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Rickets In Children And Methods Of Its Prevention

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Abstract
Rickets is a disease that occurs in children as a result of impaired bone mineralization and is associated with a deficiency of vitamin D, calcium, and phosphorus. This article provides an in-depth analysis of the epidemiology, risk factors, and prevention methods of rickets in children, including studies conducted by Uzbek scientists. A systematic review of 10 scientific sources in the Scopus and PubMed databases for 2015–2025, as well as publications from the Tashkent Pediatric Medical Institute (TashPMI) and Andijan State Medical Institute (ADTI) was conducted. The prevalence of rickets in Uzbekistan depends on climatic factors, dietary habits, and level of education, with the risk reaching up to 80% in premature children. As preventive measures, exposure to sunlight, vitamin D (400–600 IU/ day), and a diet rich in calcium are effective. The prevalence of rickets and preventive measures by age groups are presented in an expanded table. The article provides practical guidelines for the Uzbek healthcare system.
Keywords: rickets, children, vitamin D, calcium, prevention, Uzbekistan, nutritional rickets.

Rickets is a disease that occurs in children as a result of impaired mineralization of the bone growth plates, leading to bone deformity, growth retardation, and muscle weakness. According to the World Health Organization (WHO), rickets remains a major health problem in developing countries (WHO, 2019). The prevalence of rickets in Uzbekistan is associated with low sunlight exposure during the winter season, nutritional problems (lack of vitamin D-rich foods), and low levels of education (Rakhmatova, 2016). Uzbek scientists, in particular, specialists from TashPMI and ADTI, have conducted research on the prevention and treatment of rickets, which has made a significant contribution to the development of preventive strategies in local conditions. This article synthesizes international and domestic research and provides an in-depth analysis of the epidemiology, risk factors, and prevention methods of rickets, with an expanded table by age group.

Literature review. Below is an in-depth analysis of international and Uzbek research on rickets and its prevention:

1. **Pettifor (2004)** Pettifor (2004) highlights vitamin D and calcium deficiencies as the main causes of nutritional rickets. His research shows that rickets is highly prevalent in Africa and Asia, which is relevant for developing countries such as Uzbekistan. The study identified low exposure to sunlight and nutritional problems as the main factors of rickets, which is consistent with the winter conditions of Uzbekistan.
2. **Munns et al. (2016)** Munns et al. (2016) confirm that global consensus is that vitamin D levels below 30 ng/mL are associated with an increased risk of rickets and that vitamin D supplementation of 400 IU/day is effective in preventing rickets in infants. Their work is important in underpinning infant vitamin D supplementation practices in Uzbekistan.
3. **Thacher and Fischer (2006)** Thacher et al. (2006) studied the clinical signs (bone deformity, rachitic rosacea, muscle weakness) and diagnostic methods (X-ray, blood biochemistry) of rickets and found that calcium deficiency, together with vitamin D deficiency, is the main cause of

rickets. This provides an important context for analyzing dietary calcium deficiency in Uzbekistan.

4. **Simm et al (2020)** Simm et al (2020) analyzed the differences between genetic forms of rickets (e.g., X-linked hypophosphatemic rickets) and nutritional rickets, demonstrating the efficacy of novel therapeutic approaches such as burosumab. This provides a direction for studying the incidence of genetic rickets in Uzbekistan.

5. **Lanca et al. (2022)** Lanca et al. (2022) found that the prevalence of rickets among 442 children under 5 years of age in Ethiopia was 3.8%. Male children and insufficient exposure to sunlight were identified as the main risk factors, which is similar to the winter conditions of Uzbekistan.

6. **Rakhmatova Masuma Umarovna (2016)** Uzbek scientist Rakhmatova Masuma Umarovna, in her study conducted in Termez, studied the clinical course and preventive measures of rickets, and concluded that low sunlight exposure and nutritional problems are the main causes of rickets in Uzbekistan. Her work recommends 400 IU/ day of vitamin D and calcium supplements in local conditions, which is consistent with the national health system.

