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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.

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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BIOCHEMICAL ASSOCIATION BETWEEN CALCIUM HOMEOSTASIS AND SERUM URIC ACID LEVELS IN PATIENTS WITH HYPOTHYROIDISM: A COMPARATIVE EVALUATION WITH 25-HYDROXYVITAMIN D

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Abstract.

Background and Aim: The relationship between calcium, 1,25-dihydroxyvitamin D and serum uric acid levels in thyroid patients involves complex physiological mechanisms. This study aimed to evaluate the association of serum calcium and 25-hydroxyvitamin D with serum uric acid concentrations in individuals with hypothyroidism. **Methodology:** A Cross-sectional study conducted in Thumbay Hospital in Ajman UAE on 180 male and female with hypothyroidism and normal individuals, the study subjects divided into five age categories: 21-30, 31-40, 41-50, 51-60 and >60 years. The concentrations of calcium and uric acid in the samples measured by Beckman Coulter and DxI Analyzer, for the thyroid hormones and 25-hydroxyvitamin D (25-OH Vitamin D) tests used DxI Analyzer. The results analyzed by SPSS version 26, the mean and SD obtained, and "t" test independent, one-way ANOVA and Linear regression used for correlation and P value obtained to assess the significance of the results (p value of < 0.05 was significant). **Results:** Among 180 participants, no significant difference age was seen between hypothyroid patients and controls ($p = 0.959$). Hypothyroid patients showed markedly elevated TSH ($p < 0.001$) and reduced FT4 ($p = 0.001$), calcium ($p < 0.001$), and vitamin D ($p = 0.012$) levels, while uric acid increased significantly ($p = 0.015$). Correlation analysis showed a weak negative association between uric acid and TSH ($r = –0.082$). Uric acid was higher in males ($p = 0.016$), while calcium revealed significant differences across age groups ($p = 0.011$), showed age-related alterations in calcium metabolism.

Conclusion: This study showed significant associations between calcium, 25-hydroxyvitamin D and serum uric acid levels in individuals with hypothyroidism. The negative correlations between uric acid and both calcium and 25-hydroxyvitamin D underscore the complex metabolic interactions characteristic of hypothyroidism.

Key words. Calcium, vitamin D, uric acid, hypothyroidism, TSH.

Introduction.

The thyroid gland plays a crucial role in controlling development, metabolism, and other body processes [1], Thyroxine (T4) and triiodothyronine (T3) are the primary thyroid hormones that regulate cellular metabolism, affecting all tissues and organ systems [1]. Thyrotropin-releasing hormone (TRH) from the hypothalamus stimulates the anterior pituitary gland to produce thyroid-stimulating hormone (TSH), and their production is a complex process controlled by the hypothalamus-pituitary-thyroid (HPT) axis [2,3]. The body's management of calcium levels is a closely checked process, important roles in this control are played by vitamin D and parathyroid hormones (PTH) [4]. PTH is secreted by the parathyroid glands and regulates the blood calcium levels by acting on the kidneys, intestines, and bones. PTH encourages the activation of vitamin D, improves calcium reabsorption in the kidneys and accelerates the release of calcium from bones [5,6]. Vitamin D circulates in the blood in form 25-hydroxyvitamin D and is essential for controlling the body's calcium levels, bone health, immune system function, and the control of inflammatory reactions [7]. A balanced inflammatory state may be supported with the help of best vitamin D levels, which have been related to changing and controlling inflammatory reactions. 25- hydroxyvitamin D levels are commonly measured as a means of finding an individual's vitamin D status [8]. Calcium levels are not directly regulated by calcidiol (25-hydroxyvitamin D), even though it is a precursor of calcitriol (1,25-dihydroxyvitamin D), the physiologically active form of vitamin D that does. The regulation of renal function by thyroid hormones affects the excretion of many chemicals including uric acid, some of the studies revealed that the blood uric acid levels of people with subclinical hypothyroidism are much greater than those of healthy people [9]. Reduced thyroid hormone levels in hypothyroidism may affect renal function which may result in less uric acid being excreted and hence higher blood levels [10,11]. Our study through well planned trials is necessary to understand the connections between blood uric acid levels, calcitriol, and calcium in hypothyroidism.

Materials and Methods.

