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Original Article

HYPOCALCEMIA AND ANEMIA IN PREGNANCY: A HOSPITAL BASED STUDY IN JUMLA, NEPAL

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ABSTRACT

Background

Hypocalcemia is a condition where the serum calcium is below the optimum level. Calcium supplements demand increases in pregnancy. Some complications of pregnancy may be associated with lower serum calcium level e.g. pre-eclampsia during pregnancy, low birth weight, preterm delivery, and neonatal death. Iron deficiency in pregnant women is a cause of anemia and predisposes women to urinary tract infections, low birth weight of newborns and a higher risk of premature birth.

Methods

This is an observational, descriptive, prospective study which was done after the IRC approval. Blood samples were obtained from the pregnant women in their routine antenatal check-up and serum total calcium and hemoglobin were estimated by O – Cresolphthalein Complexone (OCPC) method and Cyanmethemoglobin method respectively. Initially the data were recorded in MS-Excel 2007 and analyzed by SPSS16. Level of significance was defined at $p<0.05$ at 95% confidence interval.

Results

There were 280 participants in this study with age varying from 19 to 40 and the median age was 24 years. 68.2% of it had hypocalcemia and 11.8% had anemia.

Conclusions

Hypocalcemia and anemia alone or together is a severe condition during pregnancy. Enhancing dietary calcium and iron intake together with knowledge and awareness during pregnancy could mitigate the high prevalence of hypocalcemia and anemia, thereby improving maternal and fetal outcomes.

Keywords: Anemia, Hypocalcemia, Pregnancy

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INTRODUCTION

Hypocalcemia is a condition where the serum calcium is below the optimum level. There is mounting evidence that the population in the southeast consumes less calcium from their diets than is advised each day[1]. A drop in serum calcium levels may result from inadequate calcium intake through diet[2]. In addition to the amount of calcium consumed through diet, the human body's serum calcium level is also affected by multiple variables, including vitamin D, sunshine exposure, and parathyroid hormone levels[2].The daily requirement for calcium in the non-pregnant condition is 600 mg, and during pregnancy it rises to 1,200 mg[3]. The growing and development of the fetus's bones and teeth depend on this higher calcium content. During pregnancy, an increased calcium intake can help meet this demand[3]. This higher calcium content is necessary for the fetus's bones and teeth to grow and mature. During pregnancy, an increased calcium intake can help meet this demand[3]. Hemodilution is the main cause of the drop in serum calcium levels that occurs throughout the second and third trimesters of pregnancy[4]. Lower serum calcium levels have been associated to a number of pregnancy issues, including low birth weight, premature delivery, neonatal mortality, and pre-eclampsia[5,6].

Pregnant women who are iron deficient are more likely to experience urinary tract infections and develop anemia. Premature birth with underweight of the offspring are strongly correlated with iron deficiency anemia in pregnant women[7,8]. Pregnant women should receive 27 mg of iron per day from their diet, per current recommendations[9]. The World Health Organization (WHO) suggests consuming more nutrients during gestation and breastfeeding because to the increased need for numerous micronutrients during pregnancy[10]. Notwithstanding this, the prevalence of maternal undernutrition worldwide, including deficits in micronutrients, remains high, especially in South Asia, where 10–40% of mothers are undernourished[11]. Furthermore, the amount of vitamin D, calcium, magnesium, and iron ingested in Australia is 74% less than what is recommended[12].

Serum calcium and blood hemoglobin deficiencies during pregnancy have a number of negative impacts on the developing fetus as well as the expectant mother. Therefore, research on the occurrence of anemia and hypocalcemia during pregnancy is crucial for developing pertinent regulations and assessing how well-working tactics are.

