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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
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.

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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 ВИНТИ 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 ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებშიდან.

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. Корректур авторам не высылаются, 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 computer-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 საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ 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. რენტგენოგრაფიების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების 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 ფხიხლებში 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.

Danielyan M.H, Karapetyan K.V, Avetisyan Z.A, Hovsepian A.S, Karapetyan A.G, Dallakyan A.M, Nebogova K.A. MORPHOLOGICAL AND BEHAVIORAL ANALYSIS OF THE PROTECTIVE EFFECTS OF BACTERIAL MELANIN IN A RAT MODEL OF PARKINSON'S DISEASE.....	6-11
Harmatina O.Yu, Moroz V.V. EFFECT OF DIRECT SURGICAL REVASCULARIZATION ON CEREBRAL HEMODYNAMICS AND STROKE DEVELOPMENT IN PATIENTS WITH MOYAMOYA DISEASE.....	12-21
Mirzoyan Meri S, Chochiev Dmitrii S, Rostomov Faizo E, Lyutoeva Anna S, Abdurakhmanov Makhach G, Sashkova Angelina E, Gunina Anastasia A, Batalova Anfisa B, Averchenkova Mariia M, Chistyakova Sofya L, Kachanov Dmitrii A. EFFECT OF CHRONIC ADMINISTRATION OF LOW DOSES OF POLYPEPTIDES OF CATTLE CEREBRAL CORTEX AND METHIONYL-GLUTAMYL-HISTIDYL-PHENYLALANYL-PROLYL-GLYCYL-PROLINE ON BEHAVIORAL RESPONSES OF RAT OFFSPRING.....	22-24
Nvard Pahutyanyan, Qristine Navoyan, Gohar Arajyan, Seda Harutyunyan, Anahit Pogosyan, Hrachik Gasparyan. THE IMPACT OF DIAMIDE DERIVATIVES OF OXALIC ACID ON FREE RADICAL LIPID OXIDATION IN WHITE RAT BRAIN AND LIVER.....	25-30
Vullnet Fazliu, Aferdita Gashi-Rizaj, Yll Krasniqi, Venera Bimbashi. THE IMPACT OF SYSTEMIC DRUGS ON DENTAL IMPLANT OSSEOINTEGRATION: A REVIEW.....	31-35
Natia Archaia, Vakhtang Chumburidze, Nona Kakauridze. ASSESSING THE PATIENT WITH ANTIPHOSPHOLIPID SYNDROME IN LIGHT OF THE NEW 2023 ACR/EULAR ANTIPHOSPHOLIPID SYNDROME CLASSIFICATION CRITERIA - CASE REPORT.....	36-40
Elham Hasan Mahmood, Nihad Nejrjis Hilal, Mohammed M. Abdul-Aziz. ASSOCIATION OF PLASMA NEUTROPHIL GELATINASE-ASSOCIATED LIPOCALIN WITH METABOLIC SYNDROME.....	41-44
Vakhtang Kakochashvili, Shalva Parulava, Nana Omanadze, Tamar Ordenidze, Salome Omiadze, Nino Abaishvili, Vladimer Margvelashvili. DENTAL CARIES AWARENESS AND RISK ASSESSMENT IN INTERNATIONAL STUDENTS OF GEORGIAN UNIVERSITIES.....	45-50
Valery Piacherski, Lidziya Muzyka, Iryna Kazubovich. COVID-19 ASSOCIATED REACTIVATION OF HERPES INFECTION WITH THE DEVELOPMENT OF ENCEPHALITIS: A CASE REPORT.....	51-53
Shahad M. Ali, Eman A. Sulaiman, Sarraa Dhiaa. HISTOLOGICAL EFFECTS OF CO ENZYME Q10 ON DOXORUBICIN-INDUCED DEFICITS OF CARDIOPULMONARY AXIS IN WHITE ALBINO RATS.....	54-59
Levan Beselia, Maya Tsintsadze, Ilona Sakvarelidze, Mzia Tsiklauri, Teimuraz Gorgodze, Iamze Taboridze. MORTALITY RISK ASSESSMENT AMONG PATIENTS, HOSPITALIZED FOR COVID-19.....	60-67
Nada S. Mahmood, Saif K. Yahya, Manhal A. Ahmed, Ibrahim M. Faisal. ALLOPURINOL TREATMENT IMPROVES INSULIN RESISTANCE IN NON-DIABETIC PATIENTS WITH RENAL STONE.....	68-71
Kovalenko Elizaveta V, Mordovcev Daniil A, Velmatova Olesya N, Vikhrov Nikita M, Shekhmameteva Linara N, Smirnykh Maria Yu, Kosareva Veronika R, Michailova Varvara S, Karpachev Egor A, Vildanova Aida Z, Sakharova Arina V, Khmeleva Alina A, Khacieva Madina L, Berezhnoy Nikolay N. EXPERIMENTAL STUDY OF THE EFFECT OF MINERAL WATERS ON THE GASTRIC MUCOSA OF WISTAR RATS.....	72-74
Dariy V, Serikov K, Kmyta O, Rybalko T, Kolesnyk O. PERSONIFICATION OF ANTIHYPERTENSIVE THERAPY IN ISCHEMIC CEREBRAL STROKE.....	75-79
Nvard Melkonyan, Yuliana Melkumyan, Anrieta Karapetyan, Lilit Hakobyan. PROFESSIONAL ETHICS OF PUBLIC RELATIONS PRACTITIONERS IN THE CONTEXT OF DIGITALIZATION.....	80-84
Mahmoud AM Fakhri, Amer A. Mohe, Fahad A. Jameel, Rafad R. Saadoon. INVESTIGATION OF IRON DEFICIENCY IN POSTMENOPAUSAL WOMEN BASED ON LABORATORY TESTING: A UNI-CENTRE STUDY.....	85-88
L. V. Darbinyan, L.G. Avetisyan, L.E. Hambardzumyan, L.P Manukyan, K.V. Simonyan. GENDER DIFFERENCES IN THYROIDECTOMY-INDUCED WEIGHT LOSS AND IMPAIRED GLUCOSE LEVELS: ROLE OF L-THYROXINE.....	89-92
Hussain I. Hussain, Ayad H. Ebraheem, Samira AH. Abdulla, Entedhar R. Sarhat, Elham M. Mahmood. CHLOROQUINE INDUCED LESIONS IN LIVER OF ALBINO MICE.....	93-97
Rishu Bansal, Maia Zhamutashvili, Tinatin Gognadze, Ekaterine dolmazishvili, Natia jojua. A SEVERE CASE OF NON TYPHOIDAL SALMONELLA ASSOCIATED WITH MULTIPLE ORGAN DAMAGE- CASE STUDY AND LITERATUREREVIEW.....	98-102