7. **Tashkent Pediatric Medical Institute (TashPMI) (2018)** TashPMI scientists studied the prevalence and treatment of rickets in Uzbekistan and found that the risk of rickets in premature babies reaches 80%. They recommend giving vitamin D (400 IU/ day) and calcium (500–1000 mg/day) starting from the 2nd week, which is in line with WHO guidelines.

8. **Madazimov Madamin Mominovich (2020)** Research led by Professor Madazimov of the Andijan State Medical Institute has developed strategies for preventing rickets in pediatrics in Uzbekistan. They emphasize encouraging vitamin D-rich foods (liver, fish, dairy products) and exposure to sunlight, especially in the winter season.

9. **Holick (2017)** Holick (2017) studied vitamin D metabolism and its role in the prevention of rickets and showed that 10–15 minutes of sunlight exposure provides sufficient vitamin D synthesis. This can be practically applied in the climatic conditions of Uzbekistan.

10. **Aggarwal et al. (2012)** Aggarwal et al. (2012) studied the prevalence and association of rickets with nutrition in a study conducted in India and confirmed the effectiveness of a combination of calcium and vitamin D supplementation (1000 mg/day calcium + 400 IU/day vitamin D). This is useful in developing interventions that are appropriate for the dietary habits of Uzbekistan.

Methodology

This study is based on an analysis of peer-reviewed articles in Scopus and PubMed databases from 2015 to 2025, as well as Tashkent Medical University of Medical Sciences, Tashkent Medical University of Medical Sciences, and local publications in Uzbekistan. Keywords: “rickets”, “children”, “vitamin D”, “calcium”, “prevention”, “Uzbekistan”. For studies in Uzbekistan, “Rakhmatova Ma'suma Umarovna”, “TashPMI”, and “Madazimov Madamin” were searched. The data were summarized using the narrative synthesis method. For statistical analysis, a study conducted in Ethiopia (Lanca et al., 2022) and local data from Uzbekistan were compared. The prevalence of rickets, risk factors , and the effectiveness of preventive measures were assessed by age group. The expanded table presents the prevalence of rickets, risk factors, clinical signs, and preventive measures by age group.

Distribution:

International data: In Ethiopia, the prevalence of rickets in children under 5

years of age is 3.8% (95% CI: 1.90–5.70) (Lanca et al., 2022). In India, the prevalence in children aged 6–12 years is 2.7% (Aggarwal et al., 2012).

Uzbekistan data: TashPMI (2018) data

Age group	Rickets prevalence (%)	Risk factors	Clinical signs	Preventive measures	Source
0–1 year old	5.0% (95% CI: 4.5–5.5)	Premature birth (less than 1500 g), exclusive breastfeeding, lack of sunlight, vitamin D deficiency	Rickets, hypocalcemia, muscle weakness, bone tenderness	400 IU/day vitamin D (starting at week 2), 500 mg/day calcium, exposure to sunlight (10–15 minutes, 8:00–11:00 AM), complementary feeding to breast milk	TashPMI, 2018
1–3 years old	3.5% (95% CI: 3.0–4.0)	Nutritional problems (vitamin D and calcium deficiency), low exposure to sunlight, winter season	Bone deformity (genu varum/valgum), growth retardation, rickets	400–600 IU/day vitamin D, 700 mg/day calcium, foods rich in vitamin D (fish, liver, dairy products), exposure to sunlight	Rakhmatova, 2016
3–6 years old	2.0% (95% CI: 1.8–2.2)	Poor diet, low exposure to sunlight, socioeconomic factors	Bone deformity, muscle weakness, growth retardation	600 IU/day vitamin D, 1000 mg/day calcium, sunlight exposure (10–15 minutes), parent education	TashPMI, 2018
6–12 years old	1.0% (95% CI: 0.8–1.2)	Socioeconomic factors, lack of education, lack of sunlight in the winter season	Bone deformity, growth retardation, fatigue	600 IU/day vitamin D, 1000–1300 mg/day calcium, educational programs, food fortification (dairy products, fish)	Madazimov, 2020

The prevalence of rickets in Uzbekistan is between 2–5%, reaching up to 80% in premature babies. In the winter season, cases increase by 30% (Rakhmatova, 2016).

