New Day in Medicine
Новый День в Медицине
NDM

TIBBIYOTDA YANGI KUN

Ilmiy referativ, marifiy-ma'naviy jurnal

AVICENNA-MED.UZ

ISSN 2181-712X.
EiSSN 2181-2187

6 (80) 2025

ТИББИЁТДА ЯНГИ КУН

НОВЫЙ ДЕНЬ В МЕДИЦИНЕ

NEW DAY IN MEDICINE

Илмий-реферaтив, маънавий-маърифий журнал
Научно-реферативный,
духовно-просветительский журнал

УЧРЕДИТЕЛИ:

БУХАРСКИЙ ГОСУДАРСТВЕННЫЙ
МЕДИЦИНСКИЙ ИНСТИТУТ
ООО «ТИББИЁТДА ЯНГИ КУН»

Национальный медицинский
исследовательский центр хирургии имени
А.В. Вишневского является генеральным
научно-практическим
консультантом редакции

Журнал был включен в список журнальных
изданий, рецензируемых Высшей
Аттестационной Комиссией
Республики Узбекистан
(Протокол № 201/03 от 30.12.2013 г.)

6 (80)

2025

июнь

www.bsmi.uz
https://newdaymedicine.com E:
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Received: 20.05.2025, Accepted: 06.06.2025, Published: 10.06.2025

UDK 611.314: 591.44.

NORMATIVE MORPHOLOGICAL INDICATORS OF THE SUBMANDIBULAR SALIVARY GLAND IN A 5-MONTH-OLD WHITE OUTBRED RAT

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✓ ***Resume***

The submandibular salivary gland has a complex alveolar-tubular structure and is of medium size among the three major salivary glands. In terms of secretion characteristics, it is classified as a mixed (seromucous) gland, with a predominance of the serous component. The submandibular gland plays a crucial role in maintaining the normal physiological condition of the oral cavity. Studying the morphology of this gland is important for dentistry, gastroenterology, and other fields of clinical medicine.

Keywords: submandibular salivary gland, salivary ducts, morphology, morphometry

5 OYLIK OQ ZOTSIZ KALAMUSH JAG' OSTI SO'LAK BEZINING ME'YORIY MORFOLOGIK KO'RSATKICHLARI.

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✓ ***Rezyume***

Jag' osti so'lak bezi murakkab alveolyar-naychasimon tuzilishga ega bo'lib, uchta katta so'lak bezining o'rtacha kattalikka ega bo'lganidir. Sekretsiya xarakteriga ko'ra, u aralash (oqsilli-shilimshiq) hisoblanadi, ammo unda oqsilli komponent ustunlik qiladi. Jag' osti bezi og'iz bo'shlig'ining normal fiziologik holatini ta'minlashda muhim rol o'ynaydi. Ushbu bezning morfologiyasini o'rganish stomatologiya, gastroenterologiya va boshqa klinik tibbiyot sohalari uchun ahamiyatlidir.

Kalit so'zlar: jag' osti so'lak bezi, so'lak naylari, morfologiya, morfometriya

НОРМАТИВНЫЕ МОРФОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ ПОДНИЖНЕЧЕЛЮСТНОЙ СЛЮННОЙ ЖЕЛЕЗЫ У 5-МЕСЯЧНОЙ БЕЛОЙ БЕСПОРОДНОЙ КРЫСЫ

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✓ ***Резюме***

Поднижнечелюстная слюнная железа имеет сложное альвеолярно-трубчатое строение и является средней по размеру среди трёх крупных слюнных желёз. По характеру секреции она смешанная (белково-слизистая), однако в ней преобладает белковый компонент. Поднижнечелюстная железа играет важную роль в обеспечении нормального физиологического состояния полости рта. Изучение морфологии этой железы имеет значение для стоматологии, гастроэнтерологии и других областей клинической медицины.

