

Calcium Deficiency among Pregnant Women and their Newborns in Sidi Bel Abbes Region, Algeria

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Abstract

Background: Calcium deficiency is common in pregnant women and newborn infants. There are few data about the prevalence of calcium deficiency during pregnancy and infancy in Algeria. We assessed calcium status of pregnant women and their neonates in Sidi Bel Abbes, west of Algeria. The current study aimed to determine the prevalence of hypocalcemia in pregnancy and in their new born and to correlate maternal calcium status with neonates' calcium and birth weight.

Methods: A prospective study was conducted during five months (January to May 2014), on a representative sample of 900 pregnant women (in the third trimesters) attending MCH center in sidi bel abbes region, west of Algeria. Maternal serum and birth serum calcium, birth weight were studied in 900 mother-neonate pairs.

Results: The prevalence of hypocalcaemia in pregnant women was 70.55%. It is noted that 43% (or 387) are premature, 1% cases macrosomia and 79% (504) new-born at term.

The results of the study showed that 53.71% of the new born were hypocalcemic, most of these being neonates below 2500 g weight and 41.94% whose weight was between 2500 and 4000 g. The frequency of hypocalcaemia in new born whose mothers were delivered by caesarean sections was 55.94%. The frequency rate of hypocalcaemia in preterm infants was 79.09%. The proportion of hypocalcaemia in new born is higher in age between 0-3 day (46.07%) against 16.33% for age groups 4-7day ($p < 0.05$).

Our results noted that gestational diabetes, hypertension (gestational and chronic) and prematurity constitute risk factors for the fetal hypocalcaemia.

A frank correlation is noted between the maternal serum calcium and serum calcium levels of the newborn ($R = 0.34$). A low correlation between the calcium of the newborn and its weight ($R = 0.10$). By contrast, no correlation was noted between the weight of the new-born and the maternal serum calcium ($R = -0.067$).

Conclusions: The nutrition of pregnant women does not cover the daily requirements for calcium. It is desirable that the maternity hospitals have dieticians to inform mothers about the benefits of a balanced diet on their health and that of the child. Supplementation is needed to improve maternal and neonatal calcium nutrition.

Keywords: Calcium; Pregnancy; Weight; Newborn-Sidi Bel Abbes-Algeria

Introduction

Maternal nutrition during pregnancy is known to have an effect on fetal growth and development. It is recommended that women increase their calcium intake during pregnancy and lactation, although the recommended dosage varies among professionals [1].

An intake of 200 mg Ca/d is required during pregnancy and in the postpartum period for fetal skeletal mineralization, secretion into breast milk, and growth during infancy [2]. The calcium for skeletal mineralization is supplied by the mother across the placenta during fetal life and through breast milk during infancy. At birth, an infant's body contains 20–30 g Ca, almost all of which is in the skeleton [3,4].

Hypocalcaemia is a frequently observed clinical and laboratory abnormality in neonates. The prevalence of early hypocalcemia varies of birth weight and gestational age and is inversely related to the age of pregnancy and the weight of the neonate.

Calcium and bone metabolism in adults depend heavily on concentrations of vitamin D and its active metabolite 1,25-dihydroxyvitamin D [$1,25(\text{OH})_2\text{D}$]. Without $1,25(\text{OH})_2\text{D}$, the body cannot absorb calcium and phosphorus adequately, secondary hyperparathyroidism supervenes, the skeleton loses mineral content

(secondary osteoporosis), and new bone is not adequately mineralized (rickets or osteomalacia) [5]. There are few data from Algeria about the prevalence of hypocalcaemia in pregnancy and in the newborn. Our aim was to determine the prevalence of hypocalcemia in pregnancy and in their new born and to correlate maternal calcium status with neonates' calcium and birth weight.

Subject and Methods

The study was conducted during the period January - May 2014 and the sample consisted of 900 pregnant women in the age group (17-50) years and their new born. All the women were in the last trimester of gestation (37-42 weeks).

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Serum calcium level was measured in all mothers and new born by obtaining 2 milliliter blood samples. Hypocalcaemia was defined as a serum calcium level lower than 8 mg/dl and 7 mg/dl in term and preterm neonates respectively. Those with hypocalcaemia were detected and the findings were statistically analyzed. Serum glucose, urea, creatinine and hemoglobin were also analyzed.

