Section: General Medicine and Gynaecology

Original Research Article

A STUDY ON PREVALENCE AND DETERMINANTS OF IRON DEFICIENCY AND MEGALOBLASTIC ANEMIA IN ADULT FEMALES OF REPRODUCTIVE AGE GROUP

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ABSTRACT

Background: Iron deficiency and cyanocobalamin deficiency is a global health problem affecting all age groups of population. The Maternal Mortality Rate (MMR) in Madhya Pradesh is 170 per 1,00,000 live births which is 3rd worst in India following Assam and Uttar Pradesh, so this study was intended to find the prevalence of iron and cyanocobalamin deficiency in this group of reproductive age females and try identifying the determinants leading to their deficiency.

Materials and Methods: The research involved a cross sectional study design, utilizing a representative sample of adult females of reproductive age group between 18 to 30 years who visited General Medicine and Gynaecology outpatient department.

Results: We observed a 52.5% prevalence of Iron deficiency and 38.5% prevalence of cyanocobalamin deficiency among females of reproductive age group. Among normal weight patients 53% and 29.3% were having iron deficiency and cyanocobalamin deficiency respectively. Under the overweight/obese category 49% and 39.8% had iron and cyanocobalamin deficiency respectively. We found 30% and 25.6% prevalence of iron deficiency among vegetarian and non-vegetarian female of reproductive age group respectively and the prevalence of cyanocobalamin deficiency was 58% and 12.1 % among vegetarian and non-vegetarian females of reproductive age group respectively. 54.3% and 81% Rural patients were having iron and cyanocobalamin deficiency respectively and 49.5% and 64.4% urban patients were having iron and cyanocobalamin deficiency respectively. In this study we also observed that 12.56% patients were deficient for both Iron and cyanocobalamin levels.

Conclusion: This study provides valuable insights into the prevalence of poor nutritional status among females of reproductive age group, offering a foundation for the development of targeted healthcare strategies. By understanding the factors contributing to inadequate nutrition, healthcare professionals can tailor interventions to address the unique needs of this population group.

Keywords: Iron Deficiency Anaemia (IDA), Cyanocobalamin (Vitamin B12) deficiency, Maternal Mortality Rate (MMR).

INTRODUCTION

Iron Deficiency Anaemia (IDA) is a global health problem. It involves population of all age group and sex,[1] similarly Cyanocobalamin (Vitamin B12) deficiency leads to a wide spectrum of disorders affecting all age groups,[2] but females in reproductive age group are most vulnerable,[3] to it also the deficiency of these mineral and vitamin play a significant role in maternal mortality. According to

the study of C meh et al,[4] the MMR in Madhya Pradesh is 170 per 1,00,000 live births which is 3rd worst in India following Assam and Uttar Pradesh, so this study was intended to find the prevalence of iron and cyanocobalamin deficiency in this group of reproductive age females and try identifying the determinants leading to their deficiency. India is facing a dual burden of undernutrition and overweight/obesity, and there are gaps in our understanding of the driving factors over time.[5]

Several factors contribute to the vulnerability of reproductive age females to poor nutritional status. Socioeconomic disparities, educational background, cultural influences, and lifestyle choices can significantly impact dietary habits and nutritional intake. Moreover, societal expectations regarding body image and beauty standards may influence dietary behaviors, potentially leading to inadequate nutritional practices.

Iron deficiency is defined as the noticeable reduction of iron supply to tissues in the body due to depleted iron stores, Iron deficiency can lead to iron deficiency anemia, which is the final/most severe stage of iron deficiency.[6] This condition results in microcytic erythrocytes and insufficient synthesis of hemoglobin (Hb). Poor iron status can lead to the development of iron deficiency anemia, giving rise to symptoms such as diminished cognition, fatigue, compromised immune function, pregnancy complications, and an increased risk of lead poisoning.

Deficiencies of vitamin B12 (B12) and folate (FA) are of particular interest due to their pleiotropic role in 1-carbon metabolism. It acts as a cofactor in one-carbon transfers through methylation and molecular rearrangement.[7] In addition to adverse birth outcomes, deficiencies of B12 and FA, or an imbalance in FA/B12 status, are linked to metabolic disorders.[8] These activities are integral to various metabolic pathways, including those related to fatty acids, amino acids, and nucleic acids. Pregnancy is a critical stage during the life cycle when the requirement for vitamin B12 increases due to the rapid cell multiplication resulting from the enlargement of the uterus, placental development, and fetal growth.[9] Cyanocobalamin deficiency becomes clinically apparent in both the blood and nervous system, where cobalamin plays a pivotal role in cell replication and fatty acid metabolism. Cyanocobalamin hypovitaminosis can occur due to insufficient absorption, genetic defects impacting transport, or inadequate dietary intake.

