

PREVALENCE OF RICKETS AMONG CHILDREN BELOW ONE-YEAR ENCOUNTER OF NORTH WEST ARMED FORCED HOSPITAL IN TABOUK

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ABSTRACT

Background: Nutritional rickets is a disorder of bone affecting children early in their life. It tends to be under diagnosed and under treated especially in the primary health care centres.

Aims & Objective: To estimate the prevalence of children those attend the North West Armed Forced Hospital, Well Baby Clinic and to find the association between the rickets and certain variables.

Materials and Methods: A cross-sectional epidemiological study was conducted in North West Armed Forces Hospital (NWAFFH), Saudi Arabia by using questionnaire.

Results: The sample was included 114 infants their age ranged between 9-12 months, we was interviewed their mothers using a questionnaire and measuring the serum level of Alkaline phosphate, Calcium and phosphate in infants. The results of this study showed that the prevalence rate of rickets was 3.5% and all rachitic infants were breast-fed compared with 17.3% in non-rachitic infants. Also the height of the child at the time of interview was lowered in rachitic infants comparing with non-rachitic infants. Other studied risk factors were not significant.

Conclusion: The rickets was quite existed among Saudi children attending NWAFFH-WBC. For that, increase awareness of primary health care physicians about rickets, diagnosis and management were recommended.

Key Words: Rickets; Infants; Prevalence; Saudi Arabia

Introduction

Rickets is a childhood disorder involving softening and weakening of the bones. It is primarily caused by lack of vitamin D, calcium and phosphate.^[1]

Vitamin D may be absorbed from food by intestine or may produce by the skin when the skin exposed to sunlight. In its active form vitamin D acts as a hormone to regulate calcium absorption from intestine and to regulate levels of calcium and phosphorous in the bones. Sunlight is important to skin production of vitamin D; environmental condition where sunlight exposure is limited may reduce this source of vitamin D. Lack of vitamin D production by the skin may occur if a person is confined indoors, or stays indoors during the daylight hours or lives in climates with little exposure to sunlight.^[1]

Because vitamin D is a fat-soluble vitamin, condition that reduces digestion or absorption of fats will decrease the ability of vitamin D to be absorbed from intestine. When the body is deficient in vitamin D, it is unable properly regulate calcium and phosphorus levels. If the blood level of these minerals becomes too low, other body hormones may stimulate release of calcium and phosphorus from the bone to the bloodstream to elevate the blood levels.^[1]

Rickets is a bone disease that affects children when these deficiencies occur. It causes progressive softening and weakening of the bone's structure. There is a loss of calcium and phosphorus from bones, which eventually cause destruction of the supportive matrix.^[1]

Rickets is most likely occurring during periods of rapid growth when body demands high levels of calcium and phosphorus. It may be seen in young children 6-24 months old and is uncommon in new-born.

Nutritional causes of rickets occur because of a lack of vitamin D in the diet or in association with mal-absorption disorder characterize by poor fat absorption. A dietary lack of vitamin D may occasionally occur in people on vegetarian diet who do not drink milk production or in people who are lactose intolerant (have trouble digestion of milk products). A dietary lack of calcium and phosphorus may also play a part in nutritional causes of rickets. Rickets caused by a dietary lack of these minerals is rare in developed countries because calcium and phosphorus are present in milk and green vegetables.^[1]

Rickets may also cause by kidney disorder involving (renal tubular acidosis). Renal osteodystrophy occurs in people with chronic renal failure.^[1]

The diagnosis of rickets based on: a dietary history of poor vitamin D intake and little exposure to direct ultraviolet sunlight. The serum level of alkaline phosphatase (ALP), 25-hydroxy vitamin D3, calcium, phosphate and magnesium, in addition to x-rays study and iliac crest biopsy, all will confirm the diagnosis of rickets.^[2]

If rickets is not treated can lead to: chronic skeletal pain, skeletal deformity and/or skeletal fracture without cause.^[1]

A hospital based research conducted in Sulimania Children Hospital in Riyadh during 1986-1987 showed the prevalence of rickets was 1.3%, where sub-clinical cases was 3% with mean age 1 year.^[3]

Another study conducted in King Abdul Aziz University Hospital in Jeddah in 1996 showed that 9% of Saudi pregnant female were with vitamin D deficiency.^[4]

Thus, rickets is still a problem in our community that needs to be investigated and prevented. Health education is one way to prevent rickets by ensuring the balanced diet and adequate exposure to sunlight with vitamin D supplement as needed.^[2,5,6]

If rickets is not corrected while children are still growing skeletal deformities and short stature may be permanent. And if it is corrected while the child is young, skeletal deformities often diminish or disappear with time.^[1]

Materials and Methods

A cross-sectional epidemiological study was conducted in NWAFFH by using a questionnaire, which has been previously used in Jeddah, 2002.^[7] Tabuk city is located in north-west area in Kingdom Saudi Arabia. NWAFFH is a governmental hospital serving a special governmental sector. There are many primary health care centers covering Tabuk area, in addition to Air Base clinic and all these centers served the military and its dependants in Tabuk area and the village around it.