METHODS

This is a hospital-based prospective study conducted in the department of Biochemistry in collaboration with department of Obstetrics and Gynecology at Karnali Academy of Health Sciences, Jumla, Nepal after the ethical approval of the Institutional Review Committee (IRC) with the reference No. 2078/2079/47. The study involved 280 low-risk pregnant women aged 19 to 40. It included all pregnant women of all the trimesters who visited the hospital for routine follow-up and got their serum calcium and hemoglobin levels measured beside other investigations.

Blood was be kept in vacutainer having EDTA for hemoglobin estimation and in the vacutainer having citrate buffer for the serum calcium estimation. Hemoglobin estimation was done by Cyanmethemoglobin method and serum calcium by O – Cresolphthalein Complexone (OCPC) method. The reference levels of serum calcium and blood hemoglobin were 9 – 11 mg/dl and 12- 15 g/dl (for female) respectively. Initially, the data were recorded in MS-Excel, and later, statistical analysis was performed using SPSS software. Statistical significance was determined at the $p < 0.05$ level.

RESULTS

Table 1: Serum calcium level in different trimesters

Trimester	Serum Total Calcium Concentrations		Participants number	P-value
	< 9 mg/dl	9-11 mg/dl		
I	12 (80%)	3 (20%)	15 (100%)	0.295
II	27 (60%)	18 (40%)	45 (100%)	
III	152 (69.1%)	68 (30.9%)	220 (100%)	
Total	191 (68.2%)	89 (31.8%)	280 (100%)	

Table 2: Hemoglobin (Hb) level in different trimesters

Trimester	Hemoglobin Concentrations			Participants number	P-value
	<12 g/dl	12-15 g/dl	>15 g/dl		
I	0 (0%)	12 (80%)	3 (20%)	15 (100%)	<0.001
II	15 (33.3%)	24 (53.3%)	6 (13.3%)	45 (100%)	
III	18 (8.2%)	168 (76.4%)	34 (15.5%)	220 (100%)	
Total	33 (11.8%)	204 (72.9%)	43 (15.4%)	280 (100%)	

There were 280 participants who were involved in the study. The maximum participants were in third trimester followed by the second and least with 15 persons in the first trimester. The study population varied the ages from 19 to 40 years with the median age of 24 years.

From the table 1, hypocalcemia is found to be 68.2% and the normocalcemia was 31.8% of the study population. Comparing the hypocalcemia in different trimesters, the p-value was found to be 0.295 which is statistically insignificant.

Similarly, the table 2 shows the status of hemoglobin level. 72.9% of the total participants had normal hemoglobin level and 11.8% had low hemoglobin level, so 11.8% of the participants were anemic. The status of hemoglobin level also varied in different trimesters. 33.3% of the participants in second trimester and 8.2% of the participants in third

trimester were anemic. None of the participants in first trimester were anemic. Status of anemia in different trimesters had a p-value of <0.001 , so it is statistically significant.

DISCUSSION

The findings of this study highlight the significant prevalence of hypocalcemia and anemia among pregnant women in Jumla, Nepal.

Hypocalcemia prevalence in our study is 68.2%, while Benali and Demouche (2014) revealed that pregnant women in Algeria had a high prevalence of hypocalcemia (70.55%)[13]. However, Kumar et al., in 2010 reported that approximately two thirds of pregnant women in India were hypocalcaemic despite any clinical symptoms[14]. In the study conducted by Kant et al., the prevalence (95% CI) of hypocalcaemia was 23.9% (20.8 – 27.2%)[15]. In our study, we found the prevalence of hypocalcemia to be 80% in the first trimester which may be due to insufficient participants as compared to the second and the third trimester. But as comparison to the second trimester, prevalence of hypocalcemia is more in the third trimester due to increased fetal demand or hemodilution, which aligns with the similar study done by Ajong et. al in 2019[16]. During the last trimester, the rate of calcium crossing the placenta from the mother to the foetus increases[17]. The total calcium concentration has significant umbilical arteriovenous differences, and this differences reflect variations in the protein-bound form only[17]. Calcium is required in its maximal concentrations in the third trimester for foetal bone formation and consolidation[18,19]. However, the lack of statistical significance in the variation of hypocalcemia across trimesters (p = 0.295) indicates that some other factors, such as number of participants differences in the trimesters, dietary habits, sunlight exposure, calcium supplements , vitamin D status etc.,may play a significant role in calcium status during pregnancy.

