Original Article

Prevalence of Rickets among Saudi Population in Arar, Saudi Arabia

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ABSTRACT

Background: Rickets is the most common non-communicable disease in pediatrics in developing countries, often observed in societies with strict vegetarian diets and not introduced to foods enriched in vitamin D. This poses a barrier to effective treatment, making it a chronic and often subclinical disease.

Objective: This study aims to assess the prevalence of rickets among Saudi children and infants in Arar, Saudi Arabia, identify risk factors, and assess symptoms.

Methodology: This is a cross- sectional study conducted among Saudi general population in Arar, Saudi Arabia. Adult participants completed a self-administrated questionnaire for their children concerning rickets. All data was entered and analyzed using SPSS 23 with using appropriate statistical methods for description and analysis. P-value less than 0.05 was considered for statistical significance

Results: The study included 393 participants, 21.1% of them were males and 78.9% were females. 51.9% aged between 20- 30 years old. 27.3% of participants reported having a child diagnosed with rickets. Age of child at time of diagnosis was less than 12 months (63.4%), between 12- 24 months (31%) and more than 24 months (5.6%) of diagnosed children. Risk factors were identified as vitamin D deficiency at the time of diagnosis in 81.7%, vitamin D deficiency during pregnancy in 78.9%, preterm labor in 45.1% and artificial breastfeeding in 31% of diagnosed children. 91.5% of diagnosed children improved after adherence to treatment.

Conclusion: Prevalence of rickets among Saudi children is high, and infants and toddlers should be the focus of rickets prevention strategies.

Keyword: Rickets, Vitamin D deficiency, Bone mineralization, Development delay, Saudi Arabia.

Introduction

Rickets is a common non-communicable disease in developing countries, particularly in societies where children are not exposed to foods high in vitamin D [1]. Bony deformities caused by abnormalities of the growth plate cartilage, such as bow-legs and knock-knees, are caused by abnormalities of the growth plate cartilage [2]. Even though there are preventative measures available, the disease is widespread throughout the globe. In contrast to established nations Rickets is more common in developing nations. Countries in Asia, the Middle East, and Africa have incidence rates ranging from 10% to 70% [3] Vitamin D supplementation, legislation to improve air quality, and public awareness of the importance of vitamin D have reduced the prevalence of rickets in developed countries [3]. Most frequently impacting infants and young children, rickets is the most common bone disease though vitamin D deficiency is the primary

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Reason, calcium and phosphate deficiencies are also a major contributor. Vitamin D controls the levels of calcium and phosphorus in the blood, and vitamin D deficiency impairs the osteoblasts' ability to properly mineralize the osteoid they create [4]. Asymptomatic to irritability, growth impairment, and sudden death are all on the continuum of presentation. Rickets needs to be quickly identified and aggressively treated in order to prevent long-term complications. Radiography, biochemical tests, physical examination, and medical history are typically used to confirm the diagnosis [5, 6]. In a cross-sectional study conducted on all children between the northern Saudi Arabian age range of 6 months and 3 years. Alsharif, Mahmoud Mohammed, et al. (2017) found that 9% of the toddlers had rickets. Rickets can arise as a result of chronic illnesses and family members who have the condition, but child sex, age, sibling arrangement, mother's education level, work, father's education level, work, relationship between parents, contact with sunlight, child feeding, vitamin D supplementation, egg consumption, or dairy milk ingesting did not significantly affect rickets [4]. A cross-sectional study on 864 participants in various social media platforms to determine the prevalence of rickets among Saudi Arabian children revealed that 15.3% of the children had the disease, and 50.5% of those diagnosed were between the ages of 0 and 5. Regarding risk factors, 15.4% of the toddlers were obese and 41.9% drank soft drinks. Only 55 % of participants breastfed their children, 35.9 % knew what rickets was, 45.3 percent sought medical attention after their kid was diagnosed, and 75 % believed that vitamin D can prevent rickets [5]. Even though there is a lot of sunlight, nutritional rickets is still a problem in many emerging nations. Despite attempts by medical professionals to lessen the prevalence of the disease, it is still the most prevalent type of growing bone disease. Everywhere in the world, vitamin D deficiency is a major health problems [6- 9]. The creation of region-specific guidelines is hampered by the lack of population-based studies, as well as gaps in research on infants, pre-pubertal children, and teenagers, which represents a significant barrier to tackling this chronic and frequently subclinical disease. Thus, this study aims to assess the prevalence of rickets among Saudi children in Arar, Saudi Arabia.