Amenah M. Younis, Abduladheem R. Sulaiman. EFFECTS OF ACID ETCHING ON COLOR CHANGES AND SURFACE MORPHOLOGY OF ENAMEL TO BE BLEACHED WITH DIFFERENT TECHNIQUES.....	103-109
Bondarenko A.V, Malieieva O.V, Malieiev D.V, Lantukh I.V, Filonenko O.V, Baiazitov D.M, Gulbs O.A. PSYCHOLOGICAL FEATURES OF THE REHABILITATION OF PERSONS IN POST-COVID-19 CONDITION.....	110-115
Bodnia I, Bodnia K, Maslova V, Ogienko V, Pavliy V. CLINICAL PREDICTORS OF BLASTOCYSTOSIS TREATMENT EFFICACY.....	116-119
Nina Davidova, Lali Pkhaladze, Nana Kvashilava, Ludmila Barbakadze, Archil Khomasuridze. EARLY PREGNANCY LOSS: INVESTIGATING THE ROLE OF PROGESTERONE-INDUCED BLOCKING FACTOR.....	120-125
Rihab J. Mansoor, Zainab YM. Hasan, Yasir H. Zaidan. ANTICANCER ACTIVITY OF PHLORETIN COMPOUND PURIFIED FROM IRAQI <i>MALUS DOMESTICA</i> L. (APPLE) LEAVES.....	126-136
Sagatbek M, Ardabek A, Chergizova Bibigul T, Gulnur K. Ryspaeva, Ishigov Ibrshim A. MODELING METHODS FOR TEACHING MEDICAL UNIVERSITY STUDENTS ABOUT THE REPRODUCTIVE SYSTEM.....	137-139
Domanchuk T, Chornenka Zh, Mohammad Watek O. Alsalama, Amelina T, Ishrak Laban Adnan, Abdulraheem Mohammad Issa Abu Jubbeh. IMPROVEMENT OF THE MODEL OF PREVENTION OF MALIGNANT NEOPLASM OF THE GASTRIC.....	140-148
Koptelin Ilya A, Panevin Egor A, Belenkova Iuliia B, Zenkin Nikita A, Ponomareva Yulia V, Makarova Maria A, Simonov Vladimir A, Savkina Ksenia I, Manina Valeria G, Minnebaeva Milena I, Parfenova Anastasia V, Ugai Olga I, Zvozil Elena A, Arteev Vladimir V, Kachanov Dmitrii A. SPECIFICS OF PRESCRIBING ANTIRETROVIRAL DRUGS IN THE TREATMENT OF HIV INFECTION.....	149-153
Zainab S. Hussein, Ajile A. Alzamily. MITOCHONDRIAL VITIATION CONGRUENTLY APTLY WITH AUTISM SPECTRUM DISORDER.....	154-160
Onishchenko NM, Teremetskyi VI, Kolesnikov AP, Kovalchuk OYa, Shabalin AV, Romas MI. PROTECTION OF CONFIDENTIAL MEDICAL INFORMATION IN UKRAINE: PROBLEMS OF LEGAL REGULATION.....	161-168
Rongrong Wang, Yulei Xie, Liang xie, Jinjin Liu, Jiameng Jia, Xin Chen, Qing Wu. PLATELET-RICH PLASMA VERSUS CORTICOSTEROID IN THE TREATMENT OF KNEE OSTEOARTHRITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS.....	169-182

