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An epidemiological and biochemical study on osteomalacia among pregnant women in Egypt

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With 6 tables

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Osteomalacia is a nutritional deficiency disease that might affect pregnant and lactating women.

Nutritional surveys on osteomalacia have not been conducted in Egypt. A study previously conducted by Abd El Fattah et al. 1974 on nursing mothers showed a poor dietary pattern characterized by a low intake of milk and milk products and lack or irregular intake of mineral or vitamin supplements during the antenatal care. A degree of osteomalacia is expected to be met with among pregnant and lactating women of low socio-economic standard.

The present study aimed at:

1. Describing the state of nutrition of pregnant mothers with special emphasis on bone mineralization.
2. Finding out the relation between social, environmental and dietary factors or other conditions relevant to the deficient calcium state.

Materials and methods

This study has been conducted on 230 pregnant women of low socio-economic standard, attending the Material and Child Health Centre of Giza Governorate. The study included the following aspects:

1. Questionnaire of the mother

This included the following items:

- Parity history, by duration of pregnancy and number of previous pregnancies.
- Housing conditions and frequency of outdoor exposure to sunshine.
- Bone aches, toothaches and muscular contractions.
- Dietary pattern, regarding the frequency of milk and cheese intake and the amount used to be taken at a time.
- Antenatal care provided in the form of supplements (Calcium or vitamin D) and nutrition education.

2. Clinical examination

Each woman was examined for the presence of nutritional deficiency signs and her weight and height were measured. The pregravid body weight was calculated, WHO 1965 and the percentage age of standard weight for height was assessed, *Jellie* (6).

3. Serum analysis

Serum alkaline phosphatase, serum calcium and serum inorganic phosphate have been determined in a subsample randomly choosing every third woman with a total of 82. Serum alkaline phosphatase was estimated by using *King* and *Armstrong* technique (7). Serum calcium was determined by using the method of *Baron* and *Bell* (10). Serum inorganic phosphate was assessed by following the technique in *King* and *Wootton* (7). Calcium phosphorus index was calculated.

Results

Mothers were classified according to the duration of pregnancy into groups starting from the 4th month as shown in table 1.

Tab. 1. Distribution of the pregnant women according to the duration of pregnancy

Pregnant women n 230	Months of pregnancy						
	3rd	4th	5th	6th	7th	8th	9th
Number	5	24	40	35	45	60	25
%	2	10	17	15	19	26	11

Parity: Mothers with low parity 1, 2, 3 and 4 accounted for 68 % of the group and those with high parity 5 + were 14 %. 18 % were primigravida, table 2.

Tab. 2. Distribution of mothers according to parity

Women n 230	Primi- gravida	Parity				
		1	2	3	4	5+
Number	41	64	36	27	27	32
%	18	28	16	12	12	14

Housing conditions: It was found that 72 % of the examined women were inhabiting sunny houses and 75 % of the group were exposed to sunshine during outdoor activities.

Complaint: 70 % of women complained from low backache, 37, 13 and 2 % complained from bone aches in lower limbs, pelvis and ribs respectively. Toothache was present in 29 % and muscle contraction were mentioned by 49 %.

Antenatal care: Women who attended the regular antenatal visits were 29 % of the whole group. 46 % attended irregularly and 25 % were attending for the first time.

Mothers provided with supplements as calcium preparation, vitamin D and/or nutrition education accounted for 37 %.

Dietary pattern and calcium intake:

45 % of women were found to consume milk daily, 25 % consumed it 2-3 times per week, 10 % once per week and the rest 20 % consumed it infrequently. The amount of milk intake was used to be $\frac{1}{4}$ of a glass or less in 28 of consumers, $\frac{1}{2}$ glass in 25 %, 1 glass in 40 % and 2 glasses in 7 %. The average amount of intake of milk per day among consumers was $\frac{1}{2}$ a glass (100 ml), table 3. The frequency, amount and the average intake of cheese is also given in table 3.

Tab. 3. Intake of milk and cheese (women %)

Frequency/week					Amount "glass for milk"			
	7	2-3	1	Infrequent	$\frac{1}{4}$	$\frac{1}{2}$	1	2
Milk	45	25	10	20	28	25	40	7
Cheese	15	45	15	25	20 and 30 g cheese in 60 and 40 % respectively, average of 10 g.			

Calcium intake: On calculating the average amount of calcium intake per day obtained from both milk and cheese (available calcium), it was found to be 200 mg which accounts for 20 % only R. D. A. of the pregnant women (4).

Nutritional status:

Signs of riboflavin deficiency, cheilosis and angular stomatitis were found in 28 % of the women.

Weight: Women having the % standard weight (100 ± 10) for height constituted 51 % of the group. Women having weight above the standard weight for height > 110 + constituted 40 %, and 9 % had weights lower than the standard weight for height < 90 , table 4.

Tab. 4. Weight/standard weight for height

Women	Low	weight	Standard	Overweight
230	70 -	80 -	110 ± 10	110 - 120 +
Number	5	16	118	20 71
%	2	7	51	9 31

*) Pregravid body weight was calculated as given in W.H.O. 1965.

Biochemical assessment:

Serum alkaline phosphatase: The mean value of the serum alkaline phosphatase was 10 A.S. units/dl ± 8 (normal values 3-14 units). Abnormal high levels started to appear during the 6th month of pregnancy onwards and were found to affect 18 % of the whole group tables 4 and 5.

