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Determination Of Micronutrient Deficiencies (Vitamin D, Vitamin B 12 And Iron Deficiency Anaemia) Among Maternal Aged Group Women Of Prayagraj District (U.P.)

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Abstract

Low birth weight (LBW) and other adverse birth outcomes, such as morbidity and mortality, are all significantly influenced by maternal undernutrition. The goal of the current study was to assess the prevalence of micronutrient deficiencies (vitamin B12, vitamin D, and iron deficiency anaemia) in prayagraj which made adverse affects on the health of mother and child nutrition. On the basis of the severity, 250 pregnant and breastfeeding women were chosen from the Mahewa Prayagraj. Furthermore, 50 severe expectant and nursing women were chosen to estimate their clinical symptoms and anthropometric measurements and for the estimation of biochemical profile, from two villages in the Prayagraj district: *Mahewa Purab patti* and *Mahewa Pashchim patti*. Data was collected by developing a questionnaire which consist information related to general profile, anthropometric measurement, dietary habits. The biochemical evaluation revealed vitamin D, hemoglobin, and vitamin B12 deficiency in the selected responders. Controlling child and maternal health group malnutrition, however, continues to be a concern in underdeveloped nations.

Keywords: Maternal and Child malnutrition, clinical symptoms, anthropometric assessment, vitamin D, iron deficiency anemia

INTRODUCTION

A number of adverse pregnancy outcomes, such as early pregnancy loss, congenital abnormalities, inadequate fetal growth, and postnatal morbidity and mortality, are predisposed by maternal undernutrition [1]. Poor fetal growth increases the risk of non-communicable diseases in the offspring and is associated with long-term ill health [2-4]. The Food Safety and Standards Authority of India (FSSAI) claims that India is experiencing an increase in preventable vitamin deficiencies. Secosteroid vitamin D can be found in the diet as cholecalciferol (vitamin D3) from animal sources or as ergocalciferol (vitamin D2) from plant sources. When 7-

dehydrocholesterol is exposed to ultraviolet B (UVB) light, vitamin D can also be synthesized endogenously in the skin. The liver's 25-hydroxylase breaks down vitamin D to form 25-hydroxyvitamin D [25(OH)D]. The parathyroid gland, placenta, and bone all have smaller amounts of this enzyme than the renal proximal tubular cells do [5]. Pregnant women frequently suffer from vitamin D deficiency (serum 25-hydroxyvitamin D [25(OH)D] levels 20 ng/mL in serum), especially those who belong to high-risk groups. There is evidence linking low vitamin D levels to preeclampsia and gestational diabetes, among other pregnancy-related health issues. (6) VDD can cause nutritional rickets (NR), osteomalacia, and disruptions in calcium homeostasis, whether or not there is a dietary calcium shortage. Important nutrients for skeletal development and bone health include calcium and vitamin D. VDD, or 25-hydroxyvitamin D deficiency, is particularly dangerous for children and pregnant women. By altering calcium absorption [7], parathyroid hormone expression [8], phosphate metabolism [9], growth plate function [10], and maybe by regulating the insulin-like growth factor axis [11], vitamin D may have an effect on maternal, fetal, and postnatal growth. Therefore, VDD during pregnancy has been linked to poor fetal skeletal development [12] as well as hypertension, glucose intolerance, gestational diabetes, premature birth, and other severe health effects in the mother.

