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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

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საქართველოს სამედიცინო სიახლენი

**GEORGIAN MEDICAL NEWS**

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**GMN: Georgian Medical News** is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

**GMN: Медицинские новости Грузии -** ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

**GMN: Georgian Medical News –** საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

**WEBSITE**

www.geomednews.com

## К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

**При нарушении указанных правил статьи не рассматриваются**.

## REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.**

## ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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# PEDAGOGICAL ASPECTS OF THE IMPACT OF SMOKING ON THE HUMAN BODY BASED ON RADIOGRAPHIC DENSITY INDICATORS OF MAXILLARY SINUS BONE WALLS

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## Abstract.

The most effective process of quitting smoking can be achieved through precise and complete identification of the adverse effects on the human body.

**Aim:** The aim was to examine the influence of smoking on the density of the walls of the paranasal sinuses.

**Material and Methods:** 80 individuals of the young age and both genders were included into the research. Depending on the presence of pathological changes in the sinuses and smoking habits, all participants were divided into four groups.

**Results:** It was found that in the group of smokers without any paranasal sinus pathology, the density is 2.66% lower than the intact group. This figure is significantly higher in patients suffering from rhinosinusitis but not smoking, where it is 45.18%. The maximum difference from the control group is observed in individuals suffering from chronic rhinosinusitis and being smokers, with a difference of 81.03%.

**Conclusions:** Pedagogical aspects of the impact of smoking on the human body based on radiographic density indicators of maxillary sinus bone walls were detected. It has been observed that smoking can exacerbate the negative impact of inflammatory processes in the paranasal sinuses.

**Key words.** Radiological bone density, paranasal sinuses, smoking, chronic rhinosinusitis, pedagogy.

## Introduction.

Abandoning harmful habits is a top priority in the modern world, encompassing fields like medicine, education, and various scientific and technical disciplines [1]. In recent years, there has been growing concern about the detrimental effects of smoking on human health [2,3]. One area of interest is the impact of smoking on the maxillary sinus, a vital component of the human skull [4]. The most effective process of quitting smoking can be achieved through precise and complete identification of the adverse effects on the human body [5].

Bone density stands as a key factor influencing the development, prognosis, and course of inflammatory diseases in the paranasal sinuses [6]. It also serves as an indicator, determining the risk of potential complications and influencing the specifics of treatment for this group of diseases [7]. Both researchers and practicing specialists focus not only on studying radiological density under physiological conditions and in the presence of pathology but also on the impact of certain environmental factors on this parameter [8].

Preventing the influence of these factors on the human body can be a pivotal aspect in the development of inflammatory and destructive diseases of various locations is the main task for physicians [9,10]. Smoking is an unequivocal provocative factor that can initiate a series of pathological processes in the body and exacerbate existing conditions. Smoking has pronounced overall effects, negatively impacting almost all organs and systems: vasoconstriction disrupts the cardiovascular system [11], trophic disorders affect various organs and tissues, and both the nervous [12] and musculoskeletal [13] systems suffer. Additionally, smoking has detrimental local effects on the body, caused by both temperature factors and the tar released during smoking. Consequently, it can be expected that the nasal cavity and throat organs may be among the primary targets for the development of diseases and complications associated with smoking [14]. Therefore, smoking can not only become a factor triggering the emergence of new conditions in this area but also significantly increase the risks of complications in inflammatory processes in this area.

Particular importance is given to chronic rhinosinusitis [15], a group of diseases characterized by rare but severe complications, spreading inflammatory processes to adjacent organs and tissues (eye sockets, brain). As is known, any prolonged inflammatory process is characterized by pronounced, sometimes irreversible changes in bone tissue, characterized by perifocal sclerosis, thinning, and disappearance of bone nodules. Until recently, the main indicator reflecting the degree of bone destruction was bone thickness. Nowadays, more and more studies are focused on investigating reduced bone density, considering that reduced density might be an earlier marker of inflammatory processes and their complications.

Taking all the above into account, **the aim of our study** was to examine the influence of smoking on the density of the walls of the paranasal sinuses.

## Materials and Methods.

80 individuals of a young age (according to the WHO classification of age) were included in the study to exclude the influence of age-related changes on bone tissue. The study groups were evenly distributed by gender. Patient recruitment took place from 2018 to 2020 at the Merefian Central District Hospital based on a signed active cooperation agreement (since November 2018). All patients provided voluntary consent to participate in the study. The study was approved by the bioethics committee (protocol No. 1 dated 8.11.2018).