The study population consists of Saudi infant between 9-12 months of age whom, attending well baby clinic in NWAFFH. Non Saudi and those aged below 9 months and above 12 months were excluded from the study.

The total number of children below 1 year served by NWAFFH in one year is equal to 1334 children (latest statistics). According to literature review the prevalence

of rickets in Saudi Arabia around 3%.^[3] For that the sample size calculated by using EPI INFO statistical package, confidence interval 95% and worst acceptable 6% is equal to 114.

Babies around 9 month of age usually screened routinely for anaemia. Then the results collected back to well-baby clinic and if there is abnormality, the nurse will call those babies to give them a referral letter to paediatric clinic at NWAFFH for full management.

A researcher filled up the questionnaire by interviewing the parents during the visit. Then the child sent to the laboratory where a venous blood sample for alkaline phosphatase, calcium and phosphorus drawn by the phlebotomy technician. Then the result checked through the computer. The study tools includes questionnaire asking about demographic data (age of child, sex, length, weight and age of mother) type of feeding, sun exposure and consanguinity, blood sample for measuring alkaline phosphatase, calcium and phosphorus level. Infant is considering having rickets if there is: low serum calcium level (< 2 mmol/L) and phosphorus level (< 1.5 mmol/L) and high serum alkaline phosphatase (> 500 U/L).

Data Analysis

Data analyzed by using SPSS PC software package (version 17). Continuous variable presented as mean and standard deviation. Categorical variable presented as frequency and percent. Chi-square statistical test was applied to test for the association between categorical variables. Fischer exact test was used in case of small frequencies. T-test was utilized to test for the difference of means between two groups. Dependent variable was rickets. Independent variables were age of infant, age of weaning, sun exposure, genetic cause, mother's parity, socio-demographics, status of parents (education, occupation and outcome) and consanguinity

Permission from NWAFFH administration was taken. And permission from Ghada Abuzaid was taken to use her questionnaire.

Results

The age of children ranged from 9-12 months with mean age 10.4 months (SD 1.2). Gestational age of all their pregnancy ranged from 32-42 weeks with mean 39.30 weeks (SD 1.73). Out of the 114 children there was 69 (60.5%) males and 45 (39.5%) females. Length of children at birth in centimeters ranged from 40-58 cm.

The mean length is 50.1 cm (SD 2.96). Weight of children at birth in kilogram ranged from 1.8-4.4 Kg. The mean weight is 3.02 Kg (SD 4.74). Length of children at the time of interview in centimetres ranged from 63-80 Cm with mean 71.7 cm (SD 3.26). Weight of children at the time of interview in kilograms ranged from 6-12 Kg with mean 8.4 Kg (SD 1.05). The mother age ranged from 17-45 years with mean age 28.80 years (table 1).

Regarding the laboratory data, the normal serum level of alkaline phosphates (ALP) ranged from 145 to 320 U/L. In our sample the range varies from 156 to 2091 U/L with mean level 331.61 U/L (SD 281.46). The normal serum level of calcium ranged from 2.1 to 2.7 mmol/l. In our sample the range varies from 1.90 to 2.79 mmol/l with mean level 2.44 mmol/l (SD 0.12). The normal serum level of phosphate ranged from 1.45 to 2.1 mmol/l. In our sample the range varies from 0.59 to 2.51 mmol/l with mean level 1.87 mmol/l (SD 0.25) (table 2).

Prevalence of Rickets

The case definition of rickets in this study was a serum level of ALP > 480 U/L, calcium level < 2.00 mmol/l and phosphate level < 1.45 mmol/l. From all children in our sample (114) we had 11 cases (9.6%) had high ALP level. Only 4 cases (3.5%) had high ALP with low calcium and low phosphate level (figure 1). By comparing the ALP level between the rickets cases and non-rickets cases, via applying T-test, we found that the mean ALP in rickets cases was 1305 U/L, where the mean level of ALP in non-rickets was 296.2 U/L. It is obvious that there was a significant statistical difference between the two groups. T-test = 9.358 df = 112, p <0.001. Different variable were plotted against the rickets. These different variables were tested against positive cases of rickets for significance, using the Chi-square and Fisher Exact Test for qualitative variables and T-test for qualitative variables.

