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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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THE RELATIONSHIP BETWEEN CONNECTIVE TISSUE DYSPLASIA AND OSTEOPENIA IN CHILDREN

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Abstract.

Abstract: The high prevalence of musculoskeletal disorders among children and adolescents determines significant interest from researchers and clinicians in these conditions. Among their causes are reduced bone mineral density (BMD) and undifferentiated connective tissue dysplasia (UCTD). The pathogenesis of both conditions may be associated with trace element imbalances.

Aim of the Study: To determine the frequency and pathogenetic relationships between UCTD and osteopenic syndrome in children.

Materials and Methods: The group of examined children included 375 respondents (137 boys and 238 girls) from 3 to 16 years old (average age – 10.8±0.2 years).

The diagnosis of UCTD was made according to the criteria of the guidelines for "Hereditary Disorders of Connective Tissue Structure and Function." All children had determined their daily calcium and vitamin D intake. Objective criteria included blood levels of 25-hydroxyvitamin D (25(OH)D), calcium, and magnesium. Densitometry of the calcaneus was performed using a Sunlight 2000 device. The $\chi 2$ criterion was used to analyze contingency tables, including for arbitrary tables.

Results: A strong association between osteopenic syndrome and the presence of UCTD was identified. When analyzing the effect of UCTD on the frequency of decreased BMD, the following statistically significant indicators were determined: $\chi^2 = 37.580$, critical value $\chi^2 = 9.21$, $p < 0.001$. This level of significance was found between all three groups—absence of UCTD, grade 1, and grades 2–3.

A significant increase in the frequency of insufficient dietary intake of vitamin D was observed in children with reduced BMD ($\chi^2 = 15.848$, critical value $\chi^2 = 13.277$, $p = 0.004$). Similar associations were found for calcium intake ($\chi^2 = 15.043$, critical value $\chi^2 = 13.277$, $p = 0.005$). Reduced magnesium levels were more characteristic of the subgroup of children with UCTD.

For all three parameters, the highest frequency of deficiency was found in the group with a combination of osteopenic syndrome and UCTD. Differences compared to the group without pathological conditions were as follows: for 25(OH)D – RR = 3.38 ($\chi^2 = 47.408$, critical value in all cases $\chi^2 = 11.345$; $p < 0.001$), for calcium – RR = 3.38 ($\chi^2 = 35.831$; $p < 0.001$), and for magnesium – RR = 3.38 ($\chi^2 = 20.802$; $p < 0.001$).

Conclusion: The identified features of vitamin D, calcium, and magnesium intake and metabolism in children with combined decreased BMD and UCTD require special attention, as they may represent additional risk factors for the progression of these conditions and the development of complications. Their correction requires comprehensive pharmacological prevention with periodic monitoring of results.

Key words. Undifferentiated connective tissue dysplasia, osteopenic syndrome, vitamin D, calcium, magnesium.

Introduction.

Currently, there is not only a very high prevalence of musculoskeletal disorders among children and adolescents, but also a continuing upward trend [1]. This is primarily associated with lifestyle factors and a sharply reduced level of physical activity; however, other physiological causes also play a role. One of these may be the high frequency of osteopenic syndrome [2-4]. This pathological condition, in turn, may be linked to the widespread occurrence of undifferentiated connective tissue dysplasia (UCTD) in the population [5].

Aim of the Study. To determine the frequency and pathogenetic relationships between UCTD and osteopenic syndrome in children.

Materials and Methods.

The general group included 375 children (137 boys and 238 girls) aged from 3 to 16 years (average 10.8±0.2 years). Children were included in the study with the informed consent of themselves (over 14 years of age) and/or their parents (guardians).

The diagnosis of UCTD was determined by applying the diagnostic framework described in the clinical recommendations devoted to hereditary disorders affecting the structure and functional properties of connective tissue. These guidelines served as the primary reference for evaluating the relevant clinical signs and laboratory findings necessary to confirm the condition [6].

