinate and the posterior part of ethmoturbinates adjacent to the cribriform plate. Similar observation was reported by (20) in goat and the results of (14) in horse. This region was lined with thick pseudostratified columnar epithelium (without goblet cells) characterized by sensory neurons (Fig.8).The olfactory epithelia consisted of many types of cell. The basal cells which laying on the basement membrane had round to oval shaped nuclei. The lightly stained round to oval shaped nuclei of olfactory cells arranged in many levels at the meddle of the epithelium. The dark stained elongated nuclei of supporting cells was mainly occupied superficial part of the epithelium. The same description was mentioned by (20).

The loose connective tissue propria submucosa contained, clusters of Alcian blue positive serous acinar(Bowman's glands), blood capillaries and nerve bundles (Fig.9), agree with the results of (17 and 12)in sheep whom mention that the ethmoidal conchae was lined with olfactory. The lamina sub mucosa contained serous glands, these findings confirm the result of (13) in buffaloes, who found that the olfactory region was marked by the presence of olfactory sensory cells and Bowman's glands, other researchers (19) studied the nasal cavity of camel, they reported that the propria contained serous tubuloalveolar Bowman's glands and nerve bundles were large and placed subepithelially. The Bowman's gland secretion contains binding protein which dissolves the odorant molecule to be detected by olfactory sensory neurons and also contain xenobiotic enzymes against pathogenic organism) as was mentioned by (32and 33).

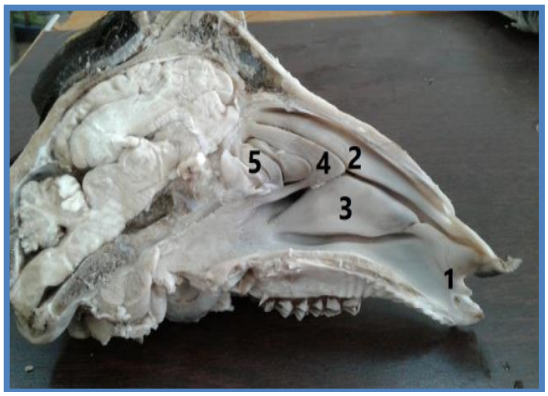


Figure (1): macrograph showing the regions of nasal cavity selected for the study: 1-nasal vestibule, 2-dorsal terbinate, 3-ventral terbinate , 4-cranial part of middle terbinate , 5-caudal part of middle terbinate .

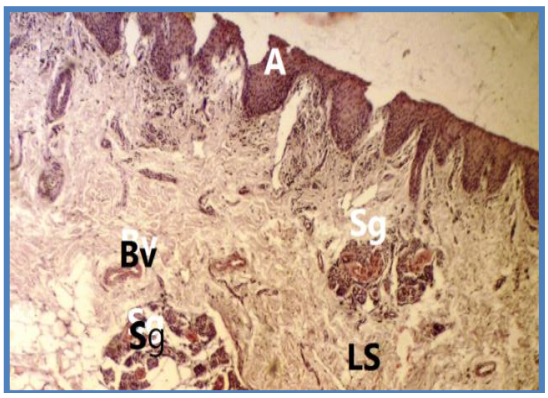


Figure (2): Histological section of nasal cavity (vestibule) showing: A-stratified squamous epithelia,LS- lamina propriasubmucosa,Sg-srous glands, Bv-blood vessel (H&EX40).

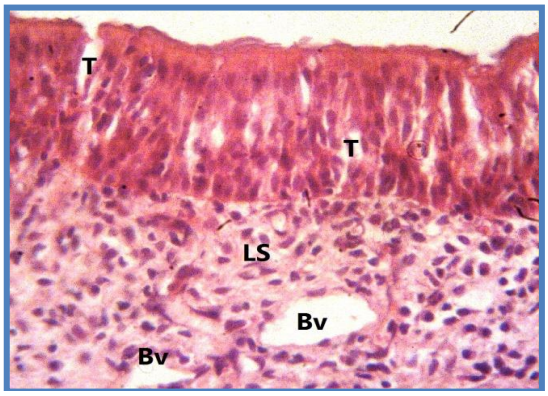


Figure (3): Histological section of nasal cavity (vestibule) showing: A-stratified columnar epithelia (transitional) , LS- lamina propriasubmucosa, BV-blood vessls, T-transmission area (H&EX 100).

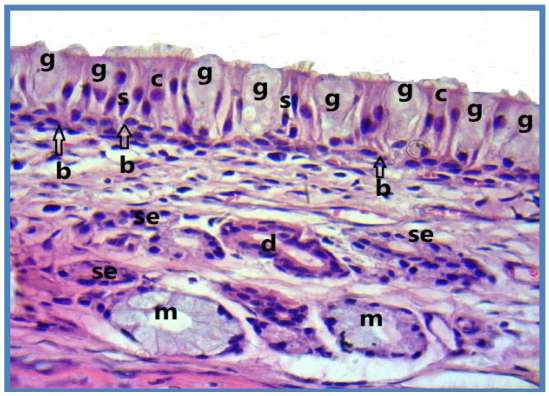
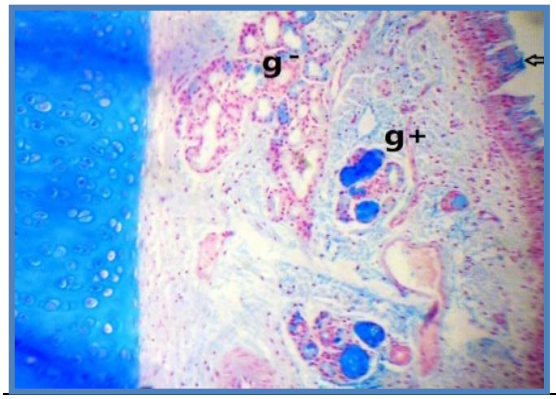


Figure (4): Histological section of nasal cavity (respiratory) showing: c-ciliated columnar cell, s-sustentacular cell, b-basal cell g-goblet cell,m-mucous gland, se-serous gland, d-duct (H&EX100)



Figure(7): Histological section of nasal cavity(nasal septum) showing: (AB+) goblet cell and respiratory glands (AlcianblueX 40).