Ключевые слова: поднижнечелюстная слюнная железа, слюнные протоки, морфология, морфометрия

Relevance

The major salivary glands play an important role in the human oral cavity and perform several functions that impact the general health of the body. They consist of three pairs of main glands:

- The parotid gland is the largest salivary gland, located in front of the ear, and primarily produces serous fluid.
- The submandibular gland is located beneath the lower jaw and produces mixed saliva.
- The sublingual gland is located under the tongue and mainly produces mucous saliva.

The primary functions of the major salivary glands include the production of enzymes such as amylase and lipase, which aid in the initial digestion of starches and fats. Saliva softens food, facilitating easier chewing and swallowing. It contains lysozyme, lactoferrin, and immunoglobulin A (IgA), which fight bacteria and protect the oral cavity from infections. Saliva also keeps the mucous membrane moist and prevents it from drying out. Additionally, it activates taste receptors through dissolved substances. The minerals in saliva (calcium and phosphorus) strengthen tooth enamel and protect against cavities.

Various pathological conditions can cause morphological changes in the salivary glands. To compare such changes, it is necessary to establish accurate normative morphological and morphometric parameters.

Aim of the study: To study the normative morphological and morphometric indicators of the submandibular salivary gland in 5-month-old white outbred rats.

Object of the study: For conducting the experimental research, 10 white outbred rats of both sexes, weighing 200–250 g and raised under standard vivarium conditions, were selected. The laboratory animals were housed in the vivarium of the Bukhara State Medical Institute.

Results and analysis

The experimental animals were provided with sufficient water and fed a balanced diet. Proper care and feeding of laboratory animals were considered essential in preparing and conducting the experimental research. A strict feeding schedule and hygienic rules during feeding were observed.

During the experiment, the bodies of deceased animals were buried, and in accordance with the ACT on the disposal of laboratory animals, the carcasses were disinfected with a 20% chlorine solution.

Initially, the white outbred rats were weighed and euthanized via decapitation under ether anesthesia. The submandibular salivary glands were removed from the oral cavity. The absolute weight of the glands was measured using a scale, and their dimensions (in the hilum region) were determined using a ruler and caliper. The gland weight index (GWI) was calculated using the formula: GWI = Vgland × 100 / Vanimal**,** where *V* represents weight.

For morphological and morphometric examination, the submandibular salivary glands were fixed in 10% neutral formalin, washed in running water for 2–4 hours, dehydrated in increasing concentrations of alcohol and xylene, and embedded in paraffin blocks using standard methods. The paraffin blocks were sectioned at 5–8 µm thickness and stained with hematoxylin and eosin. The hematoxylin-eosin staining was performed as follows:

Before staining, the blocks were deparaffinized by passing through three stages of xylene and decreasing concentrations of alcohol (100° to 70°), then placed in distilled water. The prepared sections were stained with hematoxylin for 3–5 minutes, rinsed with tap water, and differentiated. Once the nuclei turned purple (monitored under a microscope), the sections were stained with eosin for 0.5–1.5 minutes. The final stages included dehydration, clearing, and mounting.

After staining, the cellular components were identified as follows: collagen fibers – pink; acidophilic cytoplasm – red; muscles – dark pink; basophilic cytoplasm – purple; erythrocytes – cherry-red; and nuclei – blue.

Morphometric measurements were conducted using an eyepiece micrometer. The overall volume, weight, shape, and dimensions (length, width, thickness in mm), the length and diameter of the ducts (in µm), the outer and inner diameters of acini, epithelial cell height, and epithelial layer thickness (in µm) were measured. Measurements were taken in five randomly selected visual fields per histological section.

To study the cytoarchitectonics of the submandibular gland, cell counts were performed under 90x magnification using a NOVEL Model NLCD-307 (China) microscope with oil immersion. The counts were made using a morphometric grid attached to the eyepiece (10x).

The histo- and cytomorphometric data were processed mathematically on a Pentium IV personal computer using Microsoft Office Excel 7.0. Using the STTGRAPH 5.1 program, the standard deviation and representative errors were calculated. Descriptive parametric statistical methods were used to determine the arithmetic mean (M), standard deviation (σ), standard error of the mean (m), and relative values (frequency%). The significance of differences between compared values was assessed using the Student's t-test. Differences were considered statistically significant at $p \leq 0.05$.