Methods

Study design: A cross sectional study design was adopted. Study setting: The study was conducted among general population in Arar,saudi

Study period: from December 1st 2021 to February 31st, 2022.

Study population: participants living in Norther Saudi Arabia during study preiod.

Inclusion criteria: Parents, Both genders, Able to read and write independently, Saudi.

Exclusion criteria: Adults have no children, Illiterate, Not consenting or willing to participate.

Sampling and sample size: A randomized sampling technique was adopted. The least Sample size for this study was absolute according to Swinscow:

$n = Z^2 \times P \times Q \; D2$

Where:

n: Calculated sample size

Z: The z-value for the selected level of confidence $(1-\alpha) = 1.96$.

P: An estimated prevalence of rickets

Q: $(1 - 0.50) = 50\%$, i.e., 0.50

D: The maximum acceptable error = 0.05. So, the estimated smallest sample size was: $n = (1.96)^2 \text{ X } 0.50 \text{ X } 0.50 = 384$

$(0.05)^2$

Data collection tool: Data was gathered using a self-administered questionnaire with three primary parts: sociodemographic information, causes, signs, and treatment of childhood rickets. Section 1 included age, gender, marital status, level of education, occupation, place of residence, and history of rickets.

Data collection technique: The researchers created an electronic Google form to gather data over one month. Online distribution channels included Twitter, Facebook, and WhatsApp. The research team went over each participant's information and response individually using Gmail access to ensure they weren't duplicating the questionnaire-filling process.

Pilot study: A study was done on 10% of the total sample to verify the tool's feasibility, applicability, and clarity. And the participants were not included in the research.

Data management and analysis plan: Data was entered and processed using SPSS 23 and statistical techniques, with P-values under 0.05 taken into account for statistical significance.

Ethical considerations: The Regional Research and Ethics Committee in Arar assent the research idea, which did not collect personal information and was kept secure. The Local Committee of Bioethics (HAP-09-A-043).

Results

The members were 393, 21.1% were males and 78.9% were females. 51.9% aged between 20- 30 years old and 26.5% aged between 31- 40 years old. 77.9% of them were highly educated. 64.4% were married and 32.1% were single. 66.2% of all participants had children as illustrated in (Table 1). As illustrated in (Table 2); 27.3% of participants reported having a child diagnosed with rickets. Age of child at time of diagnosis was less than 12 months (63.4%), between 12- 24 months (31%) and more than 24 months (5.6%) of diagnosed children. Symptoms of rickets among diagnosed children in (Table 3) were 53.5% of children had delayed growth, 60.6% had delayed in motor skills, 63.4% had bowed or dislocated legs, 33.8% had thickened wrests or ankle and 40.8% had scoliosis. Risk factors were identified as vitamin D deficiency at the time of diagnosis in 81.7%, vitamin D deficiency during pregnancy in 78.9%, preterm labor in 45.1% and artificial breastfeeding in 31% of diagnosed children in (Table 4). As for complications of rickets; the majority reported lack of growth (45.1%), 15.5% had dental defects, 12.7% had seizures, 8.5% had bone deformities, 5.6% had scoliosis and bowed legs returned, congenital heart reported in 1.4% illustrated in (Figure 1). (Table 5) shows management options as majority of children 63.4% had breast milk formula, the milk described for 23.9% of them, vitamin D described for 2.8%, Vitamin D 24 drops a day and gradually reduce the amount described for 1.4%, other treatment methods were reported by the same percentage (1.4%) for Transfer to an advanced hospital, orange juice, given intramuscular injections and Food Supplements. The child's condition improved after adherence to treatment in majority of cases (91.5%).

Discussion

Daniel Whistler and Francis in UK made a formal diagnosis of rickets, which is still a common disease today. nd discovered that exposure to sunlight and cod liver oil could both prevent rickets [6]. The inability of growing bones and cartilage to mineralize is rickets. It is condition characterised by aberrant serum (Ca) and (Pi) levels that result in the chondrocytes' differentiation and maturation being abnormal [7]. Even though rickets prevalence is estimated globally, it is insufficient due to the lack of fundamental information, such as vitamin D nutrition intake, particularly between children in developing nations [8, 9]. Rickets is most prevalent in infants and early children between the ages of 3 and 13 months and in adolescents between the ages of 12 and 15 [10]. Research found that 27.3% of children had rickets, and 63.4%) were younger than 12 months. Another research looked at the prevalence of rickets in female adolescents and evaluated its relationship to calcium intake and sun exposure [11]. It found that 81% of participants had low vitamin D levels, while another cross-sectional research found 15.3% of children had rickets and 50.5% were between the ages of 1-5 years [13]. a cross-sectional study at the Children and Maternity Hospital showed that 9% of children in Arar had rickets [13]. Rickets' prevalence increased from 0 per 100,000 people in the 1970s to 24.1 per 100,000 people in 2000, according to a research in USA by Thacher et al [14]. Both in established and developing nations, rickets is more common. Nevertheless, is higher in developing nations than in established nations [15].

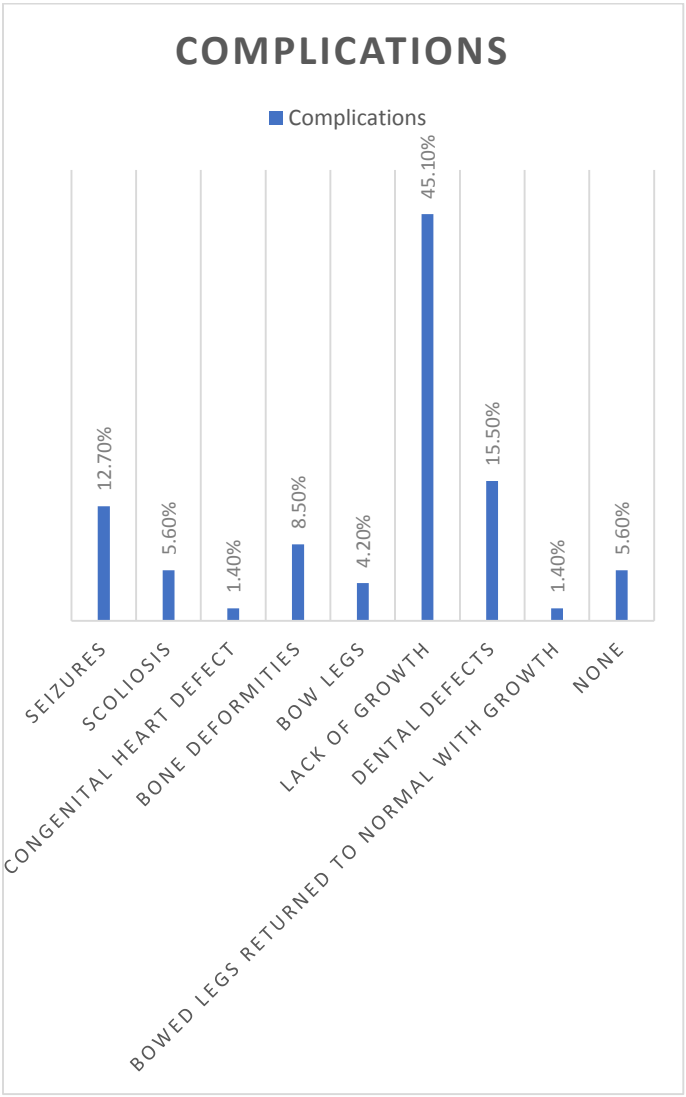

Figure 1: Complications of Rickets among Diagnosed Children (n= 71).