While previous research has provided valuable insights into general nutritional patterns and deficiencies, there is a need for targeted investigations specifically focused on females of reproductive age groups. Understanding the prevalence of poor nutritional status in this population group and identifying the factors contributing to it will facilitate the development of tailored interventions.

MATERIAL AND METHODS

The research involved a cross sectional study design, utilizing a representative sample of adult females of reproductive age group between 18 to 30 years who visited General medicine and Gynaecology outpatient department between 15 February 2023 to 15 January 2024. Various anthropometric measurements (height and weight), body mass index, Iron profile and cyanocobalamin levels were used to assess nutritional status in participants, according to Body Mass Index participants were further divided into three categories as underweight (Body Mass Index <18.5), Normal (Body Mass Index 18.5 – 24.9), Overweight/obese (Body Mass Index >25) considering WHO criteria for Body Mass Index as reference. Iron Profile by biochemical methods, serum cyanocobalamin levels by chemiluminescent microparticle immunoassay were used to access the nutritional status. Data analysis included statistical tests to identify correlations between nutritional status and various socio-demographic factors.

Inclusion Criteria

1. Patient > 18 years and < 30 Years of age.
2. Female patients who visited Gynaecology and General medicine OPD at our institute.

Exclusion Criteria

1. Patients less than 18 years of age.
2. Patients > 30 years of Age
3. Patients taking drugs that are known to cause nutritional deficiencies (Metformin, ATT etc.)
4. Patients with serious comorbid conditions.
5. Patients of Chronic Kidney disease, Chronic liver disease, Congestive heart failure, malignancy, tuberculosis, autoimmune diseases.

We collected data of a total of 820 patients who visited General Medicine or Obstetrics and Gynaecology outpatient department within the study duration.

RESULTS

Table 1 depicts distribution of our study population, out of a total of 820 patients that were finally analyzed 256 patients were pregnant females and 564 were non-pregnant females. According to Body Mass Index we divided the study population into three categories as underweight (Body Mass Index < 18.5), Normal weight (Body Mass Index 18.5 to 24.9), and overweight/obese (Body Mass Index > 25). We had a total 105 patients that were underweight, 251 were normal weight and 76 were underweight.

It was observed that out of 256 pregnant females 130 (51%) were found to have iron deficiency anemia and 146 females (55.6%) were found to be deficient for cyanocobalamin levels further, 301 (53.4%) out of 564 non-pregnant females had iron deficiency and 174 (31%) were cyanocobalamin level deficient. According to Body Mass Index, 105

(56%) out of 188 underweight patients were having iron deficiency and 43 (41%) were having cyanocobalamin deficiency.

Among the 475 normal weight patients 251 (53%) and 73 (29.3%) were having iron deficiency and cyanocobalamin deficiency respectively. Under the overweight/obese category 76 (49%) and 30 (39.8%) out of 157 had iron and cyanocobalamin deficiency respectively. We also analyzed the patients based on their dietary preferences, a total of 401 vegetarian patients and 419 patients taking non-vegetarian diet were assessed.

We found 30% prevalence (120 patients) and 25.6% prevalence (107 patients) of iron deficiency among vegetarian and non-vegetarian female of reproductive age group respectively. Also, the prevalence of B12 deficiency was 58% (233 out of 401) and 12.1 % (51 out of 419) among vegetarian and non-vegetarian females of reproductive age group respectively. According to place of residence 282 (54.3%) and 420 (81%) out of 519 Rural patients were having iron and cyanocobalamin deficiency respectively and 149 (49.5%) and 194 (64.4%) out of 301 urban patients were having iron and cyanocobalamin deficiency respectively. In this study we also observed that 103 (12.56%) out of 820 patients were deficient for both Iron and cyanocobalamin levels.

Statistical Analysis

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was statistically significant.

