Original Article

Dietary pattern of rachitic children at selected geographical area

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Abstract

Rickets causes bone deformities through the impaired mineralization of actively growing bone affecting young children in developing countries and frequently found in Africa, Asia and Middle Eastern countries. This cross sectional study was conducted with a view to assess the dietary pattern among the rachitic children among the 151 subjects of 3 north-eastern districts of Bangladesh. Out of 151 subjects 52 were having at least one visible sign of rickets and considered as rickets case. Rest of the subjects was from their neighborhoods with no such symptoms or sign. More than half of the rachitic children were aged between 6 to 15 years, with a mean of 8.61+4.07 years. Almost all of the respondents were from low family income group. Subjects were primarily children of parents with low level of education. Most frequent complaints of the patients were bending of leg and leg pain. Average intake of calcium containing food in rachitic children was lower than normal subjects and the difference was statistically significant (p<0.05). The commonest food intake other than rice in last seven days was chapatti, which contains phytate & it is a known antagonist of calcium. Average protein intake is also found lower in the rickets patients than normal group. Insufficiency of dietary calcium is thought to be the underlying cause.

Key words : Dietary pattern, rachitic children, vitamin D deficiency

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Introduction

Rickets causes bone deformities through the impaired mineralization of actively growing bone.[1] Ricket is a disease of young children in developing countries and frequently found in Africa, Asia and Middle Eastern countries. Recent report even claimed that there were 5,000,000 affected children in Bangladesh. Nutritional rickets is a disorder of growing children due to defective mineralization of newly formed bone matrix because of vitamin D deficiency and also calcium deficiency.[2] The main source of vitamin D is cutaneous synthesis when 7-dehydrocholesterol in the skin is converted to cholecalciferol (vitamin D3) by the ultraviolet-B radiation[2]. Calcium supplementation with or without vitamin D heals rickets more rapidly in children than does vitamin D alone1. Studies in South Africa and Nigeria suggest that dietary deficiency of calcium may cause rickets because there is ample sunlight in tropical countries like Bangladesh.[3] Bangladesh Institute of Child and Mother health (ICMH) found that 9% of children had clear physical signs of rickets with 11% of that number showing active rickets (with elevated alkaline phosphatase).[4] A survey in Chakaria sub-district in South-east of Bangladesh found that 4% of children aged 1-15 years had lower limb deformity due to rickets.[4-7] In these areas where the potential exposure to sunlight is unlimited, the existence of rickets due to vitamin D deficiency is unexpected. Dietary calcium deficiency is an important cause of rickets in these areas. In India particularly in the toddler age group where sunshine exposure is good, deficiency of calcium rather than vitamin D might be the primary cause of rickets. So calcium intake and sun exposure prevent nutritional rickets in young children and adolescents in our region.[10]

Rickets is readily identified in south-eastern Bangladesh. But in north-eastern Bangladesh there are many children affected by calcium deficiency rickets. In addition some presumed unaffected children show physical evidence of rickets &most display of biochemical evidence suggestive of calcium insufficiency. Lots of children are affected in Sylhet district & they will be disabled if nothing is done.

One of the early sign of ricket is craniotabes. It is due to thinning of the inner table of the skull detected by pressing firmly over the occiput or posterior parietal bone.[11-13]

A ping-pong ball sensation is felt; palpable enlargement of costochondral junction is rachitic rosary and thickening of the wrist and ankle. Sign of advanced rickets-Box head, rachitic rosary, Harrison's groove, pigeon chest deformity, Pectus carinatum, and genu Vera, genu valgum, sabre tibia, scoliosis.[14]

In Bangladesh, Social Assistance and Rehabilitation for the Physically Vulnerable (SARPV) has been working with the disabled people since 1991 in Chakaria, a sub district of Cox's Bazar. According to them, they first reported large number of rickets cases in children in that area during a cyclone relief program in 1991.