The mean weight at birth of a child with rickets is 3.09 Kg, where the mean weight at birth of child without rickets is 3.02 Kg. By applying T-test, it shows no significant relation: T-test = 0.283, df = 112, p= 0.778. The mean height at birth of a child with rickets was 50.25 cm, where the mean height at birth of child without rickets was 50.13 cm. By applying T-test, it showed no significant relation: T-test = 0.081, df = 112, p = 0.935. The mean height in rickets group was 67.75 cm while in non-rickets group, it was 71.85 cm. Using T-test, it showed a significant relation, p= 0.013.

Table-1: Description of age, gestation age, birth weight and length and present weight and length

Characteristics	Number	Minimum	Maximum	Mean	SD
Age	114	9	12	10.4	1.20
Gestation age	114	32	42	39.3	1.73
Birth Length	114	40	58	50.1	2.96
Birth Weight	114	1.8	4.4	3.02	4.74
Present Length	114	63	80	71.7	3.26
Present Weight	114	6	12	8.4	1.05
Mother Age	114	17	45	28.8	5.18

Table-2: Description of laboratory results of infants

Laboratory Test	Number	Minimum	Maximum	Mean	SD
ALP (U/L)	114	156	2091	331.61	281.46
Calcium (mmol/l)	114	1.90	2.79	2.44	0.12
Phosphate (mmol/l)	114	0.59	2.51	1.87	0.25

Table-3: The relation between birth weight and height and present weight and height in rickets

Characteristics	Rickets		Mean Difference	P-value	Confidence Interval
	Yes	No			
Birth weight (Kg)	3.09	3.02	0.07	0.778	-0.41 - 0.49
Birth height (Cm)	50.2	50.1	0.1	0.935	-2.9 - 3.1
Present weight (Kg)	8.2	8.4	-0.2	0.691	-1.3 - 0.8
Present height (Cm)	67.8	71.7	-4.1	0.013	-7.3 - -0.8

Table-4: The relation between rickets and gender of infants

Gender	Rickets Group		Non-Rickets Group		Total
	N	%	N	%	
Males	3	4.5	66	95.7	69
Females	1	2.2	44	97.8	45
Total	4	3.5	110	96.5	114

Table-5: The relation between rickets and sun exposure

Sun Exposure	Rickets Group		Non-Rickets Group		Total
	N	%	N	%	
Yes	2	6.7	28	93.3	30
No	2	2.4	82	97.6	84
Total	4	3.5	110	96.5	114

Table-6: The relation between rickets and gestational diabetes

Gestational Diabetes	Rickets Group		Non-Rickets Group		Total
	N	%	N	%	
Yes	0		7	100	7
No	4	3.7	103	96.3	107
Total	4	3.5	110	96.5	114

Table-7: The relation between rickets and Family History

Family History	Rickets Group		Non-Rickets Group		Total
	N	%	N	%	
Positive	1	12.5	7	87.5	7
Negative	3	2.8	103	97.2	107
Total	4	3.5	110	96.5	114

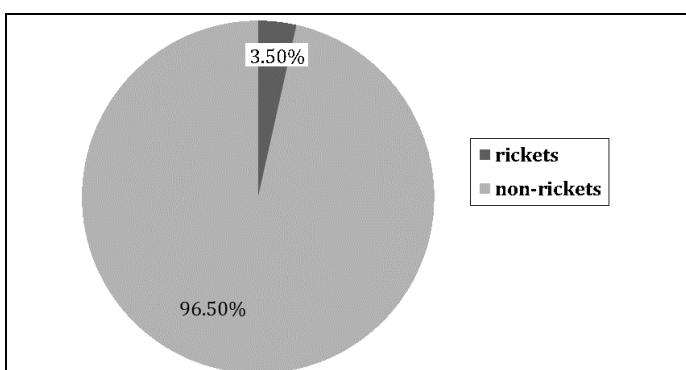


Figure-1: Prevalence of rickets among infants 9-12 months, Nwafh, Tabuk, Saudi Arabia

The mean weight in rickets group was 8.25 Kg while in non-rickets group, it was 8.46 Kg. Using T-test, it showed no significant relation, $p=0.691$ (table 3). Regarding sex of children, there is no statistical significant difference between males and females where 3 of rickets cases were males and one was female, $p= 0.547$ (table 4). There were no statistical significant differences between sun exposure and rickets group, $p = 0.273$ (table 5).

