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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.

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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. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგის 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.

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EVALUATION OF VITAMIN D SERUM LEVELS AND THYROID FUNCTION TEST IN HYPOTHYROIDISM IRAQI PATIENTS

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Abstract.

Background: The role of Vitamin D is primarily to maintain calcium and phosphate levels in the bloodstream. Significantly, steroid hormone receptors are the binding sites for both vitamin D and thyroid hormone. However, the vitamin D and thyroid function relationship is still not fully understood. The study aims to measure vitamin D serum levels and to investigate its relation with hypothyroidism in Iraq patients.

Methods: This case-control study was carried out during the period from the first of March to the end of May 2023 in Baghdad City, Iraq. The study included 90 subjects that were divided into 2 groups. The first group consists of 60 people infected with hypothyroidism. The second group (control group) consists of 30 healthy people. Blood samples were assessed for serum vitamin D, TSH, T3 and T4 using a chemiluminescence microparticle immunoassay analyzer while serum anti-TPO used an enzyme-linked immunosorbent assay technique.

Results: The study showed that the level of T3, T4 and vitamin D in hypothyroidism patients significantly decreased compared to the control group (p-value < 0.001). While TSH and anti-TPO levels in hypothyroidism patients significantly increase in comparison to the control group (p-value < 0.001). The study found a significant negative correlation between (vitamin D and T3) with (p-value < 0.01), while the study showed a significant positive correlation between (TSH and vitamin D) with (p-value < 0.01). Finally, the study demonstrated a non-significant weak negative correlation (p-value > 0.05) between (vitamin D and T4), but a non-significant weak positive correlation (p-value > 0.05) between (vitamin D and anti-TPO).

Conclusion: Patients with hypothyroidism had noticeably low levels of vitamin D, indicating that this vitamin D may be involved in the aetiology of hypothyroidism.

Key words. Hypothyroidism, Vitamin D, TSH, T3, T4, anti-TPO.

Introduction.

The thyroid gland is a vascular, reddish-brown, butterfly-shaped endocrine gland that is located in the midline of the anterior neck. It runs normally from the fifth cervical (C5) level to the first thoracic (T1) vertebra. The gland is the largest endocrine gland and typically weighs between 15 and 25 g [1]. By creating and releasing (secreting) specific hormones, it is a component of the endocrine system and regulates many vital bodily processes [2]. The primary responsibility of the thyroid is to regulate metabolic rate, which is the pace at which the body converts food into energy [3]. Hypothyroidism occurs when the thyroid gland is unable to produce enough thyroid hormone to maintain healthy physiological function. Low thyroid hormone levels make it challenging for body cells

to obtain enough thyroid hormone, which causes a sluggish metabolism [4]. Thyroid function can be sensitively detected by measuring serum Thyroid Stimulating Hormone (TSH) level. Subclinical hypothyroidism is the diagnosis if TSH is elevated, and thyroxine (T4) is normal. Central hypothyroidism may be the diagnosis if TSH is normal and T4 is low [5].

Vitamin D, also known as calciferol, which is fat-soluble, undergoes two hydroxylation processes in the liver and kidneys before being canonically transformed in vivo to the active hormone calcitriol or 1,25-dihydroxycholecalciferol [6]. Serum 25-hydroxy vitamin D measurement is used to determine the level of circulating VIT-D. Maintaining calcium and phosphate balance depends on the hormone calcitriol, which is the active form of vitamin D, known as 1,25-dihydroxy vitamin D (1,25(OH)₂D) as well, is produced mostly in the kidney [7,8].

Calcium and phosphate from the intestines are absorbed, used, and deposited in bone tissue under the control of vitamin D [9]. When blood calcium levels are low, the parathyroid hormone (PTH), which controls this process, increases the release of calcium from bone tissue [10]. Significantly, steroid hormone receptors are the binding sites for both vitamin D and thyroid hormone. People with autoimmune thyroid diseases such as Graves' disease and Hashimoto's thyroiditis have been demonstrated to be predisposed by a distinct gene in the vitamin D receptor. Patients with thyroid issues should be aware of how the vitamin D system functions for these reasons [11]. Compared to controls, patients with hypothyroid dysfunction had significantly lower serum levels of vitamin D but it has not that big role in early hypothyroid disorders [12]. The study aims to measure vitamin D serum levels and to investigate its relation with hypothyroidism in Iraq patients.