Results and conclusions

In our study, the morphological parameters of the submandibular salivary gland of 5-month-old white outbred rats were investigated. Macroscopic findings: In rats, the submandibular salivary gland is a paired organ located on the medial side of the mandible in the neck region. It has a soft, elastic texture and appears pale pink. It is medium-sized, somewhat elongated or ovoid in shape, and is well supplied with arteries, veins, and lymphatic vessels. Macroscopically, the gland consists of parenchymal tissue surrounded by a capsule. Blood vessels entering the gland and salivary ducts exiting the gland are clearly visible. In terms of secretion, the gland is mixed (seromucous), containing both serous and mucous cells, although serous cells predominate.

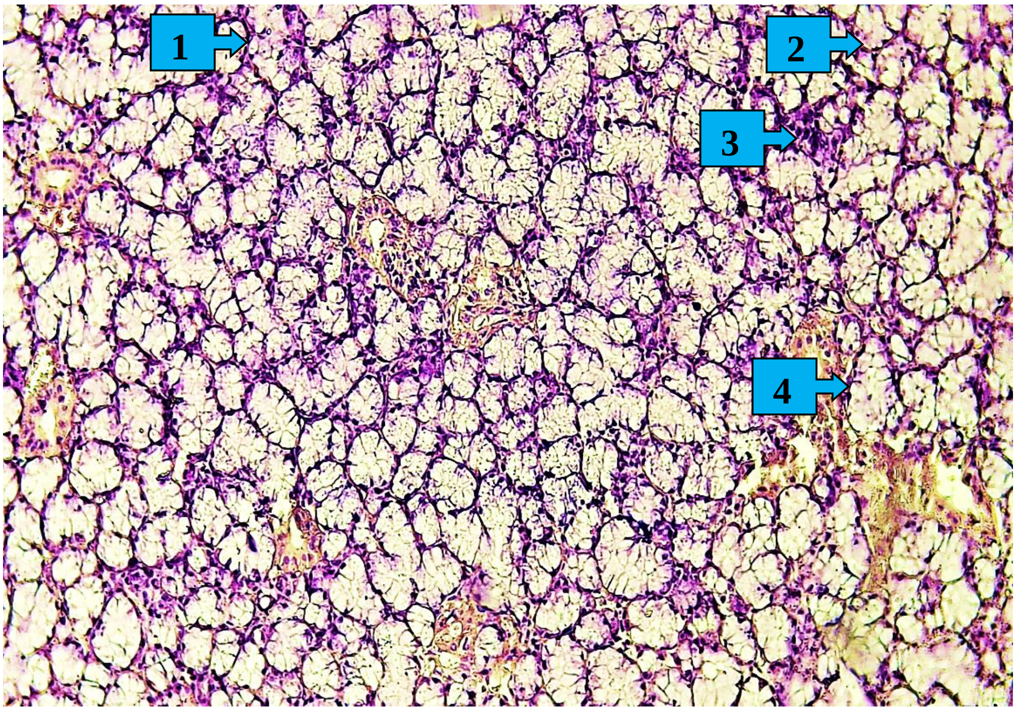

Figure 1. Microscopic view of the submandibular gland of a 5-month-old white outbred rat HE staining. Obj. lens 20x, Ocular lens 4x.

1 – Connective tissue trabecula
2 – Acinus
3 – Interlobular duct
4 – Blood vessel

On microscopic examination, the gland is externally covered by a thin connective tissue capsule, which extends into the gland as connective tissue trabeculae dividing it into lobules. Each lobule, in turn, consists of acini and the initial portions of the excretory ducts. This gland is composed of two types of secretory end pieces: pure serous and mixed secretory units. The serous acini are predominant and structurally resemble the terminal secretory units of the parotid gland, consisting of excretory ducts. The acini are composed of two types of cells: pyramidal secretory cells and myoepithelial cells located between the acinus and the basal membrane.