Depending on the presence of pathological changes in the sinuses and smoking habits, all participants were divided into four groups. The first group comprised 20 smokers suffering

from chronic non-polypoid rhinosinusitis. The second group included 20 non-smoking patients diagnosed with chronic non-polypoid rhinosinusitis. The third group consisted of 20 smokers without signs of chronic rhinosinusitis, and finally, the control group comprised 20 non-smoking individuals of both genders without signs of inflammatory diseases of the paranasal sinuses. Smokers were defined as individuals who smoked approximately 1 pack of cigarettes daily for at least 10 years.

Considering that computed tomography (CT) is the "gold standard" for diagnosing chronic rhinosinusitis, all individuals underwent multislice spiral computed tomography (MSCT). MSCT was performed on individuals without signs of inflammatory processes in the paranasal sinuses to diagnose pathologies unrelated to ENT diseases (such as suspected stroke, which was not confirmed, etc.).

An undeniable advantage of MSCT is the presence of a densitometric scale (Hounsfield scale), allowing the determination of the radiological density of tissues, including the bone tissue of the paranasal sinuses. The Hounsfield scale is a system used in radiology to measure the density of various tissues in the human body on X-ray images. This scale is based on values measured in units known as Hounsfield units (HU). Water serves as the primary standard for this scale, having a value of 0 HU, indicating zero density on the Hounsfield scale. Tissues denser than water have positive values on the scale, whereas tissues less dense than water have negative values. This scale enables radiologists to classify different tissues in the body and identify pathological changes or lesions, such as tumors, inflammations, stones, etc., based on their density on X-ray images. It is a crucial tool in medical diagnostics, allowing physicians to accurately identify and classify structures in a patient's body on X-ray images.

To determine the negative impact of smoking, the radiological density of the upper wall of the maxillary sinus in humans was calculated. Attention was specifically given to the maxillary sinus due to its higher susceptibility to inflammatory processes, attributed to its larger volumes, the positioning of its floor concerning the alveoli, and its proximity to teeth. The upper wall is potentially hazardous for the spread of pathological processes into the eye sockets. Considering that a decrease in minimum density is particularly unfavorable for the occurrence of complications, attention was focused on this parameter.

Statistical analysis was performed using methods of variation statistics. Normal distribution was assessed using the Shapiro-Wilk's test, which indicated that the samples were close to normal distribution. Statistical parameters are presented in the format of M±σ, where M represents the mean, σ is the standard deviation, and t-test was applied. Correlation analysis was conducted using the Spearman rank correlation coefficient. Statistical differences between the measured parameters were considered significant at $p < 0.05$.

## Results.

During the calculation of the minimum radiological density of the upper wall of the maxillary sinus (see Figure 1), it was determined that the lowest values of this parameter were observed in individuals suffering from chronic non-polypoid rhinosinusitis who were also smokers.

The minimum density value observed in this group was 34.77 ± 14.9 Hounsfield Units (HU). As expected, the maximum density values were found in the group of individuals who were non-smokers and did not suffer from chronic rhinosinusitis, with a density measurement at 183.32 ± 61.55 HU. Intermediate density levels were observed in groups of individuals affected by only one of the negative factors: either smoking or chronic inflammatory processes in the sinuses. In the group of individuals with signs of chronic inflammation in the sinuses who were non-smokers, the density value was slightly higher than that of smokers without chronic rhinosinusitis. The density measured 100.54 ± 54.25 HU and 178.45 ± 10.35 HU, respectively (see Table 1).

The graph of means with confidence intervals visualizes the average values for the dataset along with confidence intervals. In our case, they indicate the level of confidence regarding the true population mean (see Figure 2).

