

"Assessment of Serum Calcium Levels in Pregnant Women: A Study in Derna, Libya"

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Abstract— Background: Pregnancy is a period of heightened calcium demand necessary for the growth and development of the fetus and placenta. Women with low calcium intake may manifest hypocalcemia in pregnancy. **Aim:** This study aims to assess the prevalence of hypocalcemia among pregnant women in Derna city/Libya. **Methods:** A cross-sectional study was used from 1st January 2023 to 31 May 2023, samples were collected from obstetrics and gynecology department at Al-Wahda hospital and Zahret al-Hayat private Clinic. **Results:** The study showed that 58.4% of the pregnant women recorded a low level of calcium, 36.6% recorded a normal level and 5% recorded a high level. **Conclusion:** It is necessary to raise the level of calcium with good nutrition during pregnancy, taking calcium supplements and getting an adequate portion of vitamin D to improve the general health of pregnant women.

Keywords: Hypocalcemia, Pregnancy, Serum calcium, Vitamin D deficiency, Maternal health, Nutrition, Libya.

INTRODUCTION

Calcium is an critical mineral this is required for such a lot of physiological features withinside the frame and a sensitive stability is needed in being pregnant to deal with the heightened call for for the increase and maturation of the fetus. The multiplied calcium call for in being pregnant is most withinside the 0.33 trimester and this coincides with the duration of laying of maximum of the neonatal skeleton calcium content material of 20–30 g(1).The fetal calcium accretion regularly takes place on the fee of the mom who compensates via way of means of doubling the intestinal calcium absorption aided via way of means of multiplied diet D degrees and mild lower in parathyroid hormones(2).Calcium homeostasis relies upon at the adequacy of maternal calcium consumption and the mechanism can fail in girls with calcium consumption of much less than 500 mg/day(3) . This is particularly critical in pregnant adolescents, moms who aren't uncovered to sufficient daylight for ok synthesis of nutrition D and girls of low socioeconomic status (4-6). The above triad is a not unusualplace prevalence in a growing u . s . a . like ours and offers a super recipe for hypocalcemia to thrive. In the

remaining decade, hypocalcemia turned into particularly visible in teenage moms and lactating ladies (4,7), however currently boom in antenatal ladies imparting with hypocalcaemiccarpo-pedal spasm at some point of the second one and 0.33 trimesters, and maximum of those capabilities disappear with calcium supplementation . The new fashion of low calcium amongst pregnant ladies is probably due to their incapability to deal with the more call for at some stage in being pregnant and this requires in-intensity studies into the reasons and danger elements so that it will addressing them. The WHO has advocated ordinary calcium supplementation in being pregnant specially in regions of low calcium consumption as one of the measures to lessen the superiority of preeclampsia (8). However, calcium supplementation is not routinely done in all Libya centers. The latest protection demanding situations withinside the nation have similarly dwindled the dietary content material of the diets of maximum families, specifically the internally displaced human beings residing within side the camps and host communities.

THE STUDY PROBLEM

Pregnancy increases the demand for calcium to support fetal growth and maternal physiological changes. Inadequate calcium levels during pregnancy can result in hypocalcemia, adversely affecting maternal and fetal health, including risks such as preeclampsia and osteoporosis. In Libya, there is limited data on the prevalence and associated factors of hypocalcemia among pregnant women. This gap hinders the development of effective nutritional interventions and healthcare strategies. The research problem focuses on identifying the prevalence and determinants of hypocalcemia among pregnant women in Derna, Libya, and the role of nutritional and lifestyle factors.

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THE AIM OF THE STUDY

The primary aim of the study "Assessment of Serum Calcium Levels in Pregnant Women: A Study in Derna, Libya" is to estimate the prevalence of hypocalcemia among pregnant women attending antenatal clinics in Derna City, Libya. Given the critical role of calcium in fetal development and maternal health, this study seeks to identify the extent of calcium deficiency within this population, which may have significant implications for both maternal and fetal outcomes. By assessing serum calcium levels, the study aims to highlight the need for nutritional interventions and public health strategies to address hypocalcemia during pregnancy.