Blood sample collected by well trained technicians avoiding the squeezing and examined by calcium Liquicolor® photometric test for calcium. Hemoglobin was determined by an electronic counter (ABX micros 60-OT). Than for the Urea measurement; the enzyme Urease changes the urea to ammoniac and CO₂. Addition of the enzyme glutamate dehydrogenase, α-ketoglutarate and NADH results in the formation of a L-glutamate and NAD that can be measured and its absorbance was determined at the wavelength of 340 nm. The glucose was determined by spectrophotometric method. The enzyme glucose oxidase catalyzes the oxidation of glucose to gluconic acid. Addition of the enzyme peroxidase, phenol and 4- aminoantipyrine results in the formation of a colored compound (quinone) that can be measured and its absorbance was determined at the wavelength of 500 nm. Finally, for the creatinine measurement, creatinine reacts with picrate ion in an alkaline medium to yield an orange-red complex. Whose absorbance is measured at 510 nm.

Statistical Analysis

Data of the questionnaire and results of blood tests were analyzed using software program statistical State Vieux (1998). Frequencies and the percentages were calculated and Student's t test was performed to investigate the significance in the association of the different variables and the prevalence of hypocalcaemia. Correlations were considered significant if the observed significance level *p* was <0.05. Chisquare test was used as test of significance at 5% level. Pearson's correlation coefficient was used to study the relation between maternal serum calcium, birth serum calcium and birth weight.

Results

From January 1, to May 31, 2014, 900 pregnant women were recruited in the last trimester. The mean calcium level was 87.30 ± 12 mg/l. The mean serum glucose was 1.1 ± 0.33. The mean urea was 0.23 ± 0.09 g/l. The mean creatinine was 9.78 ± 1.58 mg/l. There were 33% primiparous and 67% multiparous.

Our patients are aged 17 to 50 years. The statistical results showed that most of them, so 73% were aged between 21 and 35 years. In our study, vaginal delivery of children is largely predominant with 60.8% of all births registered during this period, the rate of caesarean sections against identified increased slightly (35.11%).

The results show that (24%) of pregnant women suffer no pathology; (38%) have pathologies of hypertension (chronic and pregnancy), (26%) about this have notion of gestational diabetes and (7%) have anemia.

For the results of the measurements of the various variables in birth blood we summarized that: the mean serum glucose was 0.68 g/l., the mean hemoglobin was 14.78 ± 2.96 g/l, the mean urea was 0.25 ± 0.30 g/l, the mean serum calcium was 81.00 ± 12.97 mg/l and the mean creatinine was 8.43 ± 4.33 mg/l.

Our study noted that the Sex ratio 453/447 = 1.03 for male. Median

age at admission for the 900 affected neonates was 3.0 (0–7) days, and median duration of admission was 3.0 (2.0–4.0) days. It reported during the study period that 67% (n=603) had birth weight 2500 g or more and 33% (n=297) newborns with low birth weight <2500 g. The mean birth weight was 2841.65 ± 731.28 g. The LBW infants seen in the period were distributed as follows: VLBW (4%) and MLBW (29%) In the LBW group (Figure 1).

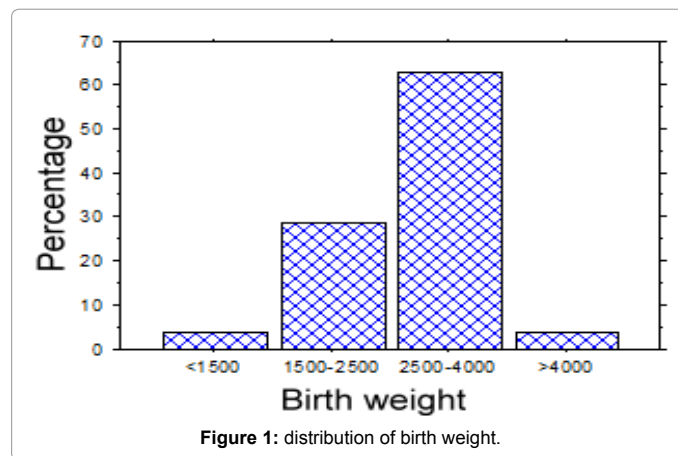
11.55% of newborns had blood glucose disorders: 0.44% for hypoglycemia and (11.11%) for hyperglycemia. Hypoglycemia is more pronounced in preterm infants is (43%) than among newborns term is (57%). The frequency of hypoglycemia in newborn term infants was 0.44%.