In ICMH, study Rickets is an important child health problem of developing countries. Cluster of rickets found in the coastal area, Chakaria of Bangladesh. Another foci found in sylhet district. Clinical presentation of rickets in Chakaria is similar to that of African Children with Calcium deficiency rickets. Studies from South Africa, Nigeria suggest that calcium deficiency may be a major cause of rickets in these regions. More recently there have been reports of rickets apparently caused by calcium deficiency in Bangladesh.[15]

After radiographic examination of a rachitic child before and after treatment with pharmacologic doses of vitamin D3 convinced that such treatment was without effect.[6] Thus the disease in Chakaria resembles that described in South Africa and Nigeria as calcium deficiency rickets.4 Available evidence suggests that low calcium intake is a predisposing factor of nutritional ricket.[16,17]

Methods

This cross sectional study was conducted from March 2006 to June 2006 in Sylhet division and study area were Sreemongal, Fenchuganje, Hobiganje sadar, Kulaura and Sylhet sadar. The study population was divided into two categories, rachitic group and non-rachitic group. Eligibility of the participant was judged on basis of the inclusion and exclusion criteria. Individuals having the clinical signs of rickets (bow leg, knocked knee, rachitic rosary) and age 1 to 20 years were included in this study as rachitic group. Those who were patients of cerebral palsy, lathyrism, epilepsy etc. were excluded from this study. For comparison group (non rachitic group) refers to person who neither having clinical sign of rickets and with more or less same age group and same geographical area. In each household one rachitic child was taken and from another household two non-rachitic respondents was selected when possible. The list of 21 clinically diagnosed rachitic patients of Sylhet districts was collected from Nutritional Surveillance Project (NSP) & SARPV and rest 31 rachitic children were collected from area that has clinical sign of rickets. Ninety nine non-rachitic respondents were selected as control group.

A structured questionnaire with food frequency questionnaire and a checklist was used to collect necessary data. The participants were interviewed face to face by asking questions in Bengali and clinical examination of the respondents was also done. Food chart was used for calculating protein and calcium content which present in various type of food measured per 100 gm of food of each variety was standardized in the food chart prepared by IPHN (Intake of food measured by measuring cup. 1 Cup=120gm.) This was taken as reference value. Calcium and protein content were calculated from the different variety of food which had taken in the last 7 days. Both descriptive and statistical procedures were used to analyze and compare the data.[13]

Results

Among the study population, 25.2% were from Sylhet Sadar and 21.9%, 21.2%, 19.9% and 11.9% were from Fenchuganj, Sreemongal, Hobiganj and Kulaura respectively. (Figure-1) Out of 151 respondents, highest proportion was 73 (48.3%) in the age group of 6 to 10 years, in which female were 52.4% and male 45.5%. Twenty children were from tribal ethnicity. Most of the parents were not educated. Among them 67.5% mothers & 39.1% fathers were illiterate. The mean monthly family income of the rickets group was slightly lower than the non rickets group.

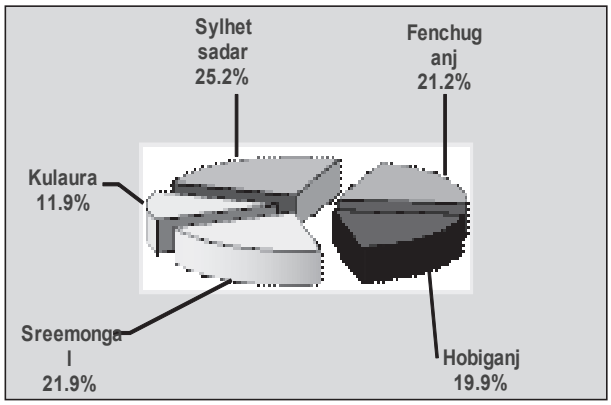

Figure-1: *Distribution of the respondents according to geographic location*

Out of 52 rickets patients 48.1% had complaints of bending of leg followed by 34.6% had complaints of pain in leg, 9.6% had complaints of weakness and 7.7% had complaints of ill health. (Figure-2)