GENDER DIFFERENCES IN THYROIDECTOMY-INDUCED WEIGHT LOSS AND IMPAIRED GLUCOSE LEVELS: ROLE OF L-THYROXINE

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Abstract.

Thyroxine, a key regulator of metabolic pathways, plays a pivotal role in glucose metabolism and the maintenance of glucose homeostasis. In clinical practice, L-thyroxine replacement therapy is commonly prescribed for patients with hypothyroidism. However, the specific effects of L-thyroxine and thyroidectomy (TX) on glucose levels remain an area of interest and investigation. In this study, 20 rats were divided into two groups (n=10 per group). The TX group (male and female rats) underwent thyroidectomy for 4 weeks. After 4 weeks, male and female thyroidectomized rats received L-thyroxine (10 µg/100 g/day, intraperitoneally) for 4 weeks. The rats' weights were monitored weekly post-surgery. Compared to the initial level, thyroidectomy resulted in weight loss, whereas L-thyroxine replacement therapy normalized the weight loss induced by thyroidectomy. Additionally, thyroidectomy led to impaired glucose levels, which were restored to normal levels with L-thyroxine treatment. These findings underscore the impact of thyroid function on glucose metabolism and highlight the potential therapeutic role of L-thyroxine.

Key words. L-Thyroxine, thyroidectomy, glucose levels.

Introduction.

Thyroid dysfunction is one of the most common health problems worldwide. Thyroidectomy in rats is a surgical procedure involving the removal of the thyroid gland, commonly utilized in preclinical and research settings concerning the endocrine system. This procedure induces hypothyroidism, characterized by a deficiency in thyroid hormones [1]. Studies have indicated the technical challenges associated with total thyroidectomy in rats due to the intricate microsurgical technique required; however, refinements have improved surgical success rates [2]. Thyroidectomized rats serve as valuable models and have been extensively employed to elucidate the role of thyroid hormones in metabolism. The resultant hypothyroidism post-thyroidectomy is associated with symptoms such as bradycardia, hypotension, reduced respiratory rate, decreased oxygen consumption, and an increased risk of metabolic and neuropsychiatric disorders [3]. Studies have shown that thyroidectomy can influence glucose metabolism pathways in lactating rats, impacting blood glucose levels [4]. Thyroidectomy and subsequent thyroxine replacement have been associated with impaired oral glucose tolerance in rats, highlighting the significant relationship between thyroid function and glucose regulation [5]. Patients with thyroidectomy were more susceptible to developing type 2 diabetes mellitus [6]. Thyroid hormones play a critical role in maintaining the proliferative and secretory abilities of pancreatic β cells, making maternal thyroid hormone levels crucial for offspring β cell development. Nuclear thyroid

hormone receptors (TRs), particularly TR α and TR β , act as transcription factors and are abundantly expressed in pancreatic islets [7]. Thyroid hormones regulate glucose metabolism in the liver, adipose tissue, skeletal muscle, and pancreas [8,9], with numerous studies exploring their impact on glucose homeostasis [10]. Additionally, research has identified sex differences in rats' resistance to thyroid hormone post-thyroidectomy [11].

Materials and Methods.

Experimental Materials:

All chemicals used in this study were purchased from Sigma-Aldrich (St. Louis, MO, USA).

Animals:

In the current study adult male and female rats were used (220–240 g). Rats were kept in polycarbonate cages, 3 rats/cage, in a thermostatically controlled room (temperature: 24°C, relative humidity: 45%) on a 12 h-light/12 h-dark schedule with free access to food and water. The research was supported by the Higher Education and Science Committee of MESCS RA (Research project №22YR-1F003). All animal procedures were in accordance with the National Institutes of Health Guide for the Care and Use of Laboratory Animals. The animal experiments were in accordance with the guidelines of laboratory animal care and were approved by the Animal Experimentation Ethics Committee of the Yerevan State Medical University after Mkhitar Heratsi (IRB Approval N4, November 15, 2018). ALL methods are reported in accordance with ARRIVE guidelines.