Risk factors:

Children with vitamin D levels below 10 ng/mL are at high risk of rickets.

In Uzbekistan, low exposure to sunlight, exclusive breastfeeding, black skin color , and socioeconomic factors are the main risk factors (Rakhmatova, 2016).

In premature babies (less than 1500 g), the increased need for calcium and phosphorus increases the risk of rickets (TashPMI, 2018).

Clinical signs: Bone deformity (genu varum, genu valgum), rachitic rosary, muscle weakness, hypocalcemia, and growth retardation.

Prevention:

International recommendations: 400 IU/day of vitamin D is effective in preventing rickets in infants and 600 IU/day in older children (Munns et al., 2016).

Uzbekistan practices: TashPMI recommends giving vitamin D (400 IU/day) and calcium (500–1000 mg/day) to premature infants from the 2nd week and to term infants from the 3rd week. Exposure to sunlight (10–15 minutes) is important (Madazimov, 2020).

Statistical analysis:

In Ethiopia, male children (AOR = 1.59, 95% CI: 1.10–16.57) and insufficient exposure to sunlight (AOR = 3.27, 95% CI: 1.05–5.28) are at increased risk of rickets (Lanca et al., 2022).

In Uzbekistan, TashPMI (2018) found that rickets cases increase by 30% during the winter season, which is associated with a lack of sunlight.

by age group and preventive measures

by age group , risk factors, clinical symptoms, and preventive measures:

by age group and preventive measures

Discussion

The nutritional form of rickets is exacerbated in Uzbekistan by low exposure to sunlight, nutritional problems (lack of vitamin D and calcium-rich foods), and low educational levels. Rakhmatova (2016) notes that in the conditions of Uzbekistan, insufficient exposure to sunlight and cultural factors (wearing full clothes) increase the risk of rickets. Research by ToshPMI (2018) shows that the risk of rickets in premature babies reaches 80%, emphasizing the importance of early preventive measures (vitamin D and calcium supplements). Madazimov (2020) recommends consuming foods rich in vitamin D and encouraging exposure to sunlight, especially in the winter season. Compared to international studies (Pettifor, 2004; Munns et al., 2016), the prevalence of rickets in Uzbekistan has similar factors, but prevention strategies need to be adapted due to local climatic and social factors. For example, Holick (2017) suggests that 10–15 minutes of sunlight exposure is sufficient, but this poses practical challenges in Uzbekistan during the winter season. Aggarwal et al. (2012) confirm the effectiveness of a combination of calcium and vitamin D, which is consistent with Uzbek dietary habits.

Conclusion

Rickets is a major health problem for children in Uzbekistan and is associated with vitamin D and calcium deficiency. Data from ToshPMI (2018) and Rakhmatova (2016) indicate that the risk of rickets in premature babies is up to 80%, with a 30% increase in cases in the winter season. The following preventive measures are recommended:

1. day of vitamin D starting at 2–3 weeks of age .
2. Children older than 6 years of age should receive 600 IU/day of vitamin D and 1000–1300 mg/day of calcium supplements.
3. Exposure to sunlight for 10–15 minutes a day (8:00–11:00 am or after 6:00 pm).
4. foods with vitamin D and calcium (liver, fish, dairy products).
5. Introduce educational programs for parents about rickets.

Further research should focus on the genetic patterns of rickets in Uzbekistan, the effectiveness of long-term preventive measures, and the influence of socioeconomic factors.

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