For all participants, the average daily intake of calcium (mg) and vitamin D (IU) from dietary sources was assessed. The estimation of calcium consumption was performed by calculating its total amount in the dairy products included in the individual's diet—considered the primary source of this mineral for this age group—and by adding the approximate contribution from other food categories, which commonly provide around 350 mg. The daily intake of vitamin D was derived using tabulated data on its concentration in various food items, combined with the weekly dietary patterns reported by each participant [7]. Nutrient intake levels were classified as low (below 50% of the recommended value), insufficient (50–85%), or adequate (above 85%).

To determine the concentration of (25(OH)D) in the blood [8], an enzyme-linked immunosorbent assay was performed using the test systems of Bio Khim Mak CJSC. Three gradations of vitamin D content were distinguished: deficiency (0-20 ng/ml), insufficiency (21-29 ng/ml), and optimal (30-75 ng/ml) [9].

Calcium concentration was determined using a standardized colorimetric method.

Calcaneal bone densitometry was performed using a Sunlight 2000 device using the BMD reduction criteria for the Asian population [10].

A survey of respondents was conducted to identify the characteristics of the pathological conditions under study. Information was collected regarding prior low-energy fractures, a reduced BMI (below 20 kg/m²) and/or body weight falling short of age-specific reference values, insufficient intake of calcium and vitamin D, as well as the presence of clinical conditions known to contribute to secondary osteopenia, such as rheumatoid arthritis, type 1 diabetes, and hyperthyroidism. Levels of habitual physical activity were also evaluated. In addition, a family history of fragility fractures among first-degree relatives was documented.

Statistical analysis of the results was performed using SPSS version 20 for Windows. The data processing system included automated quality control of information preparation (excluding results not relevant to the data series according to the Romanovsky criterion) and data grouping according to specified criteria. The $\chi 2$ criterion was used to analyze contingency tables, including for arbitrary tables [11]. For statistical analysis, the critical significance level p was set to 0.05.

Results.

A survey of the entire contingent of children was conducted regarding the presence of osteopenic syndrome and UCTD depending on age (Figure 1).

The mean values for osteopenic syndrome were as follows: osteopenia – 13.6% of the examined group, osteoporosis – 0.8%, which is significantly lower than data reported in many published sources. The overall average frequency was 14.4%. An increase was observed in the 11-16-year age category; however, no significant differences between age groups were found ($\chi^2 = 4.963$, p = 0.084).

In contrast, the frequency of connective tissue dysplasia (CTD) was similar across all age categories (3–7 years – 21.6%; 8–10 years – 19.4%; 11–16 years – 20.5%), with an average value of 20.0%.

Of particular interest were the numerical indicators of the association between osteopenic syndrome and undifferentiated connective tissue dysplasia (UCTD). The analysis results are presented in Figure 2.

High numerical correlations were identified between the presence of osteopenic syndrome and UCTD. When analyzing the effect of UCTD on the frequency of decreased BMD, the following statistically significant values were obtained: $\chi^2 = 37.580$, critical value $\chi^2 = 9.21$, $p < 0.001$. A posteriori analysis revealed that this level of significance was present among all three groups - absence of UCTD, grade 1, and grades 2–3.

In the reverse analysis, the results were as follows: $\chi^2 = 66.669$, critical value $\chi^2 = 9.21$, $p < 0.001$. These differences reflected variations between the osteopenia and normal BMD groups, as the osteoporosis group had an insufficient sample size.

Further analysis was conducted on the data regarding vitamin D, calcium, and magnesium intake and serum levels among the examined children. The obtained results are presented in Tables 1–3 and Figures 3 and 4.

The numerical values of insufficient dietary vitamin D intake among children with UCTD showed minimal differences compared to those without the studied pathological conditions. The presence of osteopenic syndrome demonstrated a significantly higher rate (20.4% versus 7.9%), with the differences determined by factor analysis found to be statistically significant ($\chi^2 = 15.848$, critical value $\chi^2 = 13.277$, p = 0.004).