Anemia was present in 11.8% of the participants in this study, with a significant increase in the second trimester. In Nepal, 41% of women who are of reproductive age suffer from anemia, with Province 2 having the greatest prevalence (58%) in 2016[20]. In a study done by Yadav et. al. in 2021, the overall anemia prevalence in the study population was 66.9% (95% CI, 61.1–72.3)[21]. Qiao et. al in thier study showed that the prevalence of anemia at any stage during pregnancy in the monitoring areas was 43.59% in 2016–2020[22]. The Report on Nutrition and Chronic Disease Status of Chinese Residents in 2020 reported that the prevalence of anemia during pregnancy in China was 13.6% in 2015–2017, which nearly aligns with our study[23]. The reason for having low prevalence of anemia in our study in respect to other studies can be due to high altitude, as the participants are the local resident of Jumla, Nepal (average altitude 2400 meter from the sea level) . The residents present in the high altitude have compensatory mechanism to increase the red blood cells and then the hemoglobin[24].

The correlation between low serum calcium and anemia, although not explicitly studied here, is supported by evidence that both deficiencies can coexist due to poor dietary intake and inadequate supplementation.

CONCLUSIONS

Hypocalcemia and anemia alone or together is a severe condition during pregnancy. Education provides knowledge and awareness about nutrition, health, and hygiene, which are essential for preventing anaemia and hypocalcemia. Our findings emphasize the urgent need for targeted nutritional interventions during pregnancy. Enhancing dietary calcium and iron intake together with knowledge and awareness during pregnancy could mitigate the high prevalence of hypocalcemia and anemia, thereby improving maternal and fetal outcomes.

LIMITATIONS

This study does not tell the prevalence of hypocalcemia and anemia of the entire pregnant women of this region as the participants were only the pregnant women who visited the hospital and got their serum calcium and hemoglobin estimation together done during their antenatal check-up. Moreover, there was no control group to compare the status of serum calcium and hemoglobin. Detailed history of iron and calcium supplements, medical and drug history and other factors which could alter the status of serum calcium and hemoglobin are absent.

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Conflict of interest: None

REFERENCES

1. Kumar A, Meena M, Gyaneshwori Devi S, Gupta RK, Batra S. Calcium in midpregnancy. Archives of gynecology and obstetrics. 2009 Mar;279:315-9.
2. Peacock M. Phosphate metabolism in health and disease. Calcified tissue international. 2021 Jan;108:3-15.
3. Misra A, Sharma R, Gulati S, Joshi SR, Sharma V, Ghafoorunissa, Ibrahim A, Joshi S, Laxmaiah A, Kurpad A, Raj RK. Consensus dietary guidelines for healthy living and prevention of obesity, the metabolic syndrome, diabetes, and related disorders in Asian Indians. Diabetes technology & therapeutics. 2011 Jun 1;13(6):683-94.