In this study, all rachitic infants were breast-fed, whereas in non-rachitic group only 17.3% were breast-fed, 41.2% bottle-fed and 38.6% breast/bottle-fed. Fisher Exact Test showed a significant statistical difference between the two groups, $p < 0.001$.

There were no statistical significant association between the mean age of mother and the rickets and non-rickets group. The mean age of mother age was 30.25 years in rickets group while in non-rickets cases the mean age was 28.75 years, $p = 0.570$

Regarding mother parities, there were no statistical significant difference between rickets and non-rickets group, $p= 0.959$.

Regarding using of calcium and multivitamins by mother, we found no statistical significant among rickets and non-rickets group, $p = 0.498$.

We questioned the mothers about the presence of some diseases that may affect the vitamin D and calcium status in the body (parathyroid gland disease, osteomalacia, chronic liver and renal diseases, epilepsy, intestinal resection, diabetes mellitus and gestational diabetes). Regarding gestational diabetes in the mother we found no statistical significant association among the rickets and non-rickets groups, $p = 0.603$ (table 6).

In the study group, one of rickets cases (12.5%) has positive family history of rickets in the other sibling where the remaining 3 cases (2.8%) have no family history of rickets. Seven children of non-rickets cases (87.5%) have positive family history of rickets in other sibling, $p = 0.152$ (table 7)

Consanguinity between the parents, in two cases of rickets their parents are 1st degree relatives and in the other two cases of rickets the parents are 2nd degree relatives. In comparing between the two groups, $P= 0.136$.

Discussion

The prevalence of rickets in our study was 3.5% with the mean age of 10 months. In Sadrani study of Sulimania Children Hospital in Riyadh, it was shown that the prevalence of sub clinical rickets was 3% and clinical rickets was 1.3% with mean age of 1 year.^[3] In Abuzaid study in King Fahad Armed Forced Hospital in Jeddah, it was shown that the prevalence of rickets was 3.6% with mean age of 10 months.^[7]

In Aradawi study there was 9% of Saudi pregnant female had vitamin D deficiency.^[4] In our study there is no difference in gender between the two groups where in Sadrani study, males were affected more than females.^[3] The birth weight and height in our study and Aradawi study showed no significant association with rickets or vitamin D status.^[4]

In our study the height of child at the time of interview was lower in rickets group more than non-rickets group. But the weight of child at the time of interview was not significantly differing in both groups. Our study showed that the breast-fed infants are more affected than none breast-fed infants. Aradawi study showed the same result and he found that the high prevalence of vitamin D deficiency occur among breast-fed mothers.^[4]

In the present study, there was no relation between rickets cases and presence of consanguinity between parents whereas in Sadrani study he found that the 1st and 2nd degree relatives are more affected with rickets.^[3] This study showed that the mother parity was not related to the presence of rickets where in Aradawi study he found a positive correlation between the number of pregnancy and vitamin D deficiency.^[4]

In this study there are no relation between the presence of rickets and some disease (as parathyroid gland disease, osteomalacia, chronic liver and renal disease, epilepsy, intestinal resection, diabetes mellitus and gestational diabetes). This may be related to the small sample size which cannot be found out the rare diseases. Also the mothers of our sample infants were young adults where some of these diseases is not usually present in this age group, or may be those diseases are not common in this target population.

Most of infant in our sample were bottle and breast-fed (where the milk is usually fortified with vitamin D) and sun exposed (this may lead to low prevalence of rickets in our study). As this study was set in NWAFFH, which

serves a special type of population (soldiers) in the community, this result may not be necessarily generalized to other Primary Health Care Center in other treatment settings.

Conclusion

Conclusively, the study showed that the prevalence of rickets was within the previous published prevalence range in the Saudi Arabia. We recommended screening program to be carried out for all children below 1 year toward early diagnosis and management by clinical assessment, the plasma level of Alkaline Phosphatase, calcium and phosphate. All pregnant mothers need to be supplied by calcium and multivitamins during pregnancy and lactation. In addition, breast-fed infant and children after weaning needs to be sun exposed early morning and late afternoon regularly and supplied with vitamin D in recommended dose.

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