MATERIAL AND METHOD

A. Study design:

A Cross-sectional study was conducted in obstetrics and gynecology department at Al-Wahda hospital and Zahret al-Hayat private Clinic) in Derna City. Recruitment was by convenience sampling method and the study was conducted from 1st January 2023 to 31 May 2023. Sociodemographic variables and clinical characteristics such as age, family Income, occupation, educational status, height, weight, BMI, nutritional status, gravidity, parity, abortion and gestational age, chronic disease were noted and recorded on a proforma designed for the study.

B. Sample Size and Sampling Method:

study design with convenience sampling as sampling technique. The study targeted pregnant women who were presented during the period of data collection and involve 202 populations.

RESULT

A total of 202 pregnant women were included. The age of the pregnant women ranged from 18 to 45 years, with the mean age of 29.51 ± 6.295 years, 31(13%) were between 30 to 34 years old, while 49(24.3%) of women were 35 years and older. Two third 122 (60.4%) of the pregnant women were under 30 years old. Only 8(4%) of pregnant women completed primary school, and over 45(22.3%) received a higher educational level, 145(71.8%) with a bachelor's degree and 4(2%) with a postgraduate degree. Nearly 85(42.1%) of the pregnant women stated that there was housewife occupation, while about 37(23.3%) were a teacher. However, there were no association between demographic characteristics and prevalence of hypocalcaemia of pregnant women (Table 1).

The mean height of pregnant women was 160.9 ± 7.2 range from 106 to 178 cm and the mean weight was 70.9 ± 13.7 range from 45 to 113 Kg. So, the mean BMI was 27.4 ± 5.1 range from 17.69 to 46.3 Kg/m². 72 (35.6%) of pregnant women were in healthy weight, 72 (35.6%) were in overweight and 56(27.7%) were obese. High percentage of women were in healthy weight and overweight but no association between BMI and serum calcium ($P=0.286$). Concerning obstetrical history, 17.3% were multigravida, 48.5% of the study women were parity from 0-1. The majority was in the third trimester (44.1%). However, there were no association between obstetrics and medical factors of pregnant women and hypocalcaemia (Table 2).

The mean serum calcium among pregnant women was 8.20 ± 2.02 range from 2.1 to 19.1. The prevalence of hypocalcaemia at recruitment was 118(58.4%) with 10(5%) women having calcium level high than 10.2 mg/dl (Figure 1). The mean serum vitamin D level among pregnant women was 17.910 ± 10.31 range from 3.0 to 60.74. The prevalence of vitamin D deficiency was 128(63.4%) and high in 3 women 3(1.5%) (Figure 2). 33(16.3%) of pregnant women suffer from chronic disease, 21(10.4%) were suffer from osteoporosis, 19(9.4%) suffer from preeclampsia, 6(3%) gestational diabetes, 5(2.5%) hypertension and 3(1.5%) diabetes. Most of pregnant women suffer from preeclampsia, 84.2% of them have normal serum calcium and 15.8% have abnormal serum calcium. However, there was no association between choric disease and serum calcium ($P=0.349$) (Table 3).

The majority of pregnant women 189(93.6%) took nutritional supplements. The rate of calcium supplementation with vitamin D in pregnancy among the study population was 61.4% and 17.5% took calcium alone. Sixty-three of pregnant women (16.8%) were taking folic acid, 34(16.8%) taking vitamin D and 10(5%) taking iron. However, few of pregnant women 41(20.3%) were taking iron and calcium supplements at the same time. Also, 36(17.8%) of pregnant women drank tea or coffee right after you took calcium pills.