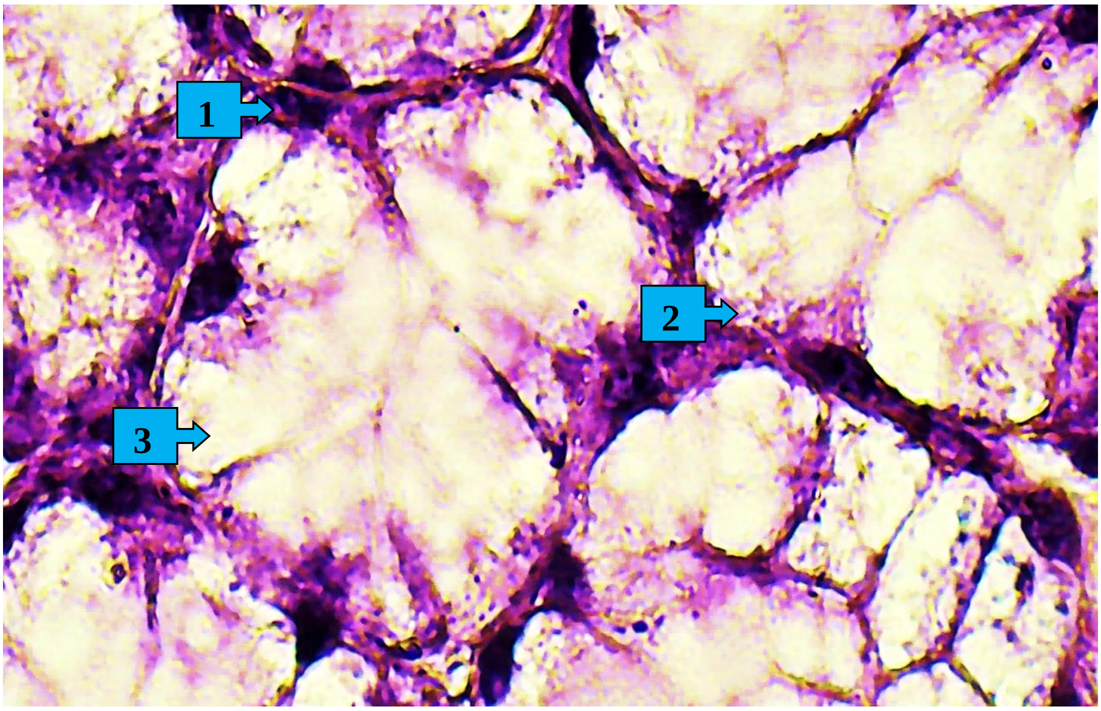

Figure 2. Microscopic view of the submandibular gland of a 5-month-old white outbred rat
HE staining. Obj. lens 20x, Ocular lens 10x.

1 – Connective tissue trabecula
2 – Acinus
3 – Interlobular duct

The pyramidal cells have small apical regions containing eosinophilic secretory granules, while the broader basal region displays basophilic characteristics. Microvilli are present at the apical surface of the secretory cells, and numerous secretory granules are located within the apical cytoplasm. The number of granules varies depending on the functional state of the cell. Among the protein-secreting cells, there is an intercellular secretory canal through which the cell product enters the acinar lumen. Myoepithelial cells contain contractile fibrils in their cytoplasm, which compress the acinar epithelium and facilitate the release of the secretion into the acinar lumen.

This gland consists of two types of secretory end pieces: pure serous and mixed secretory units. The mixed secretory units are larger and composed of two types of cells: serous and mucous cells. The mucous cells are large, with pale cytoplasm, and occupy the central part of the acinus. The nuclei of these cells are highly flattened and condensed, located in the basal part of the cell. In the mixed acini, the serous cells are positioned adjacent to the mucous cells, forming a characteristic crescent-shaped structure known as a serous demilune.