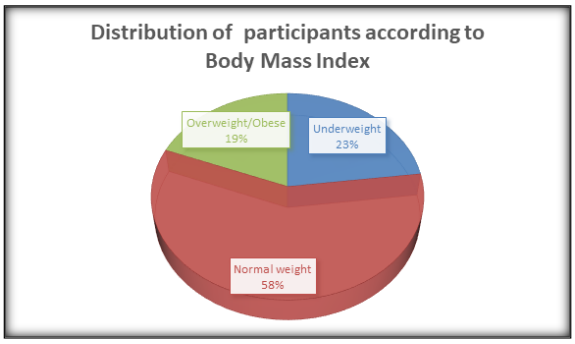

Figure 1: Showing Distribution of participants according to Body Mass Index

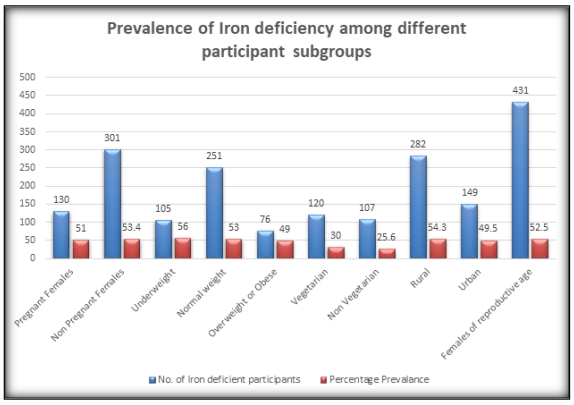

Figure 2: Prevalence of Iron deficiency among different participant subgroups

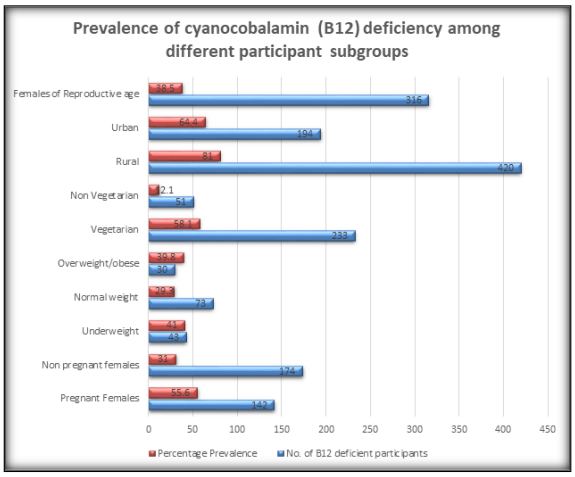

Figure 3: Prevalence of cyanocobalamin (B12) deficiency among different participant subgroups

Table 1: Distribution of participants according to status of pregnancy

S. No.	Participants	Number	Percentage
1	Pregnant females	256	31.21%
2	Non-pregnant females	564	68.79%

Table 2: Distribution of participants according to Body Mass Index

S. No.	Participants	Number	Percentage
1	Underweight	188	23%
2	Normal weight	475	58%
3	Overweight/obese	157	19%

Table 3: distribution of participants according to their dietary preference

S. No.	Participants	Number	Percentage
1	Vegetarian diet	401	49%
2	Non-Vegetarian diet	419	50%

Table 4: distribution of participants according to place of residence

S. No.	Participants	Number	Percentage
1	Rural	519	63.29%
2	Urban	301	36.71%

Table 5: Prevalence of combined deficiency of Iron and cyanocobalamin (B12) among females of reproductive age group

S. No.	Participants	Participants having both Iron & B12 deficiency	Percentage
1	820	103	12.6%

DISCUSSION

The high prevalence of iron deficiency (52.5%) observed by us is similar to data of The National Family Health Survey 2020-21 (NFHS-5) for the state of Madhya Pradesh with 51.7% and 55.9% prevalence of iron deficiency among pregnant and non-pregnant females in Madhya Pradesh,[10] and the high prevalence of cyanocobalamin deficiency in pregnant mothers (55.6%) observed in our study is similar to the results observed by Anita Mohanraj barney et.al,[11] in their study about prevalence of cyanocobalamin deficiency and its associated risk factors among pregnant women of rural south India where they observed a 55% prevalence of cyanocobalamin deficiency among pregnant mothers.

The prevalence of iron deficiency among various Body Mass Index subcategories like underweight, normal weight and overweight//obese was 56%, 53%, and 49% respectively indicates that iron deficiency is ubiquitous among all Body Mass Index subcategories, whereas there is a slightly high prevalence of vitamin 12 deficiency among underweight (41%) and overweight/obese (39.8%) patients as compared to normal weight patients (29.3%).

We also found that status of cyanocobalamin deficiency is significantly higher among Indian female outpatients who had a vegetarian dietary habit as compared to those who had non-vegetarian diet. This is because vegetarian foods are generally deficient in cyanocobalamin level since cyanocobalamin is produced in nature only by vitamin B-12- producing microorganisms, humans must receive vitamin B-12 solely from the diet.[7] This result was like the study titled Prevalence of B12 in the Northern Indian Vegetarian Population-A Clinical Study conducted by Gurpