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The prevalence of active nutritional rickets in Egyptian infants in Cairo

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KEYWORDS

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Abstract The Prevalence of Active Nutritional Rickets in Egyptian Infants in Cairo Introduction Rickets is a preventable disease which still exists in many countries needing accurate estimation to properly implement preventive strategies.

Methods: A cross sectional study was conducted on 800 healthy infants 385 at the age of 9 months and 415 at the age of 18 months attending the primary health care centres well distributed all-over Cairo to determine the prevalence of rickets. All had their weight and height measured together with measurement of serum calcium, phosphorus and alkaline phosphatase (ALP). ALP was the screening tool for rickets.

Results: Serum calcium correlated positively with the length of infants in both groups. The prevalence of rickets was 1.125% in the whole studied infants, with 1.04% of those aged 9 months and 1.2% of those aged 18 months having active rickets. No differences were found between serum calcium and phosphorus between a random sample of the study participants and the positive cases. Rachitic infants received lesser caloric intake than recommended. Positive cases at the age of 18 months showed more nutritional calcium deficiency than the younger group who were all deficient in sun exposure.

Conclusion: Rickets is still prevalent in Egypt; however, at a lower prevalence than that reported before. We recommend examining all infants at the age of 18 months by primary health care physicians and screening by ALP as this age showed a prevalence of rickets of 12/1000 to direct proper treatment and avoid the physical deformities resulting from insufficient calcium and/or vitamin D in infants in the early stages of walking. For the screening and diagnosis of rickets in a limited resources country like Egypt, we recommend the measurement of ALP. Proper education about calcium rich foods, adequate number of servings/day and adequate sun exposure is of paramount importance.

Introduction

Nutritional rickets is the effect of vitamin D and/or calcium deficiency on the growing skeleton leading to defective cartilage plate and osteoid mineralisation. Rickets represents a

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major health burden due to its physical comorbidities which may persist in later childhood and adolescence in addition to its acute life threatening complications. There are no effective community based preventive strategies till now to prevent rickets even in the most developed nations.[1] In Minnesota, USA, retrograde analysis of positive cases of rickets identified through symptomatology and radiology revealed that 17 toddlers had nutritional rickets out of 768 cases with a diagnosis of rickets.[2] Many factors contribute to the persistence of nutritional rickets in developed as well as developing countries including lack of adequate sun exposure either due to spending too much time indoors or due to some traditional clothing which covers most of the body. Prolonged exclusive breast feeding and lack of infant vitamin D supplementation as well as lacking proper maternal supplements during pregnancy come on top of the list of the factors that contribute to the presence and resurgence of rickets in the current decades.[1,3]

Population-based sampling is the recommended method to study the prevalence of rickets[1,4,5] which is markedly variable worldwide ranging between 3.16/100,000 in the UK to 85% in Tibet.[5]

The authors thought that it is essential to have a recent screen for the prevalence of rickets to have scientifically sound recommendations about the need to supply calcium and vitamin D to Egyptian infants to avoid the rachitic complications which may affect the quality of life of infants and their families and subject them to orthopaedic correction surgeries later on. It has been recommended to give prophylactic doses of vitamin D very early in life, however, this is not applied on a wide scale in Egypt till now. We chose 9 and 18 months as healthy infants in these age categories could be found in vaccination sessions where they usually draw blood samples for screening of anaemia. We aimed at determination of the age which has the higher prevalence of rickets in infancy so that we could recommend the group which would be expected to have more benefit from calcium and vitamin D supplements if supplied on a national basis through the Ministry of Health in Egypt.

Subjects and methods

Study subjects

Healthy infants at the age of 9 and 18 months who showed no evidence of systemic disease either by history or clinical examination and who received no calcium or vitamin D supplementation.

Study settings

Primary health care centres distributed in western, eastern, southern and northern Cairo in the period from March 2014 to February 2015.

Sampling technique

Multistage cluster sampling design was used to get a representative sample of infants in these 2 ages (9 months and 18 months). In the first stage, the sample was stratified according to the different locations in Cairo (eastern, western, southern and northern areas) then primary care centres were selected randomly from the list of centres obtained from the Ministry of Health. In the second stage, inside primary health care centres, infants were stratified into 2 groups; 9 months and 18 months then infants were randomly selected from each age group and all infants in selected ages were eligible to participate unless the infant met one of the exclusion criteria.

Sample size justification

The sample size was calculated as follows:

Sample size for a cluster sample

= Simple random sample size × design effect.

where the design effect = $(1 + (m - 1)\ p)$ where m = size of the cluster and p = intra-cluster correlation coefficient (ICC) assumed that the proportion to be evaluated = 0.21 and a confidence interval width = 0.2 at 95% confidence interval. The sample size for the simple random sample = 72. For correction of the cluster design, we had to estimate the ICC = 0.010 and the average cluster size (average number of infants in every cluster (the 4 different areas in Cairo)). The average cluster size was 40 and ICC was 0.01 so we had a design effect of 1.39. So, the sample size of each group after correction was approximately 100 infants. By multiplication of 100 by 4 areas in Cairo at 2 age groups, the whole sample was calculated as 800 infants; 400 in each age group.

Clinical evaluation

Weight and length were measured with comparison to the WHO reference values (WHO Anthro version 3.2.2)[6].

Biochemical evaluation

One blood sample (3 ml) was taken from each infant during the routine screening for anaemia for the assessment of total serum calcium, serum phosphorus and ALP. They were assayed photometrically[7] using Hitachi 917 autoanalyzer and Roche reagents. ALP activity was measured by the IFCC recommended method using colourless 4-nitro-phenyl phosphate (4-NPP) as a substrate. ALP hydrolyses 4-NPP in the presence of magnesium and zinc ions, forming phosphate and free 4-nitrophenol (4-NP) which has a yellow colour. The rate of formation of 4-NP is monitored at 405 nm and is directly proportional to ALP activity.[8] ALP more than 321 IU/L for 0–5 years was determined as a cut-off according to Pediatric Reference Range Guidelines for Synchron Systems-Multicentre study, 1995.[9]

Positive cases detected by screening were subjected to:

1. Detailed history including hours and season of sun exposure. Exposure of the infant for two hours per week covering the arms, legs and body without head cover was considered as an adequate exposure to sun.[10]
2. Dietary assessment of calcium and vitamin D intake by a semi-quantitative food frequency questionnaire as this is the most suitable method in epidemiologic studies.[11] It consisted of 15 questions assessing dietary intake of calcium rich food sources e.g. dairy products. A 24-h dietary recall was assessed twice and diet analysed according to the