Laboratory-based cross-sectional study conducted at Thumbay Hospital, Ajman, included 180 male and female newly diagnosed, untreated hypothyroid patients and excluding those on thyroid hormone replacement therapy, chronic kidney disease, gout medications and vitamin D or calcium supplements. The Institutional Review Board of Gulf Medical University approved the study (Ref. no. IRB-COHS-STD-17-JAN-2024), and a signed informed consent was obtained from all participants after explaining the details of the study objectives and the risks and benefits of participating in the study. The age of participants ranged between 21 to 73 years, and participants classified into five age categories: (21-30), (31-40), (41-50), (51-60), > 60 years. Serum-separating gel tubes are used to collect blood specimens. The concentrations of calcium (Ca) and uric acid (UA) in the samples measured by Beckman Coulter and DxI Analyzer, the quantification of Calcium and Uric Acid levels is achieved by the application of photometric measuring methods, in photometry the absorbance of a sample's constituents at different wavelengths of light is measured and is correlated with the sample's concentration. For the thyroid hormonal and the 25-hydroxyvitamin D (25-OH Vitamin D) tests conducted using DxI Analyzer, this analyzer is an automated immunoassay method called Electro-Chemiluminescent Immunoassay (ECLIA), the validation procedure is done according to CAP and ECLIA for precision, accuracy, and linearity. The results analysed by SPSS version 26 (IBM, Armonk, NY, USA), mean and standard deviation were calculated; independent t-test, Chi-squares, one-way analysis of variance statistical tests were used for comparison, and linear regression was used for comparison and correlation analysis. The p-value was obtained to assess the significance of the results when a p-value of <0.05 was considered significant.

Results.

This study was conducted on 180 participants, including male and female patients with hypothyroidism and healthy controls. The mean of age showed no significant difference between hypothyroidism patients (49.84 ± 17.27) and healthy individuals (47.91 ± 16.27) (p = 0.959) (Table 1). The mean of Thyroid-stimulating hormone (TSH) levels significantly increased in hypothyroidism patients (18.10 ± 20.68 µIU/mL) than healthy individuals (1.85 ± 0.79 µIU/mL, p < 0.001), while the mean of free thyroxine (FT4) decreased in hypothyroidism patients (12.47 ± 3.70) compared to (15.65 ± 2.40 pmol/L) in healthy individuals (p = 0.001). Observed from these results significant reduced in the mean of calcium levels in hypothyroidism patients (9.08 ± 0.61 mg/dL) compared to healthy individuals (9.36 ± 0.32 mg/dL) with p. value < 0.001, for serum 25-hydroxyvitamin D observed decreased the mean of hypothyroidism patients (19.99 ± 9.74 ng/mL) than in the mean of healthy individuals (34.64 ± 13.06 ng/mL, p = 0.012). Conversely, the uric acid means levels (5.55 ± 1.50 mg/dL) increased among hypothyroidism patients compared to the healthy individuals (4.79 ± 1.09 mg/dL, p = 0.015) (Table 2). A pearson correlation analysis showed a weak negative relationship between serum uric acid, TSH and FT4 (r = –0.082, p = 0.441), (r = 0.005, p = 0.966) respectively (Table 3). The scatter plot analyses showed strong inverse relationships between serum uric acid and both calcium and 25-hydroxy vitamin levels. increased concentrations of uric acid revealed strong negative correlation with the calcium levels (r = −0.847, p = 0.0). Similarly, uric acid levels were inversely associated with 25 OH vitamin D showed a significant negative correlation (r = −0.706, p < 0.001). In both cases, the linear regression lines further confirmed that higher uric acid values correspond to progressively lower calcium and 25 OH vitamin D levels (Figures 1 and 2). Among hypothyroid patients 54 had normal and 36 had elevated uric acid levels, 12 males and 42 females had normal levels while 16 males and 20 females showed elevated levels of uric acid metabolism. Gender-based comparisons revealed raised mean TSH in females (20.49 ± 23.58 µIU/mL) than males (12.83 ± 10.55 µIU/mL) (p = 0.104) and FT4 significantly higher in males (13.70 ± 3.41 pmol/L) than females (11.91 ± 3.72 pmol/L, p = 0.033). Calcium (p = 0.205) and vitamin D (p = 0.777) no significant gender differences, while uric acid significantly increased in males (6.11 ± 1.62 mg/dL) than females (5.30 ± 1.38 mg/dL) (p = 0.016) (Table 4 and Figure 3). Across age groups, TSH, FT4, vitamin D and uric acid showed no significant difference but the calcium levels differed significantly increased the mean of patients aged 51–60 years (9.33 ± 0.61 mg/dL) and decreased in those > 60 years (8.73 ± 0.69 mg/dL) (p = 0.011) (Table 5 and Figure 2).