4. Pitkin RM, Gebhardt MP. Serum calcium concentrations in human pregnancy. American Journal of Obstetrics and Gynecology. 1977 Apr 1;127(7):775-8.
5. Sabour H, Hossein-Nezhad A, Maghbooli Z, Madani F, Mir E, Larijani B. Relationship between pregnancy outcomes and maternal vitamin D and calcium intake: a cross-sectional study. Gynecological endocrinology. 2006 Jan 1;22(10):585-9.
6. Hofmeyr GJ, Lawrie TA, Atallah ÁN, Torloni MR. Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. Cochrane database of systematic reviews. 2018(10).
7. Wang L, Mei Z, Li H, Zhang Y, Liu J, Serdula MK. Modifying effects of maternal Hb concentration on infant birth weight in women receiving prenatal iron-containing supplements: a randomised controlled trial. British Journal of Nutrition. 2016 Feb;115(4):644-9.
8. Shao J, Lou J, Rao R, Georgieff MK, Kaciroti N, Felt BT, Zhao ZY, Lozoff B. Maternal serum ferritin concentration is positively associated with newborn iron stores in women with low ferritin status in late pregnancy. The Journal of nutrition. 2012 Nov 1;142(11):2004-9.
9. World Health Organization, Guideline: intermittent iron and folic acid supplementation in non-anaemic pregnant women, 2011.
10. World Health Organization, United Nations University. Protein and amino acid requirements in human nutrition. World Health Organization; 2007 Dec 15.
11. Ahmed T, Hossain M, Sanin KI. Global burden of maternal and child undernutrition and micronutrient deficiencies. Annals of Nutrition and Metabolism. 2013 Jan 1;61(Suppl. 1):8-17.
12. National Health and Medical Research Council (Australia). Nutrient reference values for Australia and New Zealand: including recommended dietary intakes. National Health and Medical Research Council; 2006.
13. Benali AI, Demmouche A. Calcium deficiency among pregnant women and their newborns in Sidi Bel Abbes region, Algeria. Journal of Nutrition and Food Sciences 2014 4(6), 318.
14. Kumar A, Agarwal K, Devi SG, Gupta RK, Batra S. Hypocalcemia in pregnant women. Biological Trace Element Research, 2010 136(1), 26 –32
15. Kant S, Haldar P, Gupta A, Lohiya A. Serum calcium level among pregnant women and its association with pre-eclampsia and delivery outcomes: A cross-sectional study from North India. Nepal J Epidemiol. 2019 Dec 31;9(4):795-803. doi: 10.3126/nje.v9i4.23150.
16. Ajong AB, Kenfack B, Ali IM, Yakum MN, TelefoPB. Prevalence and correlates of low serum calcium in late pregnancy: A cross sectional study in the Nkongsamba Regional Hospital; Littoral Region of Cameroon. PloS one, 2019 14(11), e0224855.
17. Schauberger C, Pitkin R. Maternal-Perinatal_Calcium Relationships. Obstet Gynecol. 1979;53(1):74–6. pmid:760023
18. Almaghamsi A, Almalki MH, Buhary BM. Hypocalcemia in pregnancy: A clinical review update. Oman Med J. 2018;33(6):453–62. pmid:30410686
19. Kovacs CS. Calcium and Bone Metabolism During Pregnancy and Lactation. J of Mammary Gland Biol Neoplasia. 2014;10(2):105–18.
20. MOHP Nepal. *Demographic and Health Survey 2016.* Kathmandu, Nepal: Ministry of Health and Population, New ERA, and ICF International; 2016.
21. Yadav UK, Ghimire P, Amatya A, Lamichhane A. Factors Associated with Anemia among Pregnant Women of Underprivileged Ethnic Groups Attending Antenatal Care at Provincial Level Hospital of Province 2, Nepal. Anemia. 2021 Feb 12;2021.
22. Qiao, Y., Di, J., Yin, L. *et al.* Prevalence and influencing factors of anemia among pregnant women across first, second and third trimesters of pregnancy in monitoring areas, from 2016 to 2020: a population-based multi-center cohort study. *BMC Public Health* **24**, 1100 (2024).
23. National Health Commission Disease Control and Prevention Administration. Report on nutrition and chronic diseases of Chinese residents in 2020[M]. Beijing: People's Medical Publishing House; 2021. p. 120.
24. Liu X, Yang C, Zhang X, Ye R, Li X, Zhang Z, Jia S, Sun L, Meng Q, Chen X. Association between hemoglobin concentration and hypertension risk in native Tibetans at high altitude. The Journal of Clinical Hypertension. 2024 Jan;26(1):17-23.