Most of pregnant women 178 (88.1%) were eat dairy and its derivatives daily, 56.9% had normal serum calcium and 35.4% had abnormal serum calcium. And there were no association between dairy eat and serum calcium ($P=0.369$) (Table 4). Most of women took calcium supplements, 42.1% had normal serum calcium and 27.7% had abnormal serum calcium. There was no relationship between calcium supplements and serum calcium (Table 5).

Table 1: Demographic characteristics, prevalence for pregnant women and association with hypocalcaemia:

	No (%)	Hypocalcaemia		X ²	P-value
		Yes	No		
Age					
<30	122(60.4)	73(36.1)	49(24.3)	1.679	0.432
31-34	31(15.3)	20(9.9)	11(5.4)		
≥35	49(24.3)	25(12.4)	24(11.9)		
Educational level					
Primary school	8(4.0)	5(2.5)	3(1.5)	0.662	0.882
high school	45(22.3)	25(12.4)	20(9.9)		
Bachelor's degree	145(71.8)	85(42.1)	60(29.7)		
Postgraduate degree	4(2.0)	3(1.5)	1(0.5)		
Family Income					
Low (<1200LD)	99(49.0)	55(27.2)	44(44.4)	2.895	0.235
Medium (1200 to 2400 LD)	99(49.0)	62(30.7)	37(18.3)		
High (>2400 LD)	4(2.0)	1(0.5)	3(1.5)		
Occupation					
Housewife	85(42.1)	48(23.8)	37(18.3)	6.127	0.294
Teacher	47(23.3)	28(13.9)	19(9.4)		
Clerk	28(13.9)	13(6.4)	15(7.4%)		
Doctor	21(10.4)	15(7.4)	6(3.0)		
Engineer	4(2.0)	4(2.0)	0(0.0)		
Other	17(8.4)	10(5.0)	7(3.5)		

Table 2: The obstetrics and medical factors of pregnant women :

	Hypocalcaemia			P-value
	No (%)	Yes (%)	No (%)	
Height				
106-160	113(55.9)	64(31.7)	49(24.3)	0.164
161-170	80(39.6)	46(22.8)	34(16.8)	
≥171	9(4.5)	8(4.0)	1(0.5)	
Weight				
45-60	55(27.2)	28(13.9)	27(13.4)	0.455
61-70	55(27.2)	31(15.3)	24(11.9)	
71-80	47(23.3)	30(14.9)	17(8.4)	
≥81	45(22.3)	29(14.4)	16(7.9)	
BMI				
Underweight	2(1.0)	0(0.0)	2(1.0)	0.286
healthy weight	72(35.6)	29(14.4)	43(21.3)	
Overweight	72(35.6)	23(11.4)	49(24.3)	
Obesity	56(27.7)	22(10.9)	34(16.8)	
Gravidity				
Multipara	35(17.3)	20(9.9%)	15(7.4)	0.505
Primigravidae	167(82.7)	98(48.5)	69(34.2)	
Gestational age				
1st trimester	37(18.3)	20(9.9)	17(8.4)	0.666
2nd trimester	76(37.6)	43(21.3)	33(16.3)	
3rd trimester	89(44.1)	55(27.2)	34(16.8)	
Parity				
0-1	98(48.5)	55(27.2)	43(21.3)	0.801
2-3	62(30.7)	38(18.8)	24(11.9)	
≥4	42(20.8)	25(12.4)	17(8.4)	
Abortion				
0-1	166(82.2)	20(9.9)	15(7.4)	0.505
≥2	36(17.8)	98(48.5)	69(34.2)	