Table (1): Sociodemographic characteristics of participants (n=393).

Parameter		No.	%
Gender	**Male**	83	21.1
	Female	310	78.9
Age	**Less than 20**	27	6.9
	20 – 30	204	51.9
	31 -40	104	26.5
	41 – 50	1	0.3
	51 -60	57	14.5
Education level	**Uneducated**	1	0.3
	Primary	5	1.3
	Intermediate	9	2.3
	Secondary	72	18.3
	University degree or higher	306	77.9
Marital status	**Married**	253	64.4
	Single	126	32.1
	Divorced	12	3.1
	Widow	2	0.5
Residence	**Civilized region**	352	89.6
	Countryside	41	10.4
Have children	**Yes**	260	66.2
	No	29	7.4
	I am not married	104	26.5

Table (2): Prevalence of Rickets and Age at Diagnosis (n= 260).

Parameter		No.	%
Child diagnosed with rickets	**Yes**	71	27.3
	No	189	72.7
Age of child when diagnosed with rickets	**Less than 12 months**	45	63.4
	12 - 24 months	22	31.0
	more than 24 months	4	5.6

Table (3): Symptoms of rickets among diagnosed children (n=71).

Parameter	No.	%
Delayed growth (weight and length)	38	53.5
Delay in motor skills	43	60.6
Bowed legs or dislocated legs	45	63.4
Thickening of the wrist, ankle, or both	24	33.8
Scoliosis	29	40.8

Table (4): Risk factors of rickets among diagnosed children (n=71).

Parameter		No.	%
vitamin D deficiency at the time of diagnosis	**Yes**	58	81.7
	No	13	18.3
vitamin D deficiency during pregnancy	**Yes**	56	78.9
	No	15	21.1
Born a month early	**Yes**	32	45.1
	No	39	54.9
Breastfeeding	**Artificial**	22	31.0
	Natural	38	53.5
	Both natural and artificial	11	15.5

Table (5): Management and Prognosis of Diagnosed Cases (71).

Parameter		No.	%
Taking vitamin D supplements in infancy	**Yes**	28	39.4
	No	43	60.6
Treatment methods described for your child after the diagnosis	**Breastmilk**	18	25.3
	Transfer to an advanced hospital	1	1.4
	Milk formula	45	63.4
	He was given intramuscular injections	1	1.4
	Orange juice	1	1.4
	Vitamin D 24 drops a day and gradually reduce the amount	1	1.4
	Vitamin D	3	4.2
	Food Supplements	1	1.4
Child's condition improved after adherence to treatment	**Yes**	65	91.5
	No	6	8.5
The child need surgery to correct the condition	**Yes**	10	14.1
	No	61	85.9
If yes, was the surgery performed	**Yes**	9	90.0
	No	1	10.0