Subjects and Methods.

This case-control study was carried out during the period from the first of March to the end of May 2023 in Baghdad City, Iraq. The study included 90 subjects that were divided into 2 groups. The first group consists of 60 people infected with hypothyroidism. The second group (control group) consists of 30 healthy people. Blood samples were assessed for serum vitamin D, TSH, Triiodothyronine (T3) and T4 using a chemiluminescence microparticle immunoassay analyzer while serum Anti-Thyroid Peroxidase (anti-TPO) using enzyme-linked immunosorbent assay technique.

The included participants were aged (18-70 years old) men and women, of them 30 were healthy people (for the control group) and 60 people were infected with hypothyroidism.

The study was approved by the Scientific Committee at Tikrit University - College of Medicine, and the agreement of the attendance to Salah al-Din General for collecting the samples

from the patients was approved via the Directorate of Salah al-Din Health.

All participants who agreed to be enrolled in the study were recruited and an interview was carried out with these patients using a questionnaire form designed by the investigator including Age, weight, body mass index (BMI), history of diagnosis and treatment, and demographic background. The study was approved by the ethical committee of Tikrit University, College of Medicine. All data were presented as mean and standard deviation (SD). Statistical analysis was implemented with correlation analysis and t-test. A p-value of less than 0.05 was regarded as significant and a value of less than 0.01 was considered as highly significant. Analysis was performed by International Business Machine Statistical Package for Social Sciences (IBM SPSS) Statistics for Windows version 23.0.

Results.

The study showed that the highest (mean \pm SD) of TSH, T4, Anti-TPO was recorded in hypothyroidism patients comparing with the control group (5.754 ± 0.214 versus 3.155 ± 0.814 μ IU/mL), (48.65 ± 9.90 versus 121.7 ± 25.2 μ g/dL) and (37.34 ± 8.03 versus 14.52 ± 3.33 U/mL), respectively. The lowest (mean \pm SD) of T3 and vitamin D was observed in hypothyroidism patients concerning the control group (1.012 ± 0.110 versus 2.589 ± 0.242 ng/mL), (14.35 ± 2.01 versus 37.31 ± 4.41 ng/mL), respectively. The difference was highly significant (p-value < 0.001) as shown in (table 1).

Correlations were carried out between vitamin D levels and other parameters. Highly significant positive correlations were found in hypothyroidism patients between vitamin D and TSH (p-value < 0.01) as illustrated in (table 2), whereas highly significant negative correlations were found between vitamin D and T3 (p-value < 0.01), as depicted in (table 2). Lastly, the study demonstrated a non-significant weak negative correlation

Table 1. Comparison of measured parameters between hypothyroidism patients and control group.

Parameter	Hypothyroidism Patients	Control Group	P value
TSH (μ IU/mL)	5.754 ± 0.214	3.155 ± 0.814	0.0007
T3 (ng/mL)	1.012 ± 0.110	2.589 ± 0.242	0.0008
T4 (μ g/dL)	48.65 ± 9.90	121.7 ± 25.2	0.0006
Anti-TPO (U/mL)	37.34 ± 8.03	14.52 ± 3.33	0.0007
Vitamin D (ng/mL)	14.35 ± 2.01	37.31 ± 4.41	0.0008

Table 2. Correlation between all parameters in hypothyroidism patients.