Discussion.

Our study revealed significant results obtained from the evaluation of biochemical markers in patients with hypothyroidism, because blood calcium and uric acid levels are inversely correlated, hypothyroidism patients a raised in uric acid levels as their calcium levels declined. This adverse connection showed underlying hypothyroidism-related metabolic abnormalities, which could have therapeutic ramifications. In this study we discovered that individuals with hypothyroidism often had total serum calcium levels between (8.5 and 10.3 mg/dL), which is below normal. This result is aligned with another study that found hypocalcemia to be a prevalent trait in individuals with hypothyroidism. For example, a study conducted by Kaur et al. (2018) discovered that low blood calcium levels are often linked to hypothyroidism because of reduced intestinal absorption of calcium and poor bone resorption [12]. The decrease of calcium levels in our results provided more evidence that a thyroid hormone insufficient had a negative effect on calcium metabolism. Within our study sample, 25-(OH)-Vitamin D levels varied from deficient (<20 ng/mL) to insufficient (21-29 ng/mL), with only a small number of individuals achieved normal levels (30- 100 ng/mL). This is consistent with the results of Mackawy et al. (2013), who found that patients with hypothyroidism had a significant rate of vitamin D insufficiency. In hypothyroidism a vitamin D shortage can worsen the condition's already impaired calcium metabolism, which might result in further issues [13]. Our results focused on the need to routinely check vitamin D levels in hypothyroid individuals and imply that supplements could be helpful. According to our study, many hypothyroidism patients had uric acid levels that were higher above the adult normal range (3.4–7.0 mg/dL for male and 2.4–6.0 mg/dL for female). This finding is consistent with the study conducted by

Table 1. *Characteristics of study subjects.*

Characteristics			Study subjects		P-value
			Hypothyroidism N=90	Healthy individuals N=90	
Age	Mean ± SD/ years		49.84 ± 17.27	47.91 ± 16.27	0.959
	Range / years		(21 - 95)	(18 - 79)	
Gender	Number of Patients participants	Male	28	28	1.00
		Female	62	62	

• *T. independent test: used to obtain P. value.*
• *Chi square test: used to obtain P. value.*
• *P.value < 0.05 (significance)*

Table 2. *Comparison of Mean TSH, FT4, Calcium, 25-Hydroxyvitamin D and Uric Acid Levels Between Hypothyroid Patients and Healthy individuals.*

Parameters	Study subjects (Mean ± SD)		P-value
	Hypothyroidism N= 90	Healthy individuals N=90	
TSH ulU/mL	18.10 ± 20.68	1.85 ± 0.79	<0.001
FT4 pmol/L	12.47± 3.70	15.65 ± 2.40	0.001
Calcium mg/dL	9.08 ± 0.61	9.363± 0.32	<0.001
25 OH vitamin D ng/mL	19.99± 9.74	34.64± 13.06	0.012
Uric acid mg/dl	5.55 ± 1.50	4.79± 1.09	0.015

• *T. independent test: used to obtain P. value.*
• *P.value < 0.05 (significance).*

Table 3. *Pearson Correlation of Uric Acid with TSH and FT4 Levels in Hypothyroid Patients.*

Parameters		Uric acid (mg/dL)	TSH (uIU/mL)	FT4 (pmol/L)
Uric Acid (mg/dL)	Pearson Correlation	1	-.082	.005
	Sig. (2-tailed)	-	.441	.966
	N	90	90	90
TSH (uIU/mL)	Pearson Correlation	-.082	1	-.478**
	Sig. (2-tailed)	.441	-	<.001
	N	90	90	90
FT4 (pmol/L)	Pearson Correlation	.005	-.478**	1
	Sig. (2-tailed)	.966	<.001	-
	N	90	90	90

• *Pearson`s Correlation.*
• *P.value < 0.05 (significance).*

Table 4. *Comparison of Mean TSH, FT4, Calcium, 25-Hydroxyvitamin D and Uric Acid Levels by Gender.*