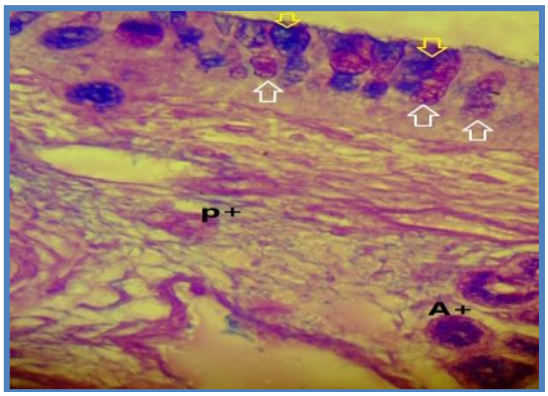


Figure (5): Histological section of nasal cavity (respiratory) showing: goblet cells PAS+ (white arrow), goblet cells AB+(yellow arrow), p- PAS+ acini , A- AB+ gland.(PAS-AB stain X100).

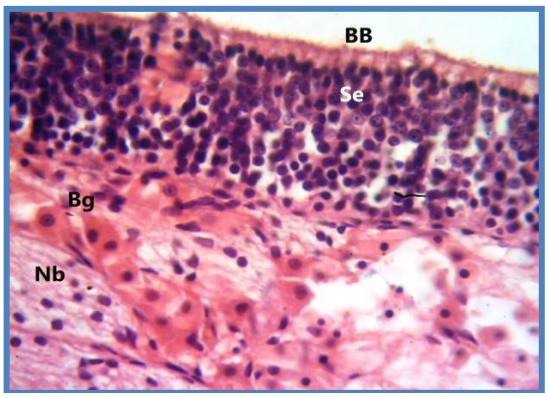


Figure (8): Histological section of nasal cavity(olfactory) showing: Se-sensoryepithelia,Bg-Bowmann gland, Nb-nerve bundles (H&EX100).

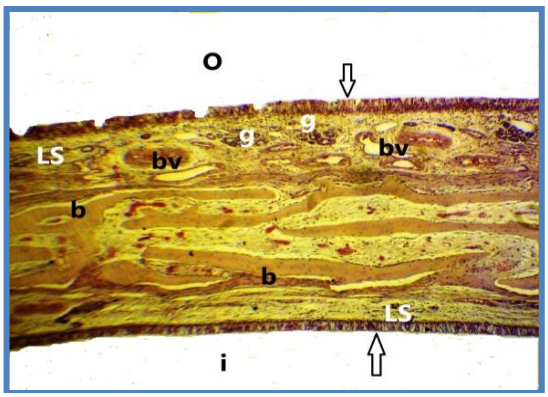


Figure (6): Histological section of nasal cavity (vestibule) showing: -respiratory epithelium(arrows) ,LS- lamina propriasubmucosa , BV-blood vessls ,G-glands, b- bone plate, o- outer surface, i- inner surface.(H&EX40)

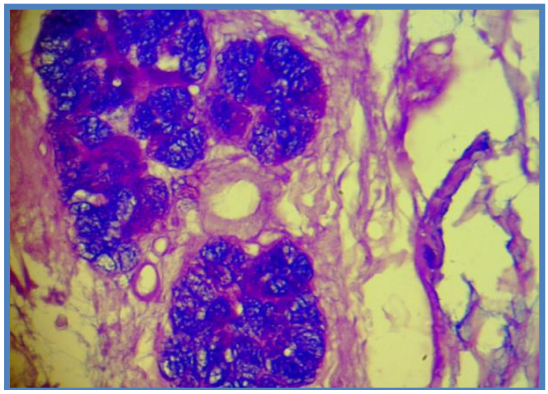


Figure (9): Histological section of nasal cavity (olfactory) showing : Alcian blue positive acini (Bowmann gland) (AB stainX400).

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دراسة نسجية للتجويف الأنفي للماعز العراقي الأسود

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الخلاصة

أظهرت الدراسة النسجية التي اجريت على الماعز العراقي الأسود أن التجويف الأنفي يتكون من ثلاثة مناطق (الدهليز ، التنفسي ، الشمي) يكون الدهليز عبارة عن منطقة ضيقة، مبطن بظهارة حرشفية مطبقة غير متقرنة، تحتوي الطبقة اللبادية تحت المخاطية على غدد عنبية مصلية وأوعية دموية. المنطقة التنفسية مبطنة بظهارة عمودية مطبقة كاذبة مهدبة وتحتوي على خلايا كاسية، وأن الطبقة اللبادية تحت المخاطية غنية بالاوعية الدموية وتحتوي على غدد مخاطية ذات تفاعل أيجابي مع صبغة باس وصبغة الاليشيان الزرقاء . المنطقة الشمية تكون مبطنة بظهارة سميكة متعددة الطبقات عمودية كاذبة خالية من الخلايا الكأسية. وتحتوي الطبقة اللبادية تحت المخاطية على غدد عنبية بسيطة (غدد بومان) وعدد كبير من الحزم العصبية. أستنتج من هذه الدراسة أن التجويف الأنفي للماعز العراقي الأسود يعتبر أداة تكيف جيدة في البيئة الحاره المغبرة.

كلمات المفاتحية : التجويف الآنفي ، الماعز ،الدهليز النسجي .

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