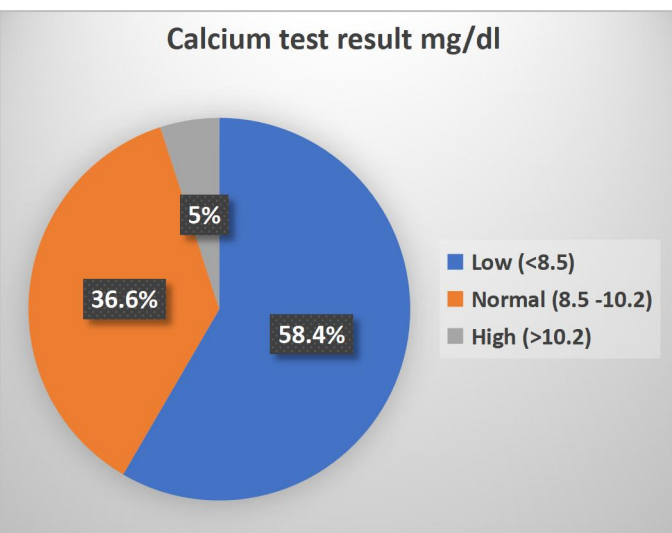


Figure 1: Calcium test result (mg/dl).

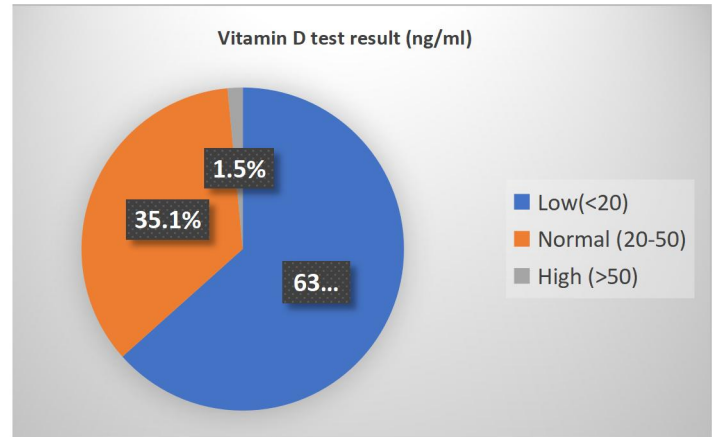


Figure 2: Vitamin D test result (ng/ml).

Table 3: The association between chronic disease and serum calcium:

	No(%)	Serum Calcium		X ²	P-value
		Normal No (%)	Abnormal No (%)		
Diabetes	3(1.5)	1 (33.3)	2 (66.4)	3.290	0.349
Hypertension	5 (2.5)	3(60.0)	2(40.0)		
Gestational diabetes	6(3.0)	3(50.0)	3(50.0)		
Preeclampsia	19(9.4)	16(84.2)	3(15.8)		
Osteoporosis	21(10.4)	12(57.1)	9(42.9)		

Table 4: The association between dairy and its derivatives eat and serum calcium:

	No(%)	Serum Calcium		X ²	P-value
		Normal No (%)	Abnormal No (%)		
Yes	178(88.1)	115(56.9)	63(35.4)	0.993 ^a	0.369
No	24(11.9)	13(6.4)	11(5.4)		

Table 5: The association between calcium supplements and serum calcium:

Calcium supplements	No(%)	Serum Calcium		X ²	P-value
		Normal No (%)	Abnormal No (%)		
Yes	141(69.8)	85(42.1)	56(27.7)	0.671	0.440
No	61(30.2)	33(16.3)	28(13.9)		

DISCUSSION:

Hypocalcaemia is a significant problem in developing countries. Our study showed the prevalence of hypocalcaemia as 58.4% among pregnant women in Derna city. This result is consistent with the study conducted in Nkongsamba hospital where the prevalence of hypocalcaemia was 58.8%(9). The prevalence of hypocalcaemia in pregnancy in this study is much higher than 1.3% reported earlier in Nigeria(10). The lower prevalence in their study may be because they used symptomatic pregnant women only.

Our prevalence is lower than 60.0% reported in Pakistan (11) and 70.55% reported in Algeria (12) and 66.4% reported in India (6). The higher prevalence in the latter studies may be because of their practice of isolation and extreme clothing of the body which might interfere with both calcium and vitamin D homeostasis. Even though Libya has geographical and culturally different, the dietary habits of the pregnant women may differ. In addition, we used good sample size for our study.