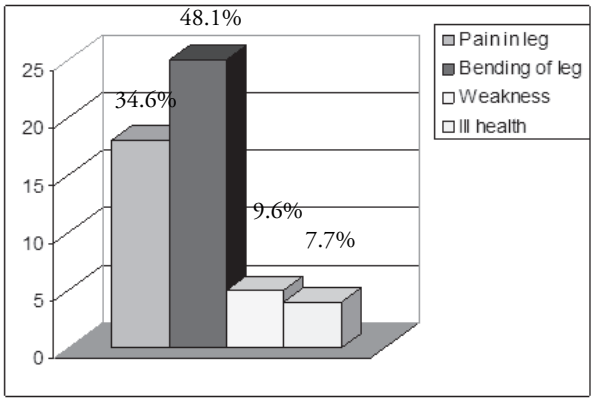

Figure-2: *Distribution of the rickets patient by clinical examination: n=52*

Maximum respondents were exposed to adequate sunlight daily and negligible percentage were exposed to sun light <1 hour per day which is also enough to produce adequate vitamin D. The relation between sun exposure and rickets is found to be statistically insignificant (p>0.05). Majority of the mothers of the respondents took usual food whereas only 8.6% took supplementary food during pregnancy. Among the rickets group 19.2% took less food than usual. The statistical association was found to be significant between intake of food during pregnancy and rickets patient. (P <0.05.) Majority of rickets patient received mother's milk over the duration of 12 months. Significant association was found (P<0.05) between rachitic children and duration of breast-feeding. Most (53.8%) mother of ricket patients fed Colostrum to their child. 69.2% of the rickets patient started weaning at 12 months of age which is found to be statistically significant. (P <0.05). (table-I)

Though the majority of respondents were in the group of normal milestone of development, it was observed that majority of the rickets group showed to have delayed milestone of development (p-<0.05). (Table-II)

Table-I: Distribution of respondents according to duration breast-feeding, colostrums feeding & period of weaning

	Non rickets	Rickets	Total
Duration of breast feeding (months)			
0	1(1.0)	1(1.9)	2(1.3)
6	25(25.3)	13(25.0)	38(25.2)
12	29(29.3)	27(51.9)	56(37.1)
24	44(44.4)	11(21.2)	55(36.4)
Total	99(100)	52(100)	151(100)
Colostrums feeding	Non rickets	Rickets	Total
No	44(44.5)	24(46.2)	68(45.0)
Yes	55(55.6)	28(53.8)	83(55.0)
Total	99(100)	52(100)	151(100)
Time of weaning	Non rickets	Rickets	Total
5 month	46(46.5)	16(30.8)	62(41.1)
12 months	53(53.5)	36(69.2)	89(58.9)
Total	99(100)	52 (100)	151(100)

Figures in the parenthesis illustrate percent (χ^2 5.038 df 3 P = 025 (χ^2 2 .040 df 1 P = .841) (χ^2 =3.47, df 1, p=0.045)

Table-II: Distribution of Milestone of development

Milestone of development	Non rickets	Rickets	Total
Normal	94(94.9)	11(21.2)	105(69.5)
Delayed	5(5.1)	41(78.8)	46(30.5)
Total	99(100.0)	52(100.0)	151(100.0)

(χ^2 87.646, df 1, P =. 000)

Protein intake in rickets group was lower than that of non-rickets group and it was statistically significant (p< 0.001). Average intake of calcium containing diet in the rachitic children was 2482.70 ± 482.86 and in normal subjects 2715.98 ± 515.25. Average intake of calcium containing food in rachitic children is lower than the non-rachitic children and the difference was statistically significant (p<0.05). (Table-III)

Table-III: Distribution of respondents by their intake of protein & calcium containing food in last 7 days

	Non Rickets	Rickets	Total
Net Protein intake (weekly)			
Low	0(.0)	1(.70)	1(.7)
Moderate	4(4.0)	7(13.5)	11(7.3)
Mild	82(82.8)	41(78.8)	123(81.5)
Normal	13(13.1)	3(5.8)	16(10.6)
Total	99(100.0)	52(100.0)	151(100.0)
Total calcium intake	Non Rickets	Rickets	Total
Very very low	0((0.0)	1(1.9)	1(0.7)
very low	33(33.3)	27(51.9)	60(39.7)
Low	61(61.6)	23(44.2)	84(55.6)
Moderate	5(5.1)	1(1.9)	6(4.0)
Total	99(65.6)	52(34.4)	151(100)

Figures in the parenthesis illustrate percent (χ^2 =7.85 df-3 p-.049) (t-2.70 df-149 P-.008)

Discussion

Several studies done in south-eastern part of Bangladesh (Cox's Bazaar district) indicate the high prevalence of calcium deficiency rickets in Bangladesh.[3,5,6] But no systemic population based survey has been conducted in other districts of Bangladesh. Current study was conducted on 151 subjects of three North-Eastern districts of Bangladesh to assess the dietary pattern among the rachitic children.