Countries in Asia, the Middle East, and Africa have incidence rates ranging from 10% to 70% [16]. As of right now, projections for the case rate range from 2.9 to 27 per 100,000 people in Europe and the United States [14]. In addition to the genu varum and genu valgum deformities of the lower extremities, abnormal dentition, slow growth, and missed developmental milestones are other clinical manifestations of rickets [17]. Our research showed that nearly half of children (53.5%) have delayed growth, 60.6% have delayed motor skills, 57.7% have pain in their spine and legs, 63.4% reported muscle pain as well, 63.4% had bowed legs or dislocated legs, 33.8% had thickening of the wrist, ankle, or both, and 40.8% had scoliosis. Another research conducted in Riyadh, Saudi Arabia, found that the most common symptoms experienced by patients (67.20%) were non-specific symptoms like bone pains and aches. Twenty-six percent of patients (20.69%) had short height, but 18.97 percent and 6.90 percent of patients, respectively, presented with skeletal deformities and pathological fractures. 10.34% of patients showed signs of muscle weakness, and three of them had serious weakness [6]. According to findings from a different study, rickets presents as delayed teething in 36.1% of cases, convulsions in 19.4% of cases, bowleg in 41.7% of cases, delayed standing in 47.2% of cases, delayed walking in 30.6% of cases, muscle flaccidity or weakness in 33.3% of cases, easy fracture in 16.7% of cases, short stature in 41.7% of cases, and abnormal gate in 30.6% of cases [13]. Another research carried out in Kuwait [18], Nevertheless, there are other symptoms, including vomiting and diarrhoea in 48 instances, fever and cough in 48 cases, spasms in 11 infants, delayed standing in 38 cases, hypotonia in 25 cases, irregular gait in 54 cases, and perspiration in 33 cases [19].

Hypocalcemia convulsions, which are described in 34% of children as the most prevalent clinical symptom of vitamin D insufficiency, are followed by chest infections (33%), gastroenteritis (25%), hypotonia (2%), and fractures (1%). Symptomatic hypocalcemia and a chronic disease with normokalaemia or silent hypocalcemia are the most typical physical symptoms or radiologic indicators of vitamin D deficiency [21]. Another study found that leg deformities, leg pain, and delayed motor milestones were the most prevalent symptoms, with poor growth accounting for 71% of clinical characteristics and having a median height for age below the third percentile [9]. Rickets is mostly brought on by vitamin D inadequacy, dietary calcium deficiencies, and poor metabolism of these nutrients, especially in temperate countries [11]. Low dietary Ca consumption, however, also has a significant impact on issues like those in Asia and Africa's low- and middle-income countries [12]. Regarding this, our study revealed that the majority of children had vitamin D deficiencies at the time of diagnosis in 81.7% of cases and during pregnancy in 78.9% of cases, were born prematurely in 45.1% of cases, and were breastfed 31% artificially and 53% naturally. In a clinical study of rickets in children and adolescents aged 2 to 18 years, Al Jurayyan, Nasir A. M. et al. (2012) found that the most common nutritional factors were low levels of vitamin D or calcium, or both, in 71.60% of patients, chronic anticonvulsant medication use in 8.87% of patients, and celiac disease in 5.17 percent of patients [6]. However, according to a different research, 15.4% of children with rickets were obese and 41.9% of them drank soft drinks. Among the volunteers, only 55% breastfed their kids [12]. Early research in Bangladesh showed that lack of vitamin D was not a significant cause of the common rickets, and calcium lack is the main etiologic reason [20]. In terms of rickets complications, a majority (45.1%) reported delayed development, 15.5% had dental problems, 12.7% had seizures, 8.5% had bone deformities, 5.6% had scoliosis, and 1.4% had congenital heart anomalies. Another study found that delayed teething accounts for 16%, bowleg 9%, delayed standing 13.8%, delayed walking 11%, abnormal gates 8.2%, short stature 13.8%, muscle flaccidity or weakness 11.5%, history of easy fracture 4.8%, fracture due to calcium deficiency or unknown cause 3%, and convulsions in 4.5% [13]. According to another research, the untreated disorders can result in multiple pathological fractures, increased intracranial tension, aberrant dentition, poor linear growth, osseous abnormalities, and hydrocephalus. Persistent hypocalcemia can result in consequences such myopathy, convulsions, and death [21].

Conclusion

When compared to statistics from earlier literature, the prevalence of rickets among Saudi children is comparatively high. Rickets control efforts should concentrate on children under the age of two. These tactics include providing vitamin D supplements to breastfed children and ensuring sufficient maternal vitamin D status both during pregnancy and after delivery.

Conflict of Interest

None

Funding

None

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