INTRODUCTION

AND

REVIEW OF LITERATURE

From the anatomical and physiological point of view, the upper respiratory tract can be considered as the gate to the respiratory system and respiration respectively. The upper respiratory tract plays an essential role in air conditioning and transport, temperature regulation, and odour perception.

The lining epithelium and submucosal glands of the upper resipratory tract share a common endodermal origin and function. They maintain the more distal alveoli of the lung free of pollution and infection.

The nose of the domestic animals is embedded in the skeleton of the face and extends from the transverse level of the eye to the anterior extremity of the head. In man, the exterinal nose is prominent and projects from the rest of the face. The mammalian nasal cavity is divided into three chambers, the anterior chamber or vestibule, the middle chamber or respiratory portion and the posterior one or the olfactory region. The ventral and dorsal conchae project from the lateral nasal wall into the respiratory portion. The ventral and dorsal conchae are covered by ciliated pseudostratified columnar epithelium with

goblet cells; while the ethmoidal conchae are covered posteriorly with olfactory epithelium (Getty, 1975).

The mucous membrane of the nasal vestibule, in domestic animals, has a pigmented stratified squamous epithelium with papillary body (Trautmann and Fiebiger, 1957). The hamster's nasal vestibule and antrium of the middle meatus are lined by keratinized stratified squamous epithelium which extends posteriorly along the nasal floor to the nasal orifice of nasoincisive duct. Ventral to the cartilagenous nasal septum, compound tubuloalveolar serous glands are located. The glandular acini are stained magenta with alcian blue-periodic acid Schiff (AB-PAS) due to the special secretory granules in their secretory cells (Adams and Mc Farland, 1972).

In 1974, Badawy and Fath El-Bab; reported that the oral part of the nasal vestibule in the camel is lined by hairy skin lacking sweat glands; while the sebaceous glands are small in size. The straight and the alar folds are covered anteriorly by stratified squamous epithelium. Seromucous compound tubular glands are scattered in the dorsal, ventral, and lateral walls of the nasal vestibule. The secretory

an abundant capillary network in the superficial layer of the propria-submucosa is connected with large blood vessels located in the deep layer in the vicinity of the surrounding musculature, cartilage or bone. Numerous nerve fibers are also present in this layer (Dellmann and Brown, 1976).

Katz and Merzil (1977) reported that the lamina propria of the rat's vestibular portion of the nasal septum contain long excretory ducts extending from PAS-negative glands in the respiratory region.

El-Sayed (1982) found that the nasal vestibule of the dog is lined by stratified squamous keratinized pigmented epithelium devoid of hair follicles and sebaceous glands. However the nasal vestibular epithelium of the rabbit is relatively thin with a well developed keratinized layer besides the presence of hair follicles and sebaceous glands.

Trautmann and Fiebiger (1957), Arey (1971), Ham and Cormack (1979) and Bloom & Fawcett (1975) mentioned that the respiratory portion of the nasal cavity, in mammals is lined with ciliated pseudostratified columnar epithelium with goblet cells. The lamina propria contains

deeply located elastic fibers. It is also rich in leukocytes. Serous, mucous or mixed tubuloalveolar glands are encountered in the lamina propria of the nasal respiratory portion.

In man, rabbit and rat, the subepithelial glands are compound alveolar, serous and mucous in man and only serous in rabbit and rat (Tylor, 1958). In man the cytoplasm of some epithelial cells give a PAS - postive reaction. The mucous glands are also strongly PAS-postive while only the superficial part of the cytoplasm of the serous glands was mucicarmine-positive. Few glands in the anterior mucosa of the rabbit are PAS-positive while in the rat, the majority is PAS positive. In rabbit and rat the mucosa of the posterior part of the nasal septum differ from the anterior part in which, the glands are PAS-positive and also stained with mucicarmine as in man. Metachromasia was noted in the goblet cells and in the nasal glands in the rabbit, rat and man.

The glandular acini of the nasal septal glands of pig are mucous in nature and alcian blue-PAS positive. The respiratory mucosal glands consist of simple branched acinar glands. Few of these glands

are branched fork-like. In the lateral nasal wall, the acini of Steno's glands expand in the wall of the maxillary sinus. No PAS activity could be seen in the acini except those of Steno's glands in the wall of the maxillary sinus (Bojsen-Moller, 1964).

Adams and McFarland (1972) described that the maxillary recess of the hamster is lined by ciliated pseudostratified columnar epithelium lacking the goblet cells. The glands of the nasoturbinals stained bluish-purple with alcian blue-periodic acid Schiff (AB-PAS).

Rhodin, (1974) stated that the respiratory nasal epithelium of the human is composed of ciliated columnar with goblet cells, however the pseudostratification cells are less clear than in trachea. Theepithelium rest on a basement membrane formed of a thin basal lamina and a network of reticular and collagenous fibrils. The lamina propria is thick and composed of loose fibroelastic connective tissue containing seromucous glands and had large thin walled venous plexus.