The distribution of serum calcium and different characteristic of new born is shown in Table 1.

The percentage of hypocalcaemia in low birth weight group (<2500 g) was 53.71% while in the birth weight group (2500-4000 g) it was 41.94% (p<0.05). However, the prevalence of hypocalcaemia was higher among prematurity (79.09%) compared to control group (20.90%), (p<0.001).

In our study, caesarean sections delivery of children with hypocalcaemia is largely predominant (55.94%). of all births registered during this period, the rate of vaginal delivery of children with hypocalcaemia decreased slightly (37.28%). This difference is statistically significant (p<0.05).

The proportion of newborns with hypocalcaemia is higher in age



Variable	Hypocalcemia n (%)	Normal Calcemia (control group) n (%)	P value
Birth weight			
<2500g (n=297)	53.71%	46.28%	< 0,05 S
2500-4000g (n=603)	41.94%	58.05%	
AGE (Day)			
0-3 day	46.07%	53.92%	< 0,05 S
4-7day	16.33%	83.33%	
Prematurity	79.09%	20.90%	< 0.001 S
Mode of delivery			
Vaginal	37.28%	62.72%	0, 05 S
Caesarean	55.94%	44.05%	

Table 1: Distribution of serum calcium in function of the characteristics of the newborn.

between 0-3 days (46.07%) against 16.33% for age groups 4-7 day. This difference is statistically significant ($p < 0.001$).

A frank correlation is noted between the maternal serum calcium and serum calcium levels of the newborn ($R = 0.34$). A low correlation between the calcium of the newborn and its weight ($R = 0.10$). By contrast, no correlation was noted between the weight of the new-born and the maternal serum calcium ($R = -0.067$), (Figures 2-4).

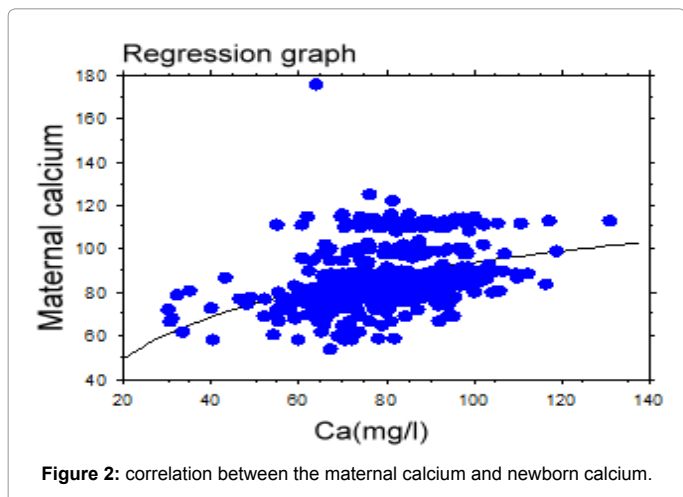


Figure 2: correlation between the maternal calcium and newborn calcium.

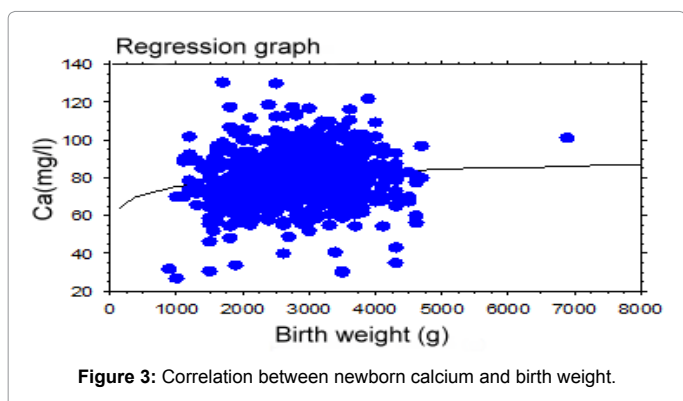


Figure 3: Correlation between newborn calcium and birth weight.