Worldwide, vitamin B12 deficiency (vitamin B12- 148 pmol/L) is a serious public health issue [13-16]. According to estimates from studies conducted worldwide [13, 17–27], India has one of the highest rates of vitamin B12 insufficiency. Inadequate vitamin B12 status during pregnancy has been related to long-term, potentially irreversible deficits in child growth and development [13-16, 28, 29] as well as increased risk of unfavorable maternal and baby health outcomes [13, 20–34]. Normal growth, development, and physiological processes all depend on vitamin B12 [35]. It is crucial for the synthesis of neurotransmitters, synaptogenesis, and brain myelination [36]. Inadequate vitamin B12 levels during pregnancy may hinder these processes and result in neural injury or brain atrophy because the fetus is entirely dependent on the mother's nourishment. Chronic severe folate deficiency is linked to decreased DNA synthesis, which impairs erythropoietin maturation and lowers the number of white blood cells and platelets. Fetal growth retardation, low birth weight, premature delivery, and neonatal folate shortage are a few more adverse effects of folate deficit during pregnancy, as are folate-responsive neural tube defects (NTDs) and neural crest diseases. Inadequate dietary intake, increased demands, malabsorption, use of anti folate medications, as well as increased folate requirements during pregnancy and breastfeeding to meet maternal and newborn needs, are all factors that contribute to folate insufficiency during pregnancy [37]. The World Health Organization (WHO) suggests periconceptional folic acid supplementation to all women from the time they decide to get pregnant until 12 weeks into pregnancy in order to avoid neural tube defects (NTDs) [38]. Folate and vitamin B12 participate in the one-carbon metabolic cycle, which controls fetal growth. Even though vitamin B12 insufficiency is widespread, India's current public health strategy solely recommends adding iron and folic acid supplements to avoid anemia. Our research revealed the prevalence of maternal vitamin B12, iron and vitamin D in pregnant and lactating women for a healthy pregnancy, birth, and child health outcomes.

METHODS AND MATERIALS

DESIGN THE RESEARCH OF THE STUDY

The study was community based cross sectional study was carried out in the Department of Food Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj with descriptive and analytical components among maternal age group of Prayagraj district.

ETHICAL APPROVAL

Before beginning the study, the Department of Public Health at the Shalom Institute of Health and Allied Sciences (SIHAS), SHUATS, Prayagraj, Uttar Pradesh, India, obtained ethical approval (Letter Registration No.-IEC/SHUATS/2019/E/06). The research was conducted from October 2019 to April 2021. Stratified random sampling was used to select the study participants A Community Health Officer and an Auxiliary Nurse Midwife from the villages receiving the educational intervention participated in the study. The data was collected anonymously, and the findings were put to use in study.

SAMPLING PROCEDURE

Sample Size estimation- On the basis of the severity of malnutrition among pregnant and lactating women, with the assistance of Auxiliary Midwives (AMW) and Accredited Social Health Activists (ASHA) workers from the chosen villages of Prayagraj, the list of 250 pregnant and breastfeeding women was chosen from the Gram Panchayat. Furthermore, 50 severe expectant and nursing women were chosen to estimate their clinical symptoms and anthropometric measurements and for the estimation of biochemical profile, from two villages in the Prayagraj district: *Mahewa Purab patti* and *Mahewa Pashchim patti*.

DATA COLLECTION PROCEDURE:

Data was collected by developing a questionnaire which consist information related to general profile, anthropometric measurement and dietary habits.

General Profile: The questionnaire contains the information regarding respondent's status, religion, age, and educational status, types of family, food habits and total income of family.

Anthropometric Measurement: Anthropometric measurement aided to provide the morphological changes reflecting due to significant functional physiological disorder. Height, weight and body mass index were measured under the anthropometric measurement.

Dietary habits Assessment: Questionnaire also consist information regarding the food frequently consumed by the respondents in a week to estimate the frequency of consumption of particular food.

Clinical Assessment: The general observation of micronutrient deficiencies were wasted and oedema. The clinical examination schedule consist of different sign and symptoms that were correlated with the anaemia, vitamin D, vitamin B12 and vitamin A deficiency among pregnant and lactating women are enlisted below in table 1:

Table 1. Clinical signs and symptoms associated with the micronutrient deficiencies