Among the subjects, 52 were with at least one or more clinical signs of rickets and were regarded as cases. Rests were the children of their neighborhood or of vicinity with no such symptom or signs. Average age of the subjects was 8.61 ± 4.07 years. Rachitic children were on an average older than the non rachitic children by very slender margin. Differences were not statistically significant following independent sample t test (p-value >0.05). Majority (69.2%) of the rachitic children were between 6–15 years of age. Over all 57.6% of the subjects were male. In the study area, tribal population was of substantial size; they were actually the tea estate workers. In the current study a total of 20 tribal subjects were included. Among the rachitic children 19.2% were tribal descendents & all of whom were Hindu by religion. Among the non tribal subjects most were Muslims. Subjects were predominantly from family with low income. The mean monthly income of family with rickets patients was somewhat higher than the non rickets group but the difference is statistically insignificant (P>0.05). Subjects were primarily children of parents with low level of education. Only one percent of mothers passed the level of higher secondary education. But mother's illiteracy was not statistically different between two groups.

Though the majority respondents in general were in the group of normal milestone of development, it was observed that after splitting the respondents into rickets and non rickets group, majority of the rickets group showed to have delayed milestone of development. Test of significance confirms association between delayed milestone of development and rickets (P < 0.05). Similar finding revealed in Chakaria et al too.[6]

Adequate intake of calcium is required for optimal growth and mineralization of the skeleton.[18] Maximum respondents were exposed to adequate sunlight daily and negligible percentage were exposed to sun light <1 hour per day which is also enough to produce adequate vitamin D. Because daily 5 minutes sun light is necessary for requirement of vitamin D. The relation between sun exposure and rickets was not statistically significant in the current study (P>0.05). The finding rules out the possibility of vitamin D deficiency as causal factor of the disease in this region and also points to some other possible factors that might be related to the disease.

Most frequent complaints of the patients were bending of leg and leg pain. Among the rickets patients 48.1% had complaints of bending of leg followed by 34.6% had complaints of pain in leg. In Chakaria study there was also same complaints.[6]

A detailed assessment of dietary pattern of the subjects were done with food frequency questionnaire. All the

respondents were asked about the frequency of intake of all possible food items taken in last 7 days. Diet during pregnancy, breast feeding history, Colostrum feeding history and period of weaning also assessed. It is scientifically proved that the amount and quality of food intake during pregnancy has an important role in development of the skeletal system of the baby in utero. Majority of the respondent's mother among nonrachitic children, 81.8% took usual food whereas only 8.6% took supplementary food. Among the rickets group 69% respondent's mother took usual food and 19.2% took less food than usual. The statistical association wasfound to be significant between food intake of respondent's mother during pregnancy (P <0.05.)

Rachitic children received mother's milk in less duration than the nonrachitic children (P value<0.05). But breast milk has an important role in children's nutrition. Supplementary foods beside breast milk at an early age prevent malnutrition. Intake of low dietary calcium containing food after weaning may result in the development of nutritional rickets.[19,20,21] In the current study majority of rachitic children 69.2% received supplementary food at late period which is significant (P value<0.05). Intake of calcium and protein containing food was found to be less among rachitic children than normal subjects (p<0.05). But Calcium containing food has an important role in development of the skeletal system[14] and Protein containing food has an important role for maintaining normal nutritional status.[22] In a study done by Thacher et al showed that Nigerian children with rickets had low intake of calcium rather than vitamin D and treatment focused on dietary supplementation with calcium.[4,23] Calcium supplementation alone affected healing of rickets in most of Nigerian children.[15] Intake of carbohydrate containing food was more or less same among the respondents. Among the tribal subjects intake of chapatti was more frequent which contains phytate, a known antagonist to calcium.[14,24-27] The striking finding is that calcium intake and protein intake is lower in the rachitic children than the normal subjects. So increase intake of calcium and protein containing food and changing of dietary pattern could prevent calcium deficiency rickets.

Creation of awareness among all the respondents about intake of calcium containing food and other nutrients for prevention of nutritional deficiency is necessary. Overall awareness creation among the vulnerable groups on pregnancy-diet, supplementary food during weaning, time of weaning, family planning and birth spacing should be considered.

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