Parameters	Gender Mean ± SD		P-value
	Males N= 28	Females N=62	
TSH; ulU/mL (mean ± SD)	12.83± 10.55	20.49± 23.58	0.104
FT4 pmol/L	13.70± 3.41	11.91±3.72	0.033
Calcium mg/dL	9.20± 0.64	9.03± 0.59	0.205
25 OH D ng/mL	20.43± 10.80	19.80± 9.31	0.777
Uric Acid mg/dl	6.11± 1.62	5.30± 1.38	0.016

• *T. independent test: used to obtain P. value.*
• *P.value < 0.05 (significance).*

Table 5. *Comparison of Mean TSH, FT4, Calcium, 25-Hydroxyvitamin D and Uric Acid Levels by Age Groups.*

Parameters	Age categories (Mean ± SD)					P-value
	21-30 years N= 13	31-40 years N= 16	41-50 years N= 19	51-60 years N= 19	> 60 years N= 23	
TSH ulU/mL	25.80± 32.17	15.15± 8.71	13.03± 11.21	13.79± 20.41	23.56± 23.65	0.223
FT4 pmol/L	11.09± 3.58	12.0±2.93	12.30± 4.55	13.61± 3.27	12.76± 3.79	0.407
Calcium mg/dL	9.0± 0.51	9.15± 0.46	9.25± 0.53	9.33± 0.61	8.73± 0.69	0.011
25 OH D ng/mL	18.68± 4.96	21.34± 14.50	15.59± 6.03	24.36± 12.40	19.82± 5.96	0.079
Uric Acidmg/dl	5.0± 1.59	5.60± 1.43	5.38± 1.02	5.58± 1.27	5.93± 1.93	0.480

• *One-way ANOVA: used to obtain P. value P.value < 0.05 (significance)*
• *P.value < 0.05 (significance).*

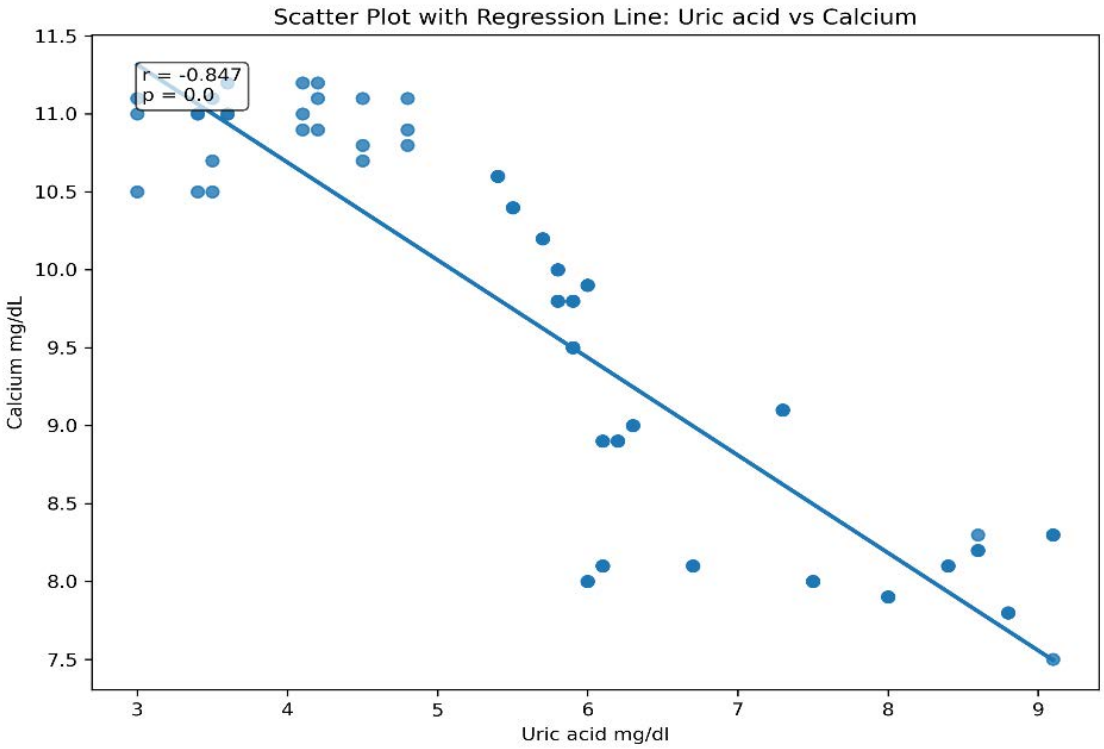

Figure 1. *Strong Negative Correlation Between Uric Acid and Calcium Levels (R = -0.847, P < 0.001).*