Low levels of calcium intake were also found in the group of children with osteopenic syndrome and showed significant differences compared to the group without this condition and without UCTD ($\chi^2 = 15.043$, critical value $\chi^2 = 13.277$, p = 0.005).

Insufficient blood levels of the studied vitamin D metabolite and calcium were most pronounced in the osteopenic syndrome group (50.0% versus 19.7% in the group without the studied pathological conditions for 25(OH)D, RR = 2.54, and 40.7%

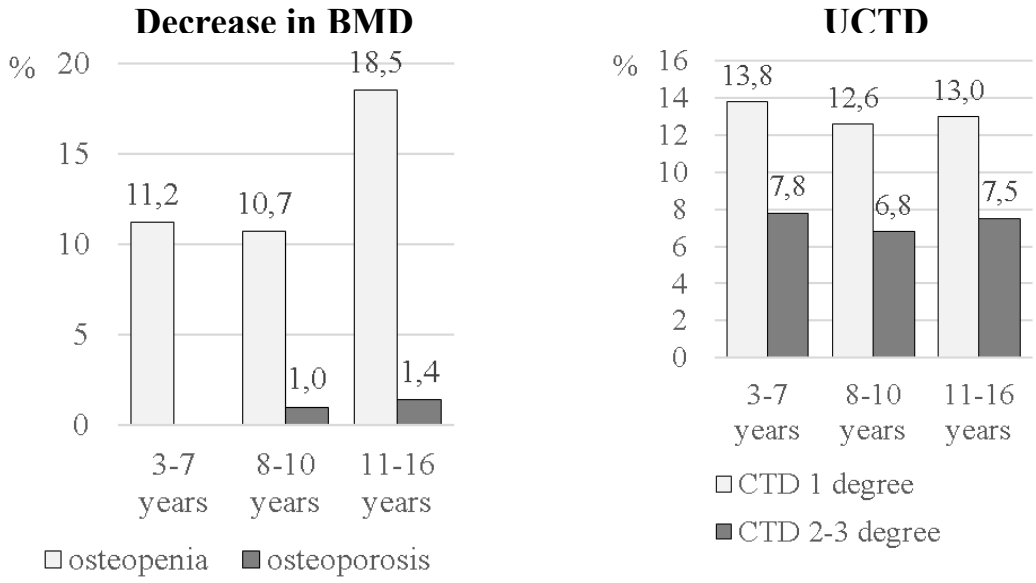

Figure 1. *Frequency of Decreased Bone Mineral Density and Undifferentiated Connective Tissue Dysplasia in the Study Group.*