Thaete, Spicer, and Spock (1981) found that the surface epithelium of the nasal cavity of the human is of the pseudostratified columnar ciliated type with mucous and basal cells. Coiled serous tubules are found in the stroma beneath the epithelium and opened directly on to the surface.

El-Enany, Abdel - Kader and Abdel Hafez, (1980 a) reported that the nasal mucosa of the immature rabbit is lined by pseudostratified columnar ciliated epithelium. The subepithelial tissue is highly cellular with few collagen fibers. The glands of the corium are mainly mucous but some serous acini are met with. The nasal mucosa of the mature rabbit possess low-height epithelium than the immature rabbit with many goblet cells. The corium is formed of a dense connective tissue with thick collagenous bundles and many mixed glands.

El-Sayed, (1982) found that the nasal respiratory portion in the rabbit is lined by ciliated pseudo - stratified columnar epithelium with goblet cells; except the scrolls of the ventral conchae which are covered by two cells thick small cuboidal cells. The respiratory mucosa revealed PAS positive glands in addition to few acini which were alcian blue positive.

In rat, Katz and Merzil, (1977) and Tandler and Bojson-Moller (1978) reported that the respiratory region of its nasal cavity is lined by ciliated pseado-stratified columnar epithelium with many goblet cells which are scattered in groups. There are thin-walled blood vessels and lymphatics two types of acinous glands are present in the lamina propria, PAS positive and PAS negative.

In Tree Shrew, slow loris, Macaque and Gibbon, the respiratory portion of the nasal septum lined by pseu-dostratified columnar ciliated epithelium (Loo, 1974).

Read (1908) described that about one-half of the ethmoturbinal folds and folds of the mucosa adjoining the cribriform plate in the dog, cat and man are olfactory. The olfactory mucosa is thick and the

transition from respiratory mucosa is sharpe. In the submucosa serous glands of Bowmann are found.

Vinnikov, (1956) examined the olfactory region in mice, dog, rabbit, swine rhesus monkey and man and found that there are two types of olfactory receptors, rod and flask-shaped.

Negus (1958) observed that only a small portion of the nasal fossa in primates in covered by an olfactory epithelium lacking goblet cells.

The yellow pigment of the olfactory mucosa is restricted to the supporting cells and the Bowmann's glands and is not present in the receptor cells (Takagi and Yajima, 1965).

In sheep, Kratzing (1970): described that the olfactory mucosa seems to be covered with pseudostratified epithelium ending in an irregular brush free border. The latter border is strongly PAS and AB positive. The Bowmann's glands are simple tubular mucus-secreting glands in the olfactory lamina propria. Their cells contian granules like those of the olfactory epithelium. The apical portions of the secretory cells react with AB and PAS. The infranuclear

cytoplasm contain granules stained with sudan black B and are PAS-positive. The lamina propria contain bundles of nonmylinated olfactory nerve fibers and has a moderately rich blood supply deeper to the Bowmann's glands.

The nasal olfactory epithelium of hamster covers the most caudodorsal portion of the nasal fossa. The olfactory glands which are simple tubular give strong staining reaction for acidic mucopolysaccharides, (Adams and McFarland, 1972).

Badawy and Fath El-Bab (1974) described that the camel's olfactory mucosa occupies only a small area of the aboral part of the ethmoidal conchae. The epithelium is thick with flask shaped crypts. Each crypt contains about 50 olfactory cells lying at different levels. The Bowmann's glands are simple branched tubular mucous glands containing melanin pigment at the basal portions of their cells.

The olfactory epithelium in Tree shrew, slow loris, Macaque and Gibbon is composed of pseudostratified columnar epithelium with 6-7 layers of darkly stained nuclei. The most superficial layer is a clear zone with darkly stained

dendrites of the olfactory receptor cells. Deep to this layer there are 1-2 layers of a pale staining oval shaped unclei of the supporting cells followed by 4-5 layers of darkly-stained nuclei of receptor cells. Basal cells are few, and are seen lying against the basement membrane. The Bowmann's glands are found in acinar and cord-like arrangements occupying the lamina propria. Numberous nerve bundles and vascular spaces are seen in the subepithelial region (Loo, 1974 and 1977).

The rat olfactory region is prevailed by Bowmann's PAS positive glands. These glands are simple tubular. Globular leukocytes are found among the olfactory epithelium cells (Katz and, Merzil, 1977). Moreover, Kratzing (1978) described the olfactory epithelium of the marsupial showing nuclear stratification with a superficial row of supporting cell nuclei, a wider Zone of sensory cell nuclei and a single line of basal cells. Typical Bowmann's glands are present. However goblet cells were absent from the sensory mucosa.

The olfactory mucosa of the dog and the rabbit is lined by tall pseudostratified columnar epithelium free of goblet cells. In dog the olfactory mucosa has a depression on its free surface which is not present in the rabbit.