Although 60.4% of pregnant women in age <30 years old, our study shows that there was association between age and hypocalcaemia among antenatal mothers. This may explain the similarity with finding of Aruna Patel et al who had majority of their study subjects in the age group 18-24 years (13).

As for the participants' monthly household income, nearly half of them 49% was in the middle-income category while another 49% were in the low-income category, leading to the presence of food insecurity which subsequently affects the nutritional food intake among antenatal. Insufficient dietary intake can also result poverty and low socioeconomic status (6).

Family Income was not significantly correlated with occurrence of hypocalcaemia in the study(6). This is different to previous reports that lower income women had lower calcium intake. It is most likely that low social class imposes a status of inadequate calcium consumption in the diet because low consumption of diets rich in calcium such as soya bean, legumes and vegetables(14).

Even, most of pregnant women had a university degree. The relation between maternal education and the hypocalcaemia observed showed no association between hypocalcaemia and maternal educational level. However, education seems to protect against hypocalcaemia because educated women are more likely to be employed and can afford meals that are rich in calcium compared to uneducated ones. Furthermore, educated women are more knowledgeable about balanced diets and often seek better pregnancy care.

In their study, pregnant women with parity 0-1 had lower serum calcium level compared to other which different to other study and no significantly different (15). To explain this relationship some investigations have proposed that frequent cycle of reproduction exert a significant stress that leads to a greater risk of malnutrition(15-16).

Low calcium often starts early in pregnancy and the consequence manifests or worsens in the third trimester. Even though our study showed that serum calcium levels were lowest in the third trimester, the differences across trimesters of pregnancy were not statistically significant but remained lower. During the last trimester, calcium actively crosses the placenta from the mother to the fetus. Significant umbilical arterio-venous differences have been reported as far as total calcium

concentrations are concerned, and these differences reflect variations in the protein bound form only.

Although there was no statistically significant association, women with a BMI less than 30 kg/m² and high then 24.9 kg/m² were 35.6 % times more likely to have lower serum calcium levels than their counterparts with a higher BMI. According to a study on obesity and calcium absorption, metabolic status affects calcium absorption so that obesity is associated with higher calcium absorption (17).

In addition, this study found 2.5% of pregnant women had hypertension, and 6.1% of them had abnormal serum calcium. However, there was no association between choric disease and serum calcium. This differs from what researchers found in a previous study. Researchers in the past have also reported a link between calcium depletion and hypertension in pregnancy in both animal and human studies (18,19,20,21). The relationship between hypertension and hypocalcaemia has led to some researchers to advocate for the use of calcium supplement to reduce the risk of developing hypertension and hypocalcaemia (22,23).

The rate of calcium supplementation among our study population was 61.4%, very low compared to the recommendations of the World Health Organization for a low-income country (24), and this means that more than 38% of these women who entered pregnancy with less than the optimal level of calcium passed during pregnancy without any calcium supplement. Our findings are consistent with those in Benin on calcium absorption, which indicate that more than 90% of pregnant women in Southern Benin had a low calcium intake during pregnancy (25).

This was in accordance with already published data and proved that calcium level disturbance could be an eminent cause of preeclampsia in women 9.4%. Few studies also reported the same findings and suggested that reduced calcium levels are considerably associated with abnormal blood pressure in pregnant women (26,27, 28, 29).

Despite its clear advantages, the rate of calcium supplementation among our study population 17.3% was very low compared to WHO recommendations for a low oncome country (30).

In our study, 20.3% of pregnant women took calcium and iron supplements at the same time. Negative interactions between iron and calcium supplements in pregnancy have been described. Therefore, it is advised that the two nutrients be taken preferably several hours apart rather than concomitantly (30).