The gland’s duct system includes intralobular, interlobular, and the main excretory ducts. The intralobular ducts consist of intercalated and striated ducts. Intercalated ducts are lined by low cuboidal epithelium, with myoepithelial cells located on the basal membrane. The striated ducts are lined with simple columnar epithelium with eosinophilic cytoplasm.

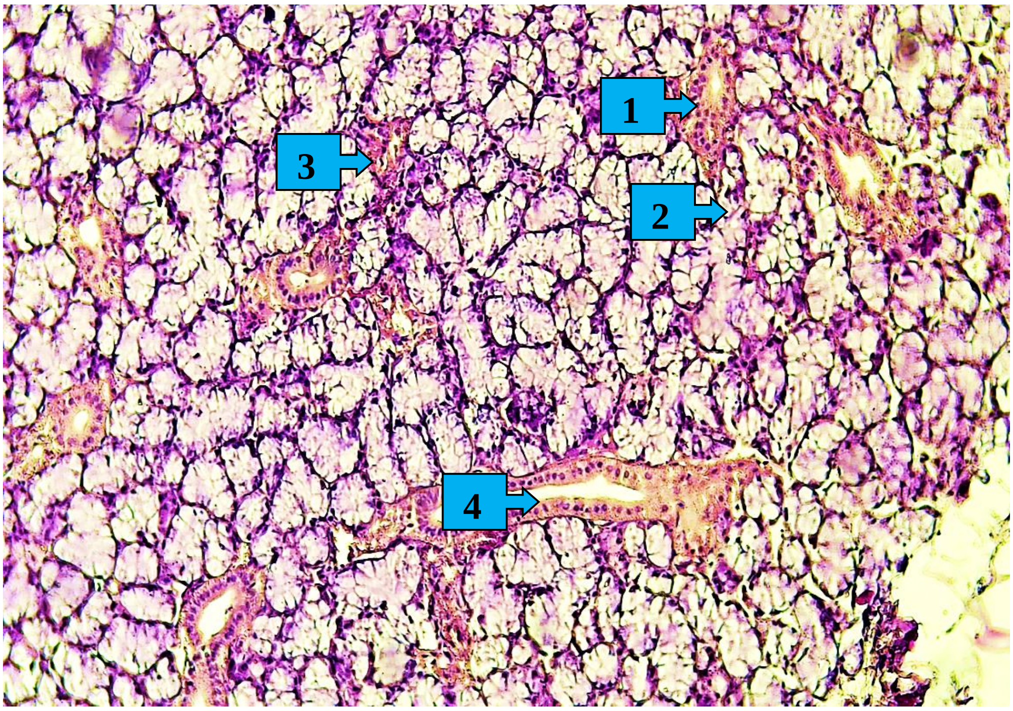

Figure 3. Microscopic view of the submandibular gland of a 5-month-old white outbred rat
HE staining. Obj. lens 4x, Ocular lens 20x.
1 – Connective tissue trabecula
2 – Acinus
3 – Interlobular duct
4 – Blood vessel

The interlobular ducts join to form the main excretory duct. These ducts are lined by stratified cuboidal epithelium, and at the point where the duct opens into the oral cavity, the epithelium becomes stratified squamous. The main excretory duct, known as Wharton's duct, opens into the floor of the mouth near the sublingual gland duct at the sublingual caruncle.

Morphometric study results showed that in the control group of 5-month-old white outbred rats, the outer diameter, inner diameter, and epithelial cell height of the submandibular salivary gland acini were 36.27±2.17 μm, 9.47±0.63 μm, and 14.18±1.05 μm, respectively.

Conclusion

The submandibular salivary gland is one of the important glands involved in saliva production and maintaining oral cavity moisture. Enzymes present in saliva (such as amylase) break down carbohydrates and help balance the oral microflora.

In our experiment, it was morphologically confirmed that its parenchyma consists of secretory units, mainly composed of mixed (serous and mucous) cells, and that the gland's excretory duct is Wharton's duct, which opens into the sublingual region.

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Entered 20.05.2025