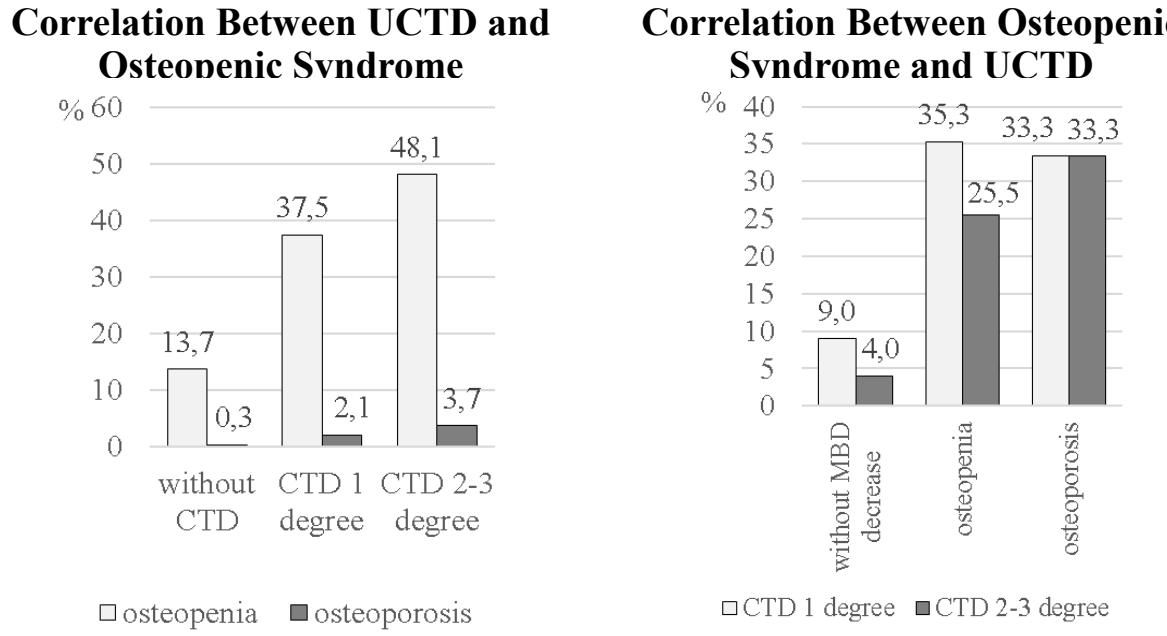

Figure 2. *Indicators of the relationship between the reduction of BMD and UCTD by the frequency of conditions.*