Micronutrient deficiencies	Signs and symptoms
Iron deficiency Anaemia	Extreme fatigue, Weakness, pale skin, Chest pain, Headache, Dizziness, Cold hands and feet, Inflammation and soreness of tongue, Brittle nails, Poor appetite, Fever at frequent rate
Vitamin D deficiency	Frequent infection, Fatigue and laziness, thin, brittle and misshapen bones, Bone pain , Back pain
Vitamin B12 deficiency	Anaemia, Weakness and tiredness, Shortness of breath, Pale skin, constipation, Diarrhoea, Loss of appetite, Vision loss

Conducted a medical camp for the identification of malnourished respondents- A medical camp was organized with the presence of medical personnel and staff in order to check the nutritional status of the undernourished pregnant and breastfeeding women among the targeted population. In order to identify the nutritional state of the chosen respondents, malnourished pregnant and lactating women (n=50) were chosen for the biochemical profile assessment based on the clinical symptoms among 250 respondents. Researchers also looked at the clinical indication of the respondents with the help of Doctor and Auxiliary Nurse Midwife. This was more convenient to correlate the deficiency disease with the sign and symptoms.

Biochemical Assessment

The biochemical profile of the blood sample of respondents was estimated in the Moti Lal Nehru Divisional Hospital, Prayagraj district. The samples were handled by the pathologist of the corresponding hospital with the needed precaution measures. The Biochemical profile assessment was done by using specific methods and instruments used in the Pathology Department by pathologists is discussed below:

I. Vitamin D Assessment through blood sample: Vitamin D estimation through blood samples was done by the ARCHITECT 25-OH Vitamin D Immunoassay. **(Abott GmbH and Co. KG, 2010) [39]**

II.Assessment of Vitamin B12: The Chemiluminescent Microparticle Intrinsic Factor assay known as ARCHITECT B12 (Abott new markers) is used to measure the concentration of vitamin B12 in human serum and plasma in a quantitative manner using the ARCHITECT i System. **(Abott Laboratories, 2010) [40]**

III.Haemoglobin Assessment: ARCHITECT HbA1c assay was used to quantitative turbid metrically determination of haemoglobin fraction of human whole blood. **(Abott Laboratories, 2010) [41]**

STASTICAL ANALYSIS

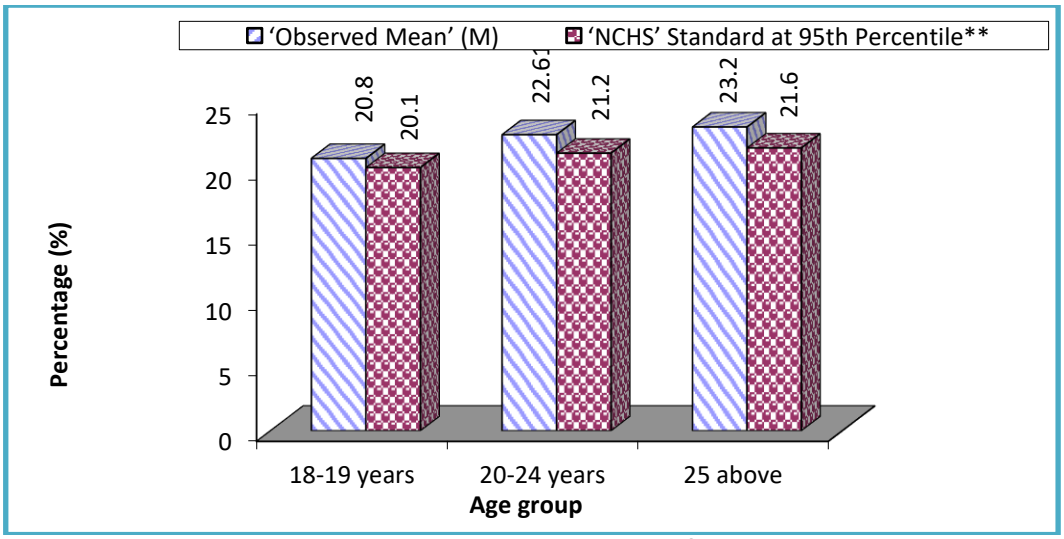
The data was manually analyzed using the t-test, ANOVA, critical difference correlation coefficient, p-value, and other suitable statistical analytical techniques to determine its significance. [42]