Serum calcium (Ca), serum phosphorus (P) and Ca X P index: The mean serum calcium was 8.9 mg/dl ± 2.5 , and serum phosphorus

4.2 mg/dl \pm 1. The Ca X P index was 36 ± 12.7 , as shown in table 4. Abnormal low values started to appear during the 5th month of pregnancy onwards. These were found in 48 % of the group for calcium, 7 % for phosphorus and 12 % for Ca X P index. The number and percentage of the affected women by month of pregnancy are given in table 5.

Tab. 5. Serum alkaline phosphatase, calcium, phosphorus and calcium phosphorus Index, n = 82

	Alkaline A.S. Units	Calcium mg/dl	Phosphorus mg/dl	Ca X P index
Mean	10	8.9	4.2	36
\pm	8	2.5	1	12.7

Tab. 6. Number and % of women with biochemical abnormalities during pregnancy

Preg- nancy	No. of	Alka phosph. > 14 A.S. Units/dl		Calcium < 8.5 mg/dl		Phosphorus < 3 mg/dl		Ca X P index < 25	
months	women	No.	%	No.	%	No.	%	No.	%
3	2	—	—	—	—	—	—	—	—
4	7	—	—	—	—	—	—	—	—
5	13	—	—	6	46	2	15	3	23
6	12	2	16	7	58	—	—	1	8
7	17	6	35	11	65	2	12	4	23.5
8	18	3	15	8	44	—	—	1	5.5
9	12	4	33	7	58	2	17	1	8
Total	82	15	18	39	48	6	7	10	12

Discussion

Results obtained from this study showed that the nutritional status of a considerable number of women was unsatisfactory. This was evidenced by the presence of riboflavin deficiency signs in 28 %, low weight for height in 9 % and overweight in 40 %. A considerable number were suffering from boneache in one or more sites and toothache denoting a deficient state of bone mineralization. Half of the women had muscular contractions characteristic of hypocalcaemia. Abnormal high values of serum alkaline phosphatase and low values of serum calcium, phosphorus and Ca X P index were found in a considerable number of the group. These biochemical changes denoting a state of deficient bone mineralization associated with an osteoblastic activity are similar to that found in infantile rickets. Dietary pattern showed a low intake of available calcium due to lack or deficient intake of milk and milk products. Supplements and nutrition education during the antenatal care were lacking or poorly provided. Reinhold (1971) reported that the high phytate content of Iranian bread in rural areas possibly lead to nutritional osteomalacia.

Again Reinhold (1972) attributed the disturbance of calcium metabolism in Indian and Pakistani immigrants to the high intake of phytates resulting from eating chapati. Similarly, Egyptian bread (Eish balady) prepared from high extracted wheat flour (85–93 % extraction), forming the main staple diet of Egyptian population might be an important contributing factor in the present study. Exposure of women to sunshine was not a problem and deprivation from sunshine did not exist. A high parity did not show to contribute in the present study, however a short inter-pregnancy spacing might possibly contribute. Therefore it could be suggested that the state of osteomalacia met with in the present study could be mainly attributed to the poor dietary pattern and lack or deficient intake of supplements. Such a state of subclinical osteomalacia might explain the high prevalence of rickets among Egyptian infants and young children of low socioeconomic standard 13% Abd El Fattah and El Rafie (2), and 14% Badran et al. (3). A mother with poor bone mineralization is expected to deliver a baby with poorly mineralized bones and liable to develop rickets early in life.

Summary

230 pregnant women of low socio-economic standard were studied regarding the nutritional status and state of calcium and bone mineralization, social, environmental, dietary and biological factors of the women were also investigated to determine their possible role in such state. Results revealed a low nutritional status associated with biochemical abnormality denoting an impaired calcium state and defective bone mineralization.

The low intake of available calcium and lack or inefficient supplements are suggested to be the main factors in causing the low state of calcium.

References

1. Abd El Fattah, M., M. Shalaby, S. El Ashmawi, S., An Epidemiologic study on Iron deficiency Anemia Among Nursing Mothers. Med. I Cairo Univ. (under publication). – 2. Abd El Fattah, M., M. El Rafie, Child 0–5 years Morbidity and Mortality in an Egyptian Rural community, under publication (1977). – 3. Badran, I. et al., Community Development project of Baragil Village, Medical part. (1976). – 4. Beaton, G. H., J. M. Bengoa, Nutrition in Preventive Medicine, W.H.O. Mon. Ser. No. 62 (Geneva 1967). – 5. FAO 1972, Milk and milk products in Human Nutrition. Nutr. Studies No. 27 (Rome). – 6. Jelliffe, D. B., The assessment of the nutritional status of the Community, Geneva W.H.O., Mon. Ser. No. 53 (1966). – 7. King, E. J., I. D. P. Wootton, Micro-analysis in Medical Biochemistry, 3rd Edit. (1959). – 8. Reinhold, J. G., High Phylate content of Rural Iranian Bread: A possible cause of human zinc Deficiency. Amer. J. Clin. Nutr. 24, 1204 (1971). – 9. Reinhold, J. G., Nutritional Osteomalacia in Immigrants in an Urban Community Lancet 1972/I, 386. – 10. Varely, H., Practical Clinical Biochemistry, 4th edit., p. 437 (1967). – 11. W.H.O., 1965, Nutrition in Pregnancy and Lactation, Tech. Rep. Ser. 302 (Geneva).

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