Our study recorded a prevalence of hypocalcaemia in pregnancy of 12.9%. This prevalence was even significantly higher when serum calcium values were uncorrected for the albumin changes in pregnancy. A similar study was conducted in Algeria targeting women in their third trimester and their babies. The authors reported a relatively higher prevalence (70.55%) of hypocalcaemia among pregnant women in their third trimester of pregnancy (31). The finding on the prevalence of hypocalcaemia in late pregnancy shows that this metabolic imbalance is highly prevalent among pregnant women in this setting.

Nutritional habits vary significantly across the different study populations given that the three studies were conducted

in three different countries with significantly different sociocultural and economic status.

In our study, (17.8%) of pregnant women drank tea or coffee immediately after taking calcium pills. Caffeine consumption-It indirectly reduces the filterable calcium in the blood and may enhance stress response to heightened stress epinephrine levels. Although there is a decrease in blood magnetism sium does not increase the secretion of the secretory hormone (32).

In our study, vitamin D deficiency among pregnant women was 63.8%, as there was a correlation between calcium and vitamin D, and therefore our results are consistent with other studies (33,34).

In contrast, Al-Graiw MH et al. (35) demonstrated a significant positive correlation between Ca^{+2} and VD. In accordance with Al-Graiw MH et al., Nair R and Maseeh A (35,36) suggested that vitamin D deficiency is associated with reduced Ca^{+2} levels. Recent evidence reported a reduction in intestinal absorption of Ca^{+2} in older age, which may lead to secondary hyperparathyroidism and bone demineralization (36). In accordance with Al-Graiw MH et al., Nair R and Maseeh A (35,36) suggested that VD deficiency is associated with reduced Ca^{+2} levels.

Conclusion and Recommendations

Several recommendations can be made to address the observed prevalence of hypocalcemia and improve the calcium status of pregnant women. First, routine calcium supplementation programs should be implemented for pregnant women, particularly in regions with low dietary calcium intake, in alignment with World Health Organization (WHO) guidelines. These programs would help reduce the risk of hypocalcemia and associated complications, such as preeclampsia and osteoporosis. Second, it is essential to develop and promote nutritional education programs to raise awareness about the importance of calcium and vitamin D during pregnancy. These programs should emphasize the role of calcium-rich foods, the recommended daily allowances, and the need for a balanced nutritional intake.

Third, dietary interventions should be encouraged, specifically promoting the consumption of calcium-rich foods such as dairy products, green leafy vegetables, and fortified foods. Nutritional counseling during antenatal visits should be a key component of this approach to ensure pregnant women are informed about their dietary options and understand the importance of maintaining adequate calcium levels. Fourth, regular monitoring and screening for serum calcium and vitamin D levels should be integrated into antenatal care services. Early detection of deficiencies would allow healthcare providers to intervene promptly, preventing further complications. Fifth, addressing socioeconomic barriers that hinder access to proper nutrition is critical. Community-based initiatives, such as food assistance programs, should be introduced to provide low-income families with calcium-rich foods or supplements. Finally, further research is needed to explore factors influencing calcium absorption and metabolism in pregnant women, particularly in relation to dietary habits, socioeconomic status, and cultural practices. This would provide deeper insights into the underlying causes of

hypocalcemia and inform more effective public health strategies.

In conclusion, the study revealed a significant prevalence of hypocalcemia, affecting 58.4% of the pregnant women surveyed in Derna, Libya. This highlights an urgent public health issue that requires immediate attention. The findings underscore the critical importance of ensuring adequate calcium intake during pregnancy for the health and well-being of both mothers and their infants. Addressing nutritional deficiencies through targeted interventions such as routine supplementation programs, educational initiatives, dietary counseling, and regular monitoring can significantly improve the nutritional status of pregnant women in Derna and similar settings. Furthermore, proactive measures to address socioeconomic barriers and enhance access to proper nutrition will contribute to reducing the prevalence of hypocalcemia, improving maternal health outcomes, and mitigating the risks of pregnancy complications. By adopting these recommendations, healthcare providers and policymakers can create a sustainable framework to promote maternal health and reduce the burden of calcium deficiency in vulnerable populations.

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