RESULTS AND DISCUSSIONS

General profile of the respondents: According to the data filled in the questionnaire by the respondents, similar numbers of lactating and pregnant women were present in the study. They mostly come from the Hindu

community. Women in the maternal age group were on average 22-25 years old. Most women in the maternal age group are from nuclear homes and practice vegetarianism. Since the majority of the respondents was ignorant or only had primary education, the respondents' educational status was deemed to be low. The income range for all respondent's family was between Rs. 1000 and Rs. 33,000. According to research done by Paul (2020), the most important predictors of maternal health care use are women's educational level and household wealth position. [43]

Anthropometric measurement: Selected Pregnant and lactating women divided into three categories on the basis of the height measurement standard provided by National Center for Health Statistics Standard. It was observed that the mean height of 18-19 years of age group was 146.17 which are lesser than the NCHS standard height 161.7. Similar observation was found among the 20-24 years aged group that indicate the observed mean was found lesser than the NCHS standard having the mean height of 160.7 and respondents above the age of 25 above also found lesser than the NCHS standard that is 146.67. While the weight measurement indicated that the three women aged 18-19 years had an average difference of 9.13, with the observed mean that was found 44.67 kg and NCHS standard was found 53.8kg which had lesser observed mean value than reference value. The Data of BMI have shown in the following graph 1.