Thus, when compared to the control group, it was found that in the group of smokers without any paranasal sinus pathology,

***Table 1.*** *The minimum bone density of the upper wall of the maxillary sinus (HU).*

| **Groups of Patients** | **Smokers + Chronic rhinosinusitis** | **Smokers** | **Chronic rhinosinusitis** | **Control Group** |
|---|---|---|---|---|
| The average value, HU | 34,77** | 100,54** | 178,45 | 183,33 |
| Standart Deviation, HU | 14,9 | 54,25 | 10,35 | 61,55 |

*Note: ** The data are significant at $p < 0.05$.*

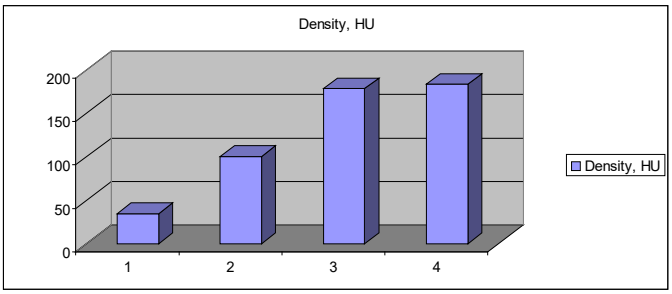


***Figure 1.*** *Results of Bone Density Calculation in the Upper Maxillary Sinus in Four Groups, p ≤0,05.*

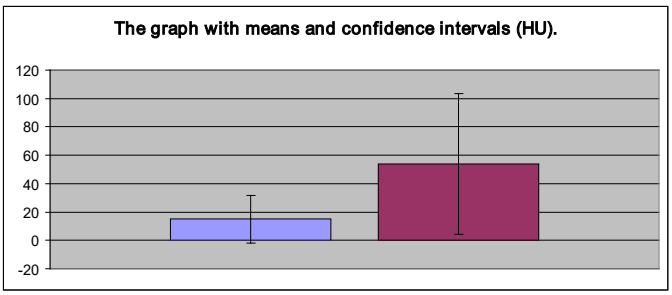


***Figure 2.*** *Graph of Mean Values with Confidence Intervals in the Group of Smokers and Non-Smokers Suffering from Chronic Rhinosinusitis, p ≤0,05.*

the density is 2.66% lower than the intact group. This figure is significantly higher in patients suffering from rhinosinusitis but not smoking, where it is 45.18%. The maximum difference from the control group is observed in individuals suffering from chronic rhinosinusitis and being smokers, with a difference of 81.03%.

## Discussion.

This study, dedicated to exploring the influence of external factors on the human body, serves as a continuation of our previous scientific research efforts [16-18]. During the conducted research, we have identified facts that suggest a detrimental impact on bone density. Interestingly, even the presence of a single negative factor such as smoking, though not significant compared to the control group, significantly ($p<0.05$) reduces the radiological density of the bone tissue of the upper maxillary sinus.

Smoking has been associated with various adverse health effects, and its impact extends to the skeletal system, including the bones in the maxillary sinus. The maxillary sinuses are air-filled cavities located in the maxillary bone of the skull. Smoking-induced bone density loss in the maxillary sinus can contribute to the development and risk of several diseases and conditions. Smoking is a known risk factor for osteoporosis, a condition characterized by a decrease in bone density and quality. This reduction in bone density can affect not only the long bones but also the bones in the skull 9as it has been seen from our research), including the maxillary sinus. Negative impact of smoking on the bone tissue can be explained by Smoking has the potential to impact the process of bone remodelling, leading to bone loss, as well as reductions in bone length, weight, and mineral density. It can also contribute to the promotion of osteoclastogenesis and the inhibition of osteoblastogenesis [19].

This may indicate that smoking patients could constitute a special risk group with more severe inflammatory processes and more frequent development of complications that can be expected in them. Additionally, such individuals require more careful attention from medical staff even in the absence of paranasal sinus pathology. Procedures such as tooth extraction or sinus lifting might associate more frequently with complications due to their lower bone density. At the same time, the presence of chronic inflammatory processes in the sinus leads to a more significant reduction in density. The most unfavourable prognosis and the lowest density are characteristic of the first group of patients (smokers suffering from chronic non-polypoid rhinosinusitis). Thus, it can be assumed that smoking might intensify inflammatory and destructive processes typical for chronic rhinosinusitis. Therefore, it is strongly recommended for patients suffering from chronic rhinosinusitis to quit smoking.

Analysing data obtained from the other two groups (smoking patients without signs of chronic inflammation in the sinus and patients with chronic rhinosinusitis), we observe a significantly greater decrease in density in the second group. Hence, it can be suggested that the inflammatory process has a significantly greater impact on bone density than smoking.