Measured Parameters	TSH	T3	T4	Anti-TPO	Vitamin D	
TSH	Pearson r	1	- 0.313	- 0.083	0.199	0.989
	P value		0.017	0.537	0.134	0.001
T3	Pearson r	- 0.313	1	0.128	-0.072	- 0.346
	P value	0.017		0.329	0.582	0.007
T4	Pearson r	- 0.083	0.128	1	0.126	- 0.074
	P value	0.537	0.329		0.336	0.574
Anti-TPO	Pearson r	0.199	-0.072	0.126	1	0.202
	P value	0.134	0.582	0.336		0.121
VIT-D	Pearson r	0.989	- 0.346	- 0.074	0.202	1
	P value	0.001	0.007	0.574	0.121	

(p-value > 0.05) between (vitamin D and T4), but a non-significant weak positive correlation (p-value > 0.05) between (vitamin D and anti-TPO), as shown in (table 2).

Discussion.

Vitamin D levels differ significantly between hypothyroidism patients and the control group (P < 0.001). Multiple studies have linked low serum levels of vitamin D to hypothyroidism. Patients with hypothyroid dysfunction showed much lower serum vitamin D compared to controls [12]. Another study concluded that there was a significant decrease in hypothyroid women in comparison to healthy controls and that deficiency in the body's vitamin D level negatively affects the immune system [3].

There may be two potential reasons why serum vitamin D levels are low in hypothyroid patients: First, owing to the poor absorption of vitamin D from the gut is a contributing factor. The bodies of these patients also do not react well to vitamin D [14]. Second, the body might not correctly activate vitamin D. Notably, steroid hormone receptors are the same receptors that are bound by thyroid hormone and vitamin D. It was discovered that a distinct gene in the vitamin D receptor predisposes persons to autoimmune thyroid disease, encompassing Graves' disease and Hashimoto's thyroiditis [15].

In this study, there was a highly significant positive relation between vitamin D and TSH (P < 0.01). However, couple of studies found a negative correlation between serum vitamin D and TSH levels in primary hypothyroidism [16,17]. This may be attributed to different methodologies, various cut-off points, study population involved, season-to-season variation and time of sampling.

In contrast, highly significant negative correlations were found between vitamin D and T3 (p-value < 0.01). Despite that, it has been found that hypothyroidism has a strong positive correlation between serum-free T3 and vitamin D levels [18,19].

The conflicting and inconsistent findings of the studies are partially attributable to interlaboratory and interassay variability in measurements of 25 (OH) vitamin D, seasonal variations in 25 (OH) vitamin D blood sampling, variations in the patient selection process, dietary vitamin D intake, sun exposure, and the various cutoff levels used to define vitamin D deficiency or insufficiency.

However, a non-significant weak negative correlation (p-value > 0.05) between (vitamin D and T4) was observed. Other studies found a non-significant positive correlation between serum vitamin D and T4 [15,18]. Likewise, another study found a positive correlation between the mentioned variables [19]. The contrary and insignificant correlation might be due to the small number of participants in the study, and the fact that blood samples were collected in the winter season in which vitamin D is affected by season-to-season variations that might mask and conceal the causal relation between vitamin D and T4. The importance of vitamin D supplementation should be considered in the light of frequently reported vitamin D deficiency [20,21]. In addition, vitamin D has been shown to have a great impact on arthritis and postmenopause [22,23]. However, interaction with other drugs or diseases having same impact on thyroid function should be considered [24,25].

Conclusion.

patients with hypothyroidism tend to have noticeably low levels of vitamin D in their blood, further supporting the notion that there may be an association between the two. Vitamin D plays a crucial role in various bodily functions, including bone health, immune system regulation, and hormone production. The thyroid gland, responsible for producing hormones that regulate metabolism, may be affected by insufficient levels of vitamin D in the body. Although the exact mechanisms underlying this relationship are not yet fully understood, it is believed that vitamin D may influence the functioning of the thyroid gland and the synthesis of thyroid hormones. Further research is required to investigate the precise nature of this association and to determine whether vitamin D supplementation could potentially be beneficial for individuals with hypothyroidism. Nonetheless, these findings shed light on the importance of maintaining adequate levels of vitamin D for overall health and suggest a potential avenue for further exploring the aetiology and treatment of hypothyroidism.

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