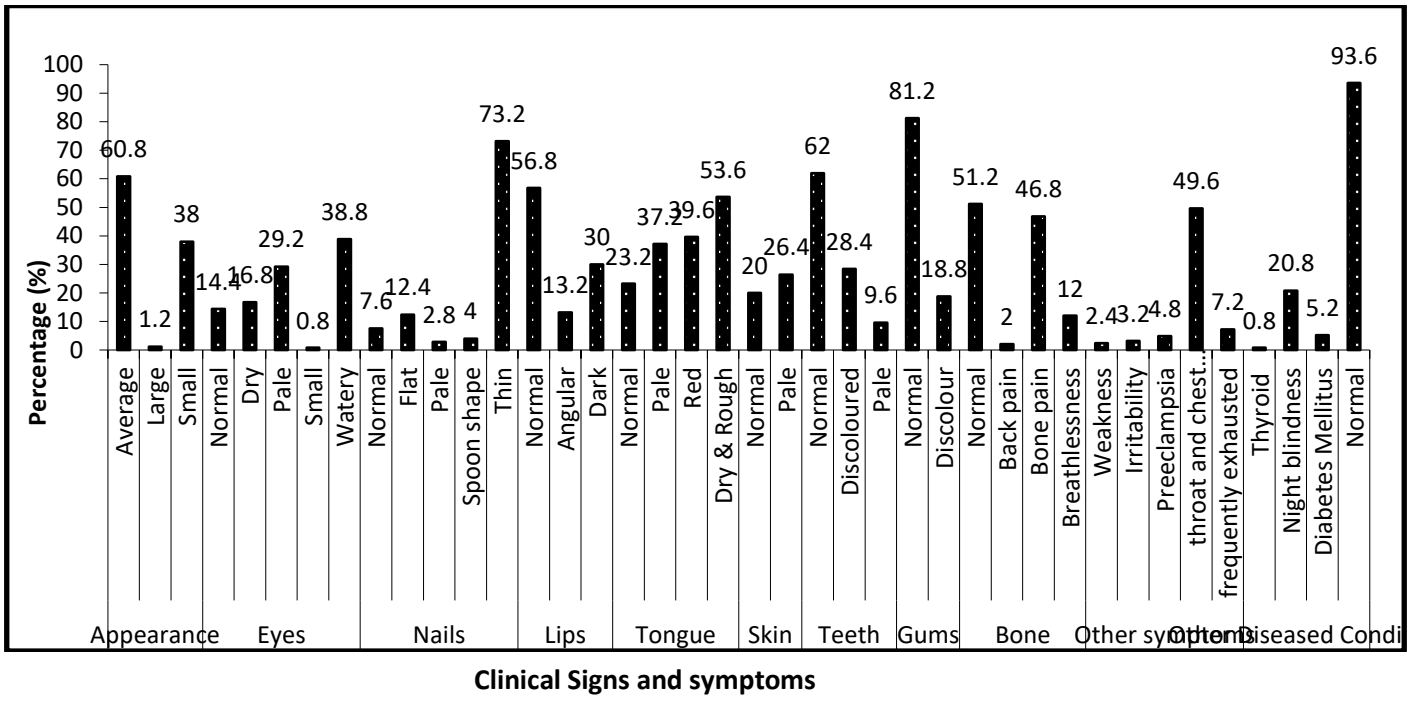


Graph 1: Comparison of Mean Body Mass Index (Kg/m^2) of respondents with 95 percentile standard BMI given by ICMR (2010)

Similarly study done by, Vasundhara *et al.*, (2020) stated that birthweight, crown heel length, and head circumference of the newborns all shown positive correlations with maternal age, height, weight, MUAC (three time points), gestational age at delivery, and post-natal weight [44].

Assessment of dietary habits among respondents: According to the data listed above, the consumption of milk and dairy products, fruits, and green leafy vegetables is quite low among expectant mothers because some of them have vegetarian eating habits, which indicates that there is a micronutrient shortage among the pregnant women. As per the data, the breastfeeding mothers were observed to consume less frequently fruits, green leafy vegetables, milk, and milk products. Results were consized by the study done by **Sharma *et al.*, (2020)** examined the relationships between nutritional intakes and anthropometric measurements in young people and newlywed women, including waist circumference, hip ratio, and body mass index (BMI) [45]. Similar study was observed by **Bhandari *et al.*, (2016)** concluded that the majority of women consume starchy staple foods, while vegetables, meat, fruits, and dairy items have received less attention [46].

Clinical Examination: Among the 250 respondents, the signs and symptoms clearly indicated the presence of micronutrient deficiency among the maternal aged group as the data shown through the figure 2.



Graph 2: Clinical Examination of the Selected Respondents

The observed data on a person's socioeconomic condition, health, and chronic illnesses that had not yet been noted in medical records were analyzed, according to Kersten et al. (2014). A wide range of prenatal and postnatal variables were evaluated. In the SNIP, every fifth pregnant woman has at least one chronic disease, and higher prevalence rates have been observed in the literature. Chronically ill women were much older, more educated, and had higher incomes than healthy women [47].

Table 2: Determination of the nutritional deficiencies (Vitamin B12 and Vitamin D) through the Biochemical assessment among the maternal aged group women (15-49 years).

Parameters	Pregnant women (n=25)		Lactating Women (n=25)	
	Observed (Mean± SD)	Standard Value	Observed (Mean± SD)	Standard Value
Vitamin D (µg/ml)	14.29 ±6.78	≥20*	12.15 +3.81	≥30*
Vitamin B12 (pg/ml)	236 ±96.12	99-526**	283.26 +151.80	279- 966**

Source: * Michael *et al.*, (2011) [48]
****Mina Abbassi- Ghanavati *et al.*, (2009) [49]**

Table 2 shows that pregnant and lactating women were diagnosed severe deficiency of vitamin D that is 14.29 and 12.15µg/ml. Whereas, the mean value of vitamin B 12 of pregnant and lactating women was 236ml and 283.26ml which were found lesser approximately starting range that is between the 279-966pg/ml. **Kamboj *et al.*, (2018)** concluded in research study, among various age groups, hypovitaminosis D was found to be highly prevalent. In light of research into the effects of vitamin D deficiency [51]. Similarly, **Chacham *et al.*, (2020)** examined the positive correlation between maternal and infant vitamin D status ($r=0.074$, $p<0.001$) with pregnancy period and low socioeconomic status [52].