Study design:

1. **Thyroidectomy:** 10 male and 10 female rats underwent thyroidectomy surgery.
2. **Thyroidectomy + L-Thyroxine:** After 4 weeks post-thyroidectomy, both male and female rats received daily intraperitoneal injections of L-thyroxine at a dose of 10 µg/100 g/day.

Thyroidectomy:

Before thyroidectomy surgery (TX), male and female rats were anesthetized with pentobarbital (35 mg/kg, intraperitoneally). The thyroid glands were then excised from the tracheal tube. A neck necklace incision was made, entering through the middle of the submandibular gland and sternohyoid muscle, to access the skin and subcutaneous tissue. The bilateral thyroid lobes were removed over the trachea, and total thyroidectomy was performed using a scalpel. The incision was closed with sutures, and Penicillin (bicillin) powder was applied to the wound [12,13]. Subsequently, the rats were allowed to recover and were returned to a standard diet with access to tap water. Both male and female rats underwent thyroidectomy to

induce hypothyroidism (4 weeks), after which they received L-thyroxine (TX+L-thyroxine, 10 µg/100 g/day, i.p., one week after surgery) for 4 weeks. The dosage of L-thyroxine and the administration route used in this study were determined based on previous research [14].

Statistical analysis:

We performed statistical analysis using GraphPad Prism 8 software (San Diego, CA, USA). To compare the significance of differences in body weight and blood glucose levels among the groups, we utilized a two-way ANOVA followed by Tukey's multiple comparisons test. The results of the experiments are displayed as the means ± SEM.

Results and Discussion.

Body weight:

We observed an obvious decrease in body weight in male and female TX rats after 4 weeks following thyroidectomy. Following treatment with L-thyroxine (4 weeks), the decreased body weight of TX rats was mitigated. Specifically, the body weights of male TX rats decreased from 242 ± 9.24 g to 200 ± 6.8 g, while the body weights of male TX+L-thyroxine rats were maintained at 220 ± 7.42 g. For female rats, the body weights of TX rats decreased from 230 ± 8.4 g to 190 ± 4.24 g, while the body weights of TX+L-thyroxine rats were maintained at 210 ± 5.4 g. Thus, both male and female thyroidectomized rats showed a significant reduction in body weight after 4 weeks, which was reversed by L-thyroxine treatment, maintaining body weights close to baseline levels ($P < 0.05$).

Determination of blood glucose:

Fasting blood glucose levels were checked using a glucometer (Contour Plus) for each rat before (week 1), after thyroidectomy (week 4), and after treatment (week 8). The bibliographic literature presents varying blood glucose values in rats, with sources suggesting ranges of 50-125 mg/dL and 85-132 mg/dL. These variations emphasize the need to consider factors such as fasting duration, species, and experimental conditions when interpreting rat blood glucose values [15].

Gender Differences in Response to L-thyroxine Treatment:

In our study, we found that in male rats, blood glucose levels increased significantly from an initial level (day 1) of 3.8 ± 0.3 mmol/L to 5.4 ± 0.54 mmol/L in the thyroidectomized (TX) group at 4 weeks ($P = 0.0004$). Similarly, in female rats, blood glucose levels decreased significantly from an initial level of 3.7 ± 0.29 mmol/L to 2.4 ± 0.24 mmol/L in the TX group at 4 weeks ($P = 0.0001$).

Comparing the effects of thyroidectomy and L-thyroxine treatment, significant differences were observed in blood glucose levels between the TX and L-thyroxine treatment for both genders. In males, the 4-week L-thyroxine treatment showed a decreased blood glucose level of 3.48 ± 0.22 mmol/L compared to 5.4 ± 0.25 mmol/L in the TX group at 4 weeks, indicating a difference that was statistically significant ($p < 0.001$). However, in females, 4 weeks of L-thyroxine treatment markedly increased blood glucose levels to 4.52 ± 0.4 mmol/L compared to the TX group's 4-week level of 2.4 ± 0.2 mmol/L, highlighting the greater effectiveness of L-thyroxine treatment in reducing blood

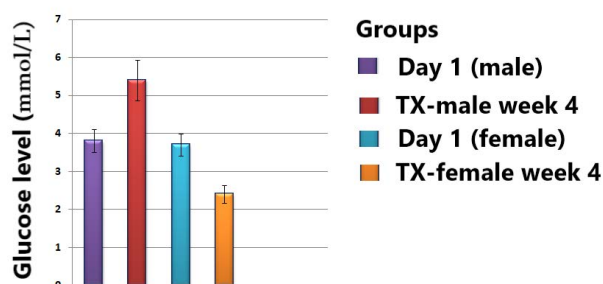


Figure 1. Effect of thyroidectomy (TX) on glucose levels. Values are expressed as mean ± SE from 10 rats, $P < 0.05$.