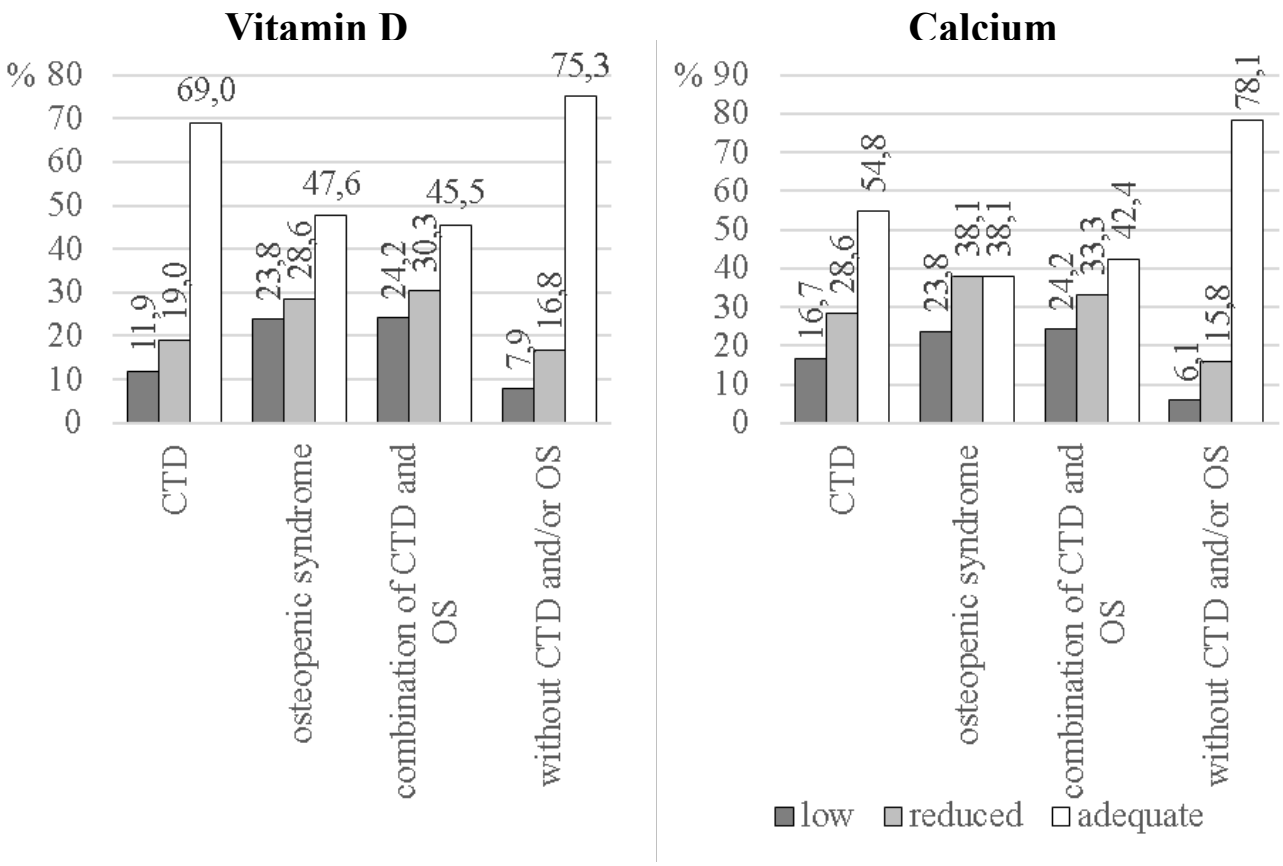

Figure 3. *Frequency of Different Levels of Vitamin D and Calcium Intake Depending on the Presence of Combined Decreased BMD and UCTD.*