In both of these latter animals, the cells of ducts and acini of Bowmann's glands are AB and PAS positive. The apical parts of their cells give moderate and weak reactions respectively for lipofuscin pigment by schmorl's method (El-Sayed, 1982).

Trautmann and Fiebiger (1957) reported that the larynx of domestic animals consists of a mucosa, a middle layer of cartilage, ligments and connecting fiberous membrane & a muscular layer. The mucosa of the laryngeal vestibule down to the oral margin of the vocal fold bears a stratified squamous epithelium. The remainder of the laryngeal epithelium is of the ciliated pseudostratified type. The lamina propria is made of fibroelastic tissue containing lymph nodules especially in ruminants. The number of these nodules decreases in horse, pig and carnivores progressively.

In the rat the laryngotracheal glands, consist of serous tubules containing neutral glycoprotein and mucous tubules containing sialylated and sulfated glycoprotein (McCarthy and Reid 1964; Jones, Bolduc and Reid 1973).

The respiratory glands of the rat exhibit a tubulo-acinar organisation. serous tubules and demilunes are present in abundance in laryngeal glands which contain neutral glycoprotein. Mucous tubules are found in abundance in epiglottal glands which often produce sulfated glycoprotein. However, mucous tubules in epiglottal glands contain few cells with sialylated glycoprotein (Mochizuki, Setser, Martinez and Spicer, 1982; Spicer, Setser, Mochizuki and Simson, 1982).

In the human, the anterior surface of the epiglottis is lined by stratified squamous nonkeratinized epithelium, while it's posterior surface is coveres with ciliated pseudostratified columnar epithelium with goblet cells. Mucous glands with some serous secretory units are present in the lamina propria under the posterior surface, throughout the larynx, the cilia beat and more the superficial blanket of mucus towards the pharynx. The lamina propria contian a large number of elastic fibrils. Seromucous glands are often located in the submucosa of the larynx (Rhodin, 1974 and Ham and Cormack, 1979).

Trautmann and Fiebiger (1957) stated that the trachea of domestic animals consists of a ciliated pseudostratified epithelium, a basement membrane

As well, the secretory units of the glands present in the interstical between the bundles of smooth muscle and even outside the smooth muscle in the adventitia.

Wailoo and Emery (1980) described that the transverse muscle fibers of children's trachea are present in all sections examined and throughout the entire trachea. The fibers bridge the gap between the opened ends of the cartilage. They never attach to the cartilagenous ends. There are longitudinal muscle fibers situated in the posterior membrane behined the transverse muscle fibers. These longitudinal muscle fibers vary considerably in size and distribution through out the trachea. In 16% of tracheas, the longitudinal muscle fibers are absent, while in the other 84% their distribution is variable being in the lower half of trachea in approximately 70% of cases. The longitudinal fibers are separated from the transverse ones by mucous glands.

In 1982, Spicer et al., described that the rat's tracheal glands are composed mostly of serous tubules and few mucous one and prominent mucus ducts.

A year later, Spicer, Schulte and Thomopoulos (1983) stated that in most mammalian species including man, the secretory cells of the surface epithelium, consist of muc us goblet-like cells from the nasal to the bronchial epithelium the mucosal glands provide most of the secretion of the respiratory tract. These glands occupy the lamina propria of the trachea and in most species extend in the bronchi as far distally as the cartilagenous plates. In, rat, however, the glands are absent below the trachea.

In the same year (1983), Tandler, Sherman Boat and wood, reported that the membranous portion of the cat's trachea is lined predominately by ciliated pseudostratified epithelium which contains fewer goblet cells than in the cartilagenous portion that possesses numerous ones. The middle third of the epithelium covering the membranous portion is relatively flat in contour. Few small, usually mixed glands are scattered in the submucosa of this membranous portion. Ducts emanating from these glands usually have an ostium bordered by cuboidal cells which are lacking cilia.

The distribution of the enzymes is applied primarily from procedures involving the stractural distribution in

tissue. However, recently developed methods had permitted the localization of specific enzymes in tissue sections.

Cress, Spock and Duncan(1965) found that the succinic dehydrogenase is scattered throughout the cytoplasm of the ciliated and nonciliated respiratory epithelial cells of human and rabbit. While El-Enany, Abdel-Kader, and Nada, (1980b)stated that the fine granular reaction is seen at the base of the cells of the surface epithelium in the nasal mucosa and basal bronchi of the lung. The goblet cells showed very few positive peripheral granules. The majority of the acini are mucus in type and give a faint positive reaction, while the few serous acini give a slightly stronger reaction all over the cytoplasm.

Cress et al. (1965) revealed that the adenosine triphosphatase activity is restricted to the cilia and the areas under it in regions of the ciliary basal bodies. This suggested an association between adenosine triphosphatase activity and ciliary activity.

Tylor (1958) mentioned that the alkaline phosphatase reaction is found only in the blood vessels. In