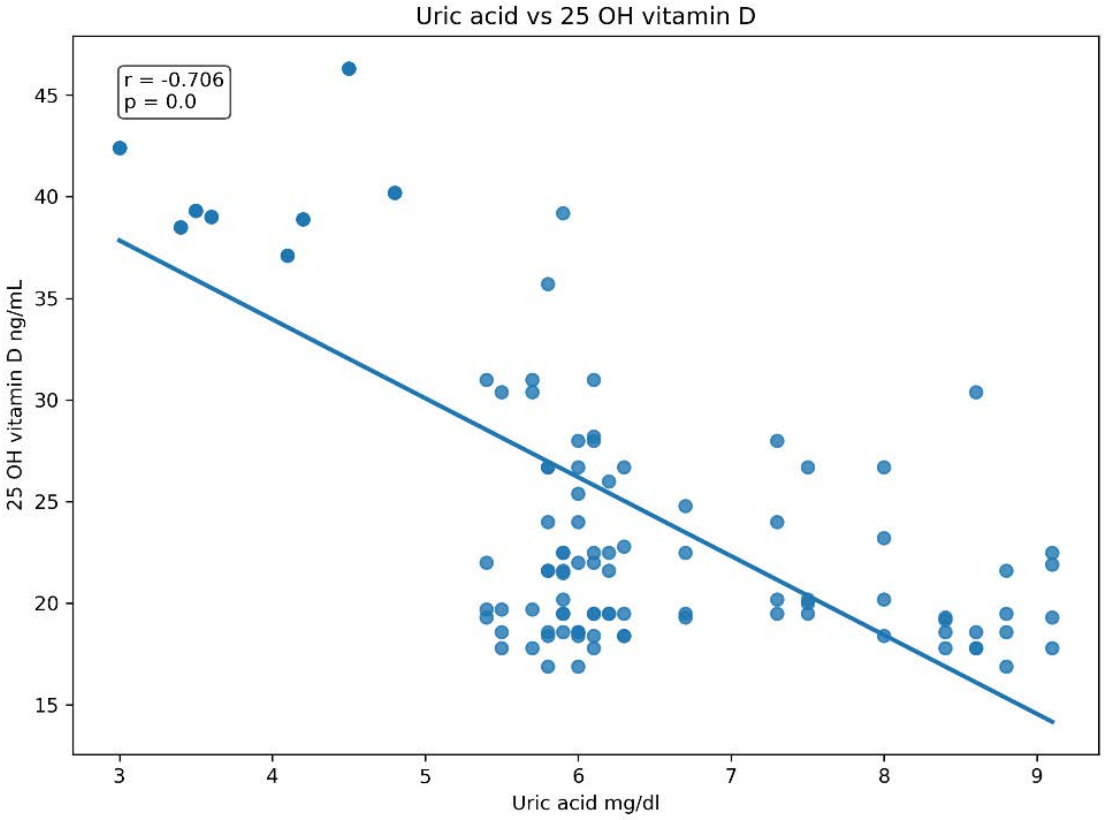

Figure 2. *Negative Correlation Between Uric Acid and 25-OH Vitamin D Levels (R = -0.706, P < 0.001).*