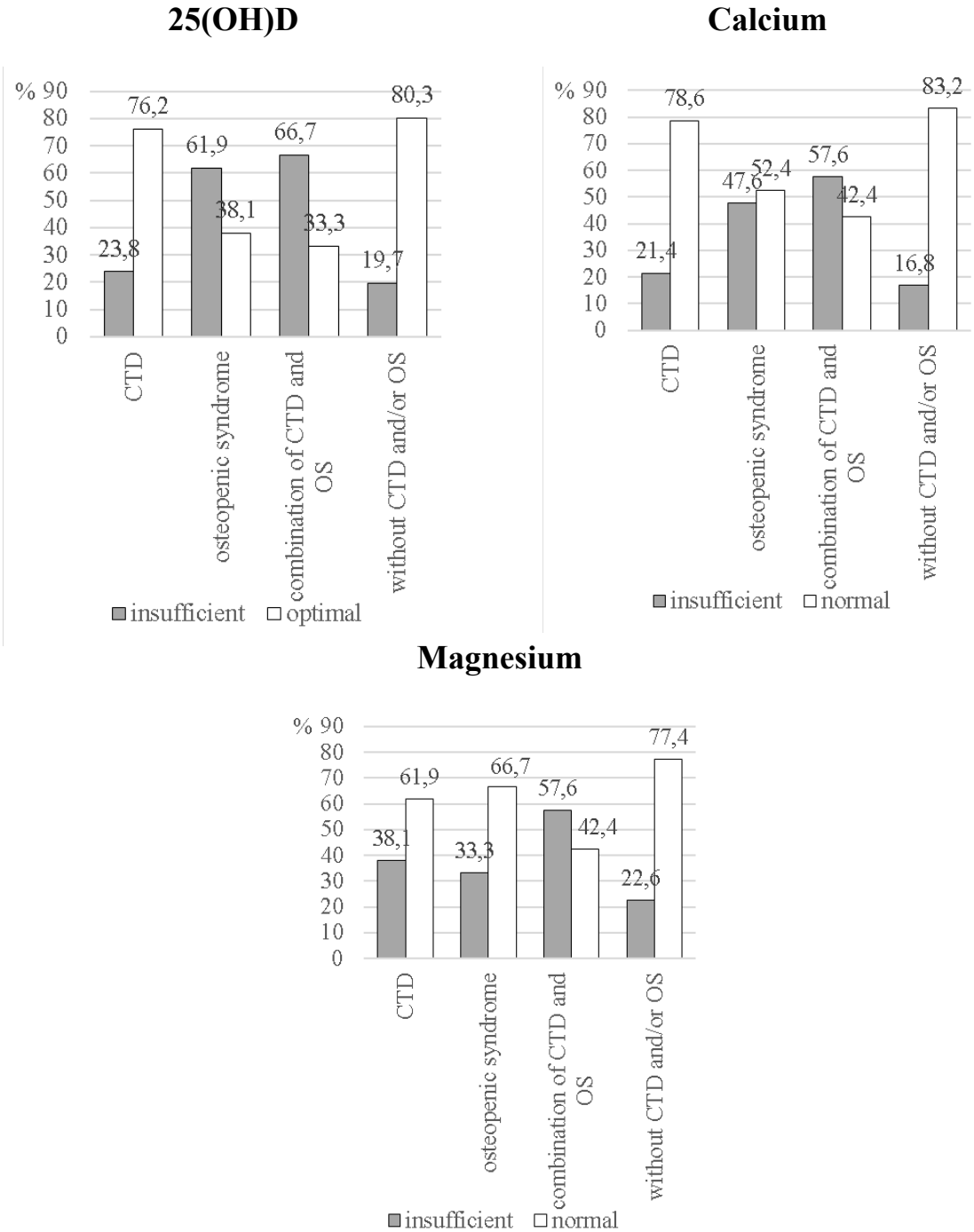

Figure 4. *Frequency of Abnormal Levels of 25(OH)D, Calcium, and Magnesium Considering the Presence of Combined Osteopenic Syndrome and UCTD.*

versus 16.8% for calcium levels, RR = 2.42), while no differences were found in the subgroup with UCTD grade 1.

The opposite situation was observed for magnesium levels, the decrease of which was more characteristic of the subgroup of children with CTD (34.7% versus 22.6%, respectively, RR = 1.54).

Analysis of the same indicators, with a focus on the group with combined osteopenic syndrome and UCTD, yielded the following results. For all three parameters, the highest frequency of insufficient levels of the studied substances was observed in the combination group. Differences compared to the group without pathological conditions were as follows: for 25(OH)D – RR = 3.38 (χ^2 = 47.408, critical value χ^2 = 11.345; $p < 0.001$), for calcium – RR = 3.38 (χ^2 = 35.831; $p < 0.001$), and for magnesium – RR = 3.38 (χ^2 = 20.802; $p < 0.001$).

The lowest values of blood 25(OH)D and calcium content were determined in children with decreased BMD. Regarding the content of the Vitamin D metabolite, the differences compared to those examined without confirmed osteopenic syndrome and UCTD averaged 54.5% for this group, $p<0.001$, and 55.8% for the group with the combination of both conditions, $p<0.001$.

Upon analysis of calcium content, the differences in the first

Table 1. *Calculated Indicators of Vitamin D and Calcium Intake in the Examined Children.*

Examined Group	Vitamin D						Calcium					
	Low		Reduced		Adequate		Low		Reduced		Adequate	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs..	%	Abs..	%
CTD Grade 1, n = 48	4	8,3	7	14,6	37	77,1	5	10,4	9	18,8	34	70,8
CTD Grades 2–3, n = 27	3	11,1	4	14,8	20	74,1	3	11,1	6	22,2	18	66,7
Osteopenia, n = 51	9	17,6	12	23,5	30	58,8	11	21,6	14	27,5	26	51,0
Osteoporosis, n = 3	2	66,7	1	33,3	0	0,0	1	33,3	2	66,7	0	0,0
No Studied Conditions, n = 279	22	7,9	47	16,8	210	75,3	17	6,1	44	15,8	218	78,1
Note – In 33 cases, a combination of decreased BMD and CTD was observed.												

Table 2. *Data on the Frequency of Abnormal Levels of 25(OH)D, Calcium, and Magnesium in the Examined Groups.*

Examined Group	25(OH)D				Calcium				Magnesium			
	Insufficient		Optimal		Insufficient		Normal		Insufficient		Normal	
	абс.	%	абс.	%	абс.	%	абс.	%	абс.	%	абс.	%
CTD Grade 1, n = 48	10	20,8	38	79,2	9	18,8	39	81,3	15	31,3	33	68,8
CTD Grades 2–3, n = 27	8	29,6	19	70,4	7	25,9	20	74,1	11	40,7	16	59,3
Osteopenia, n = 51	24	47,1	27	52,9	19	37,3	32	62,7	14	27,5	37	72,5
Osteoporosis, n = 3	3	100	0	0,0	3	100	0	0,0	2	66,7	1	33,3
No Studied Conditions, n = 279	55	19,7	224	80,3	47	16,8	232	83,2	63	22,6	216	77,4
Note – In 33 cases, a combination of decreased BMD and CTD was observed.												