- **Haemoglobin assessment of respondents' blood Sample**

Table 3. have shown about the haemoglobin concentration of pregnant and lactating mother. Majority of the respondents were belongs to moderate and severe anaemic among maternal age group as the mean value of haemoglobin content was determined 8.4gm/dl. Similarly the lactating women were belongs to the moderate and severe anaemic and the mean value of haemoglobin was found 9.7 gm/dl which is considered lower than the standard reference value.

A glance at the data revealed that there were various factors linked with the iron deficiency anaemia among pregnant and lactating mothers. The poor knowledge about maternal diet was major contributing factor to maternal malnutrition and iron deficiency anaemia The majority of the respondents were found anaemic

because of their poor educational status and socio demographic profile and also unable to consume appropriate micro-nutrient rich diet.

Table 3. Haemoglobin concentration for the diagnosis of Prevalence of anaemia among Pregnant and Lactating Women aged between (15-49 years)

Degree of Anaemia	Standard Haemoglobin Level	Pregnant Women		Standard Haemoglobin level	Lactating Women		Total Respondents
		Frequency (n=150)	Percentage (%)		Frequency (n=100)	Percentage (%)	
Non-Anaemic	<11gm/dl	25	16.67	<12gm/dl	20	20	45
Anaemic	≥11gm/dl	125	83.33	≥12gm/dl	80	80	205
Grading of Anaemia							
	Pregnant Women			Lactating Women			
Categories	Standard Value	Frequency (N=150)	Percentage (%)	Standard Value	Frequency (N=100)	Percentage (%)	Total no. of respondents (Pregnant and Lactating women)	Overall Prevalence (%)
Normal	≥ 11 gm/dl	25	16.66	≥12gm/dl	20	20	45	18%
Mild Anaemic	10-10.9gm/dl	25	16.66	11-11.9 gm/dl	20	20	45	18%
Moderate Anaemic	7-9gm/dl	55	36.66	8-10.9 gm/dl	35	35	90	36%
Severe Anaemic	<7gm/dl	45	30	<8 gm/dl	25	25	70	28%
	Pregnant women (15-49 years)	8.4		Lactating Women (15-49 years)	9.7		250	

Source: Standard Value: Haemoglobin Concentration for the diagnosis of anaemia and assessment to severity, WHO, (2011) [52]

Some other factors like food habits and age of having pregnancy and gap between the births of two children also affects the women body from inside also deprived from the nutrition as the repeated pregnancies gradually depleted the iron stored in mother's body. Food habits such as vegetarian diet did not meet the actual requirement of iron in body. Secondary factors those affect the iron availability in body were poor hygiene and sanitation as the presence of viral disease and worms in gut area badly affected the nutrient availability in body. Source of drinking water and cleanliness of kitchen and toilet area is alternatively affected the intestinal tract causing diahorreal diseases. Also, **Sharma *et al.*, (2020)** were found that women who consume a low-mixed vegetarian diet frequently may experience unfavourable pregnancy and birth outcomes. To meet the increased micronutrient and macronutrient requirements for better maternal and child health, healthy dietary patterns are necessary during pregnancy and lactation.[53]

CONCLUSION-

According to the findings, maternal malnutrition is linked to a lack of access to and knowledge of nutrient-dense foods, poverty, poor health, and a lack of sanitation facilities in the local area. These factors were found to be the main factors that directly accelerate the rate of maternal morbidity and malnutrition. Additionally, the biochemical assessment revealed that the chosen responders had vitamin D, hemoglobin, and vitamin B12 deficiencies. Scientific knowledge about maternal malnutrition, its types, prevention and dietary management have significantly declined the cases of malnourishment. However it is also remain a challenge among developing countries to control the malnutrition among children and maternal health group.

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CONFLICT OF INTEREST

There is no conflict of interest between the authors.

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