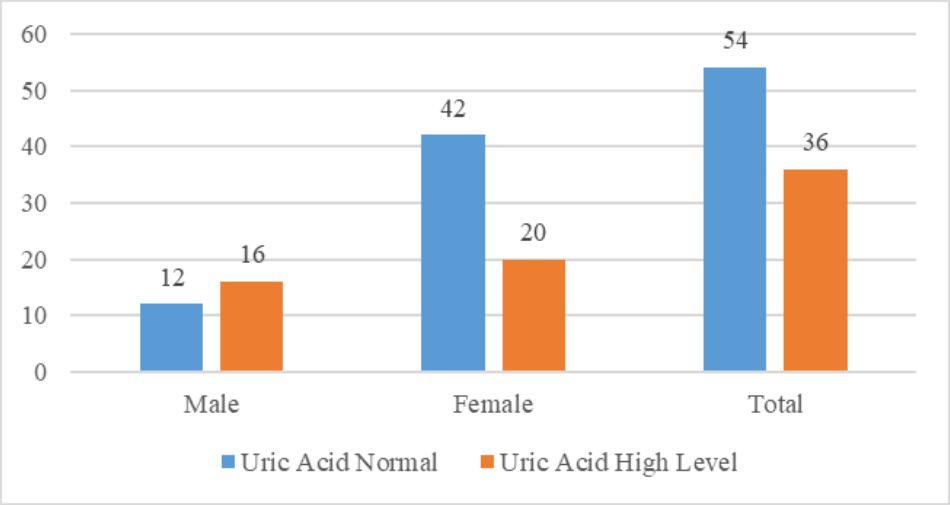

Figure 3. *Distribution of Uric Acid Levels According to Gender.*

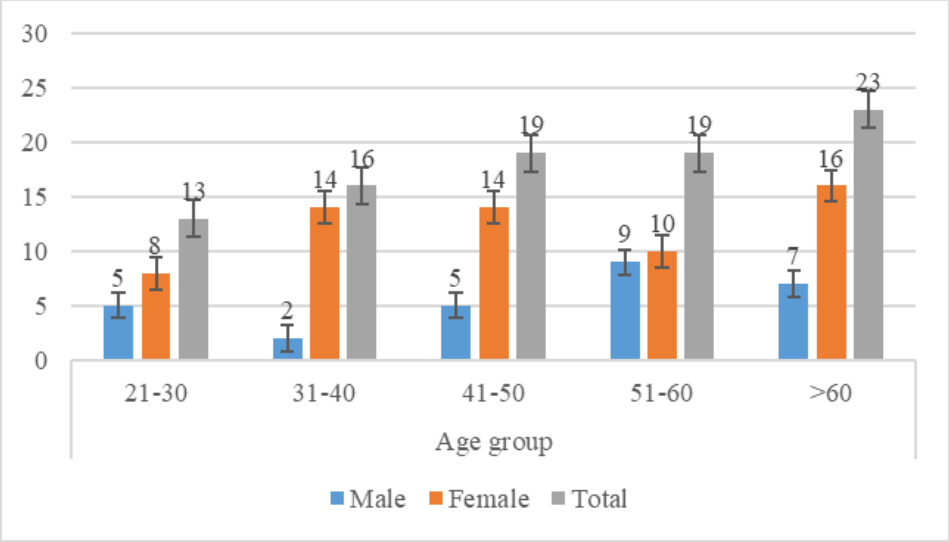

Figure 4. *Distribution of Patients According to Age Group and Gender.*

Choudhury et al. (2017), which found that hypothyroidism often results in hyperuricemia because of reduced uric acid clearance by the kidneys [14]. The significance of uric acid monitoring in these patients is underscored by the higher uric acid levels in our patients, which may show a predisposition to gout and other uric acid- related diseases in persons with hypothyroidism. Our results revealed a substantial negative relationship between blood calcium and uric acid levels, showing that people with hypothyroidism may have greater uric acid levels when their calcium levels are lower. The study of Al-Jurayyan et al. (2014), which also found an inverse association between calcium and uric acid levels in individuals with metabolic diseases, can be used to support this conclusion [15]. Furthermore, we found that there was a negative relationship between uric acid and 25-hydroxyvitamin D levels. Studies show that vitamin D supplementation can affect uric acid metabolism and are consistent with this link. It may do so via enhancing renal function and lowering inflammation (Nimitphong H et al., 2021) [16]. Our results have important therapeutic ramifications. Osteomalacia and hyperuricemia are two consequences of hypothyroidism that must be avoided by controlling calcium and vitamin D levels. Consistent observation and suitable supplementation of these nutrients may enhance the results for patients. Our study showed that managing these metabolic abnormalities ought to be a key part of treating hypothyroidism. The results of this investigation added to the increased amount of data about the intricated interactions among uric acid, calcium, and vitamin D in individuals with hypothyroidism. Comprehending these correlations is important in formulated focused therapies aimed at enhancing the general health and welfare of hypothyroid individuals.

Conclusion.

Significant negative relationships between calcium, 25-hydroxyvitamin D and serum uric acid levels in individuals with hypothyroidism showed by this study. The complex metabolic relationship in hypothyroidism is focused by the inverse correlations between uric acid and calcium as well as uric acid and 25-hydroxyvitamin D.

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Competing Interests.

The authors declare that they have no competing interests.

Author contribution.

1: Participant recruitment and data collection.
1,10: Laboratory investigations and biochemical analyses.
2,8: Data curation and statistical analysis.
4,7: Interpretation of results.
3,6: Manuscript drafting.
5,9: Critical revision for important intellectual content.

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