Table 3. *Mean Levels of 25(OH)D, Calcium, and Magnesium in the Examined Groups.*

Examined Group	Parameter		
	25(OH)D, ng/mL	Calcium, mmol/L	Magnesium, mmol/L
CTD, n=75	61±5	2,31±0,02	0,83±0,05
Decreased BMD, n=54	35±2	2,10±0,02	0,87±0,04
Including the combination of CTD and decreased BMD, n=33	34±3	2,13±0,02	0,81±0,07
No studied conditions, n=279	77±8	2,45±0,03	0,99±0,12

pair of values were 14.3%, p=0.033, and in the second pair, 13.1%, p=0.042.

The concentration of magnesium ions was relatively low in the group of children with CTD (16.2% compared to the group without studied conditions, p=0.040), while the group with osteopenic syndrome did not show significant differences compared to the latter. The lowest magnesium content values were determined in the group with the combination of decreased BMD and UCTD (the differences compared to the group without studied conditions were 18.2%, p=0.027).

Discussion.

Osteopenic syndrome in children is currently a fairly common finding during the corresponding examination. For example, there is data that its prevalence among general school students ranges from 28% to 65% [2]. According to other sources, this figure varies from 15% to 50% or higher [12,13].

Research data conducted in countries with developed healthcare systems are similar to those presented above [14,15].

It should also be noted that osteopenic syndrome is the most important risk factor for the development of musculoskeletal pathology in children and adolescents.

Chronic forms of spinal damage leading to its deformation are quite common [16,17]. In addition, the incidence of traumatic injuries with severe damage, which may be associated with reduced bone strength, is increasing [18,19].

In our study, we identified a very moderate rate of osteopenic syndrome in comparison with published data, which may be due to the study population, which was dominated by children of Kazakh nationality.

Undifferentiated Connective Tissue Dysplasia (UCTD), in turn, is a very widespread pathological condition. When observed in a child - particularly in cases characterized by numerous clinical features and involvement of the cardiovascular system - this condition may indicate a substantially elevated risk of unfavourable consequences. These may range from a higher likelihood of developing morphofunctional abnormalities of the musculoskeletal system [20] to the possibility of sudden cardiac death related to rhythm disturbances [21]. A crucial element of its pathogenesis is the disruption of the metabolism of certain elements, beginning with reduced intake into the body [22].

In our study, the main emphasis was placed on a group of children that was practically not considered before: those with a combination of decreased Bone Mineral Density (BMD) and UCTD. Specifically, we studied the indicators of intake and content of three nutrients vital for both pathological conditions - Vitamin D and the divalent cations calcium and magnesium. Overall, the expected results were obtained, consisting of a

more pronounced reduction in their content in children of the target group. This may serve as a basis for more active drug prophylaxis, which we recommend to prevent the progression of pathological conditions and reduce the risk of complications [23].

We consider the omission of data on the clinical features of the target group - children with a combination of osteopenic syndrome and UCTD compared to others - to be a limitation of the work. These results have been obtained and are planned for future presentation.

Another limitation of this study concerns the indirect estimation methods for dietary intake. The calculation of calcium intake using the sum of dairy calcium content plus a constant value for non-dairy sources represents a simplified model that may reduce precision. Similarly, the assessment of vitamin D intake based on weekly food logs may be affected by recall bias. These methodological features should be taken into account when interpreting the obtained results.

In general, it should be concluded that the clinical significance and features of management of children with common pathological conditions such as osteopenic syndrome and undifferentiated Connective Tissue Dysplasia (UCTD) remain underestimated to this day, which requires additional attention primarily from general practitioners and only in severe forms, from specialists of the relevant clinical profiles.

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Informed Consent Statement.

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement.

Not applicable.

Conflicts of Interest.

None of the authors have any conflicts of interest to disclosure.

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