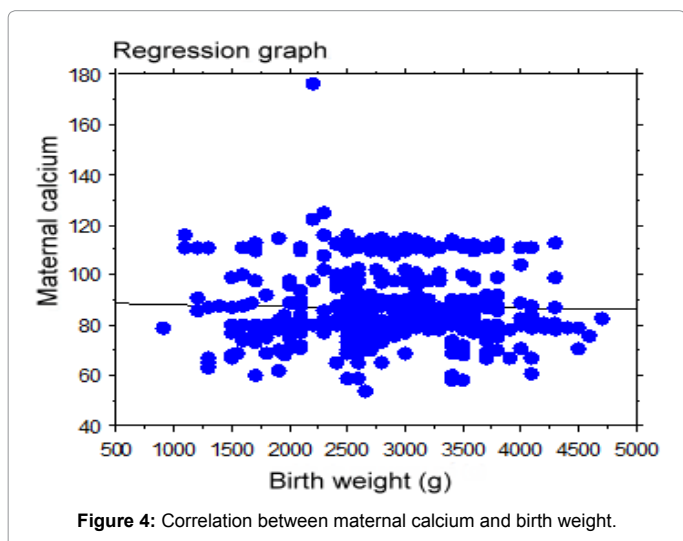


Figure 4: Correlation between maternal calcium and birth weight.

Discussion

Pregnancy is associated with physiologic changes that result in increased plasma volume and red blood cells and decreased concentrations of circulating nutrient-binding proteins and micronutrients. In many developing countries, these physiologic changes can be aggravated by undernutrition, leading to micronutrient deficiency states. [6].

Our study showed that prevalence of hypocalcaemia in pregnant women was 70.55%. During the last trimester, calcium is actively transferred from mother to the fetus as demonstrated by a significantly high level of total calcium concentration in cord blood compared to maternal serum [7].

Maternal nutrition during pregnancy is known to have an effect on fetal growth and development. It is recommended that women increase their calcium intake during pregnancy and lactation, although the recommended dosage varies among professionals.

The results of this research showed that approximately 53.71% of low birth weight infants developed early hypocalcaemia, and 79.09% of preterm suffered from hypocalcaemia. That is higher to the research conducted in the United States, because the prevalence of hypocalcaemia in full-term infants was 30 to 40 percent. Also, it is still higher to that found in Iran where reported rate is 22.4% [8,9].

The associated risk factors were prematurity, birth weight, of the mother and since the majority of afflicted infants were asymptomatic, the importance of routine measurement of serum calcium levels in this group of infants becomes clear [10].

On the other hand, with better care during pregnancy and prior to delivery, it is possible to prevent problems such as pre-eclampsia, prematurity, IUGR, and birth asphyxia and consequent hypocalcemia of infants can be prevented. Paying close attention to the afore-mentioned problems and timely recognition of hypocalcemia and appropriate management will prevent the undesirable consequences of this disease.

Further study is recommended to detect other causes of infantile hypocalcemia, the effects of increasing care during pregnancy (nutrition or treating complications of pregnancy and prescribing vitamin D) and its effect on the occurrence of infantile hypocalcemia and the consequences of pregnancy on the prevalence of hypocalcemia and also ways of preventing prematurity and IUGR to reduce hypocalcemia in newborns [11-15].

Our study noted that low correlation between the calcium of the newborn and its weight ($R = 0.10$). The effect of maternal calcium intake on infant growth remains unclear. Calcium intake during pregnancy may have a positive effect, but the research has provided conflicting results [16-18]. A positive relationship between maternal calcium intake and infant length or mid-upper arm circumference has been shown [17,18]. But the results have not been reproduced in other studies [16,17]. The literature also reports inconsistent findings of positive relationships between maternal calcium intake and newborn weight and infant total body calcium. [19-22].

Neonatal hypocalcaemia is higher in Algeria, is often a sign of coexistent vitamin D insufficiency or deficiency and hypomagnesaemia, and is readily managed with therapy of limited duration.

In summary, we recommend that the evaluation of neonates presenting with early hypocalcemia should include an initial assessment of calcium, phosphorus, magnesium, intact PTH, and 25 (OH)D levels.

Conclusion

We observed a high prevalence of significant hypocalcaemia among pregnant women and their newborns, the magnitude of which warrants public health intervention. It is recommended that all infants weighing less than 2500 with or without clinical signs undergo screening tests and their level of calcium measured so that prompt treatment can be provided to prevent the serious consequences of this disorder.

There is an urgent need for this pathology so that both program effectiveness and program efficacy can be improved in Algeria.

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