This study is one of the first aimed at determining bone density in smokers [20]. It is worth noting that in most cases, researchers focus on the density of long tubular bones [21], which can be explained by the importance of this parameter for elderly patients. The process of determining density in this case is quite laborious. However, our proposed study of radiological density does not require additional efforts from medical staff and can be conducted parallel to CT scans using DICOM Viewer, making it easy to explore the radiological density of bone tissue of any localization [22].

When it comes to studying the density of paranasal sinuses, the alveolar process of the upper jaw is undoubtedly the leader of the research. This interest can be explained by the importance of this anatomical area. Although studies dedicated to exploring the density of cancellous bone are limited. Presumably, this can be attributed to the complexity of performing these measurements. The paranasal sinus bony wall resembles a sponge in its structure, and even a slight deviation in determining density along the coordinate axis can significantly distort the obtained data. Therefore, the entire process of determining density requires increased attention from medical staff. Additionally, it is important to consider that multiple points determining density are identified on a single slice. The process of selecting correct points is quite laborious. In our case, we determined density at points located most superficially to the sinus lumen, considering the presence of an inflammatory process in the sinus.

As it is known to the date, researchers have explored this issue through various methods, one of which involves analyzing radiographic density indicators of the bone walls of the maxillary sinus. This research not only sheds light on the physiological consequences of smoking but also has important implications for education and public health awareness.

Several pedagogical aspects arise from this research. First and foremost, understanding the radiographic density indicators of maxillary sinus bone walls is crucial for healthcare professionals, educators, and the general public [23]. By comprehending the visual cues provided by X-rays, individuals can gain insight into the structural changes caused by smoking. Educators can play a pivotal role in disseminating this knowledge to students, fostering a deeper understanding of the consequences of smoking on the human body [24].

Additionally, this research emphasizes the importance of preventive education. Educators can use this information to develop targeted anti-smoking campaigns in schools and communities. By raising awareness about the specific impact of smoking on the maxillary sinus, these campaigns can effectively deter individuals, especially young people, from engaging in this harmful habit. Visual aids, such as X-ray images illustrating the differences in bone density, can serve as powerful educational tools to drive home the message about the risks associated with smoking [25,26].

Furthermore, this research underscores the significance of interdisciplinary collaboration between healthcare professionals, educators, and researchers. By working together, these professionals can create comprehensive educational programs that encompass both the medical and social aspects of smoking. Integrating radiographic findings into educational materials can enhance the overall understanding of the health consequences of smoking, making the information more accessible and impactful for diverse audiences [27].

The placement of HU measurements on a CT scan involves understanding the radiodensity of tissues, assigning HU values to pixels, and implementation of these values for diagnostic and clinical purposes. The interpretation of HU values is a fundamental aspect of CT imaging and contributes significantly to the accuracy and clinical relevance of the diagnostic process.

In conclusion, the study of radiographic density indicators of maxillary sinus bone walls provides valuable insights into the effects of smoking on the human body. By incorporating this knowledge into educational initiatives, society can take significant steps towards reducing the prevalence of smoking and promoting better overall health. Through collaborative efforts and targeted education, individuals can make informed decisions about their lifestyles, leading to healthier communities and improved public well-being [27].

It should be noted that the continuation of this study holds promise for the future. In this current research, the degree of bone density reduction was determined using classical methods of variation statistics, which are well-known in medicine to the date [28]. It would be interesting to broaden the scope of conducted studies by incorporating new approaches to bone density calculation [29-31] and by expanding the range of diseases, the progression of which can be worsened by smoking with development of inflammatory processes of different origin [32,33] that allow to perform prognosis for pathological processes [34] and organize therapeutical measures [35, 36] especial in children and adolescents [37,38] due to necessary combination of famous methods of investigation for smokers [39,40] with other pathology of maxillofacial area [41,42] especially with necessary antibiotic treatment [43,44].

## Conclusion.

Pedagogical aspects of the impact of smoking on the human body based on radiographic density indicators of maxillary sinus bone walls were detected. It has been observed that smoking can exacerbate the negative impact of inflammatory processes in the paranasal sinuses. Interestingly, even on its own, smoking can lead to a decrease in radiographic bone density in individuals who do not suffer from chronic rhinosinusitis. However, it is worth noting that the presence of inflammatory processes in the sinus leads to a more pronounced decrease in radiographic bone density compared to smoking alone.


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## Conflict of interest statement.

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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