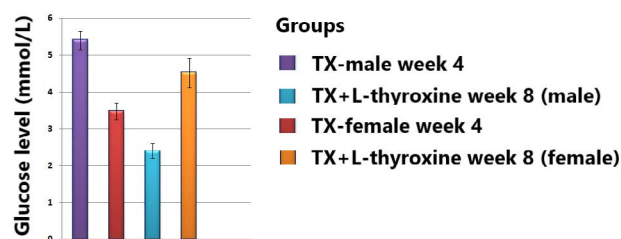


Figure 2. Effect of L-thyroxine on glucose levels. Values are expressed as mean ± SE from 10 rats, $P < 0.05$.

glucose levels in male rats post-thyroidectomy ($p < 0.001$) (Figure 2). Hyperthyroidism is one of several reversible causes of hyperglycemia and is recognized to be associated with increased gluconeogenesis, increased rates of glucose absorption, and a decreased insulin half-life [16,17]. The development of insulin resistance in hypothyroidism is also associated with a decreased rate of blood flow in peripheral tissues [18]. Subclinical thyroid dysfunction is associated with changes in glucose homeostasis [19]. It has been shown that glucose production is decreased in hypothyroidism [20]. It is well known that hyperthyroidism causes extensive weight loss despite normal or increased calorie intake [21]. In hyperthyroid humans as well as in experimental thyrotoxicosis in animals, glucose turnover and hepatic glucose production are increased due to increased metabolic rate and peripheral glucose utilization [22]. Thyroid hormones regulate metabolic activities such as growth rate [23], and weight gain is a symptom of hypothyroidism. Individuals with hypothyroidism may experience weight gain because of a decreased metabolic rate. Yatvin et al. [24] reported that thyroidectomy may reduce food intake and lead to decreased body weight in rats. Thyroid hormones are important determinants of glucose metabolism [25]. Whether subtle changes in FT4 levels within the euthyroid range alter glucose homeostasis has not yet been fully elucidated. Previously, Roos et al. have demonstrated that fasting glucose and insulin levels were significantly related to lower FT4 levels in the analysis of 2,703 euthyroid subjects [26]. Thyroid hormones regulate several key molecules in gluconeogenesis, such as phosphoenolpyruvate carboxykinase and glucose-6-phosphatase. Alanine transport and its conversion to glucose in the liver were observed to be increased by thyroid hormones [27]. As physiological levels of thyroid hormone have been observed to exert protective effects on pancreatic islets [28],

thyroid hormones may have favorable roles in terms of lowering glucose levels. The contribution of thyroidal status to insulin signalling and glucose homeostasis has been implicated as a potential pathophysiological factor in humans, but the specific mechanisms remain largely elusive. Fasting induces changes in both thyroid hormone secretion and insulin signalling [29]. Regarding gender-specific responses to L-thyroxine treatment, the studies do not provide specific information on how males and females respond differently to this treatment in the context of post-thyroidectomy hypothyroidism. However, one study suggests that female patients with differentiated thyroid cancer had a higher risk of developing hyperlipidemia than male patients, and these risks increased when TSH increased [30]. It was shown that male rats that underwent thyroidectomy exhibited a lower removal rate of plasma glucose compared to normal rats, while female rats that underwent thyroidectomy showed an increased removal rate of plasma glucose compared to normal rats. This suggests that thyroidectomy has opposite effects on blood glucose levels in male and female rats [31].

Conclusion.

In conclusion, our study demonstrates that thyroidectomy elicits divergent effects on blood glucose levels in male and female rats, with males exhibiting an increase and females showing a decrease. Furthermore, L-thyroxine treatment post-thyroidectomy revealed gender-specific responses, being more effective in reducing blood glucose levels in males but less effective and even causing an increase in females. Despite these gender-specific effects on glucose metabolism, L-thyroxine treatment effectively reversed the decreased body weight observed in thyroidectomized rats, maintaining body weights close to baseline levels. These results underscore the importance of considering gender-specific responses in thyroid-related interventions and highlight potential complexities in managing glucose metabolism, particularly in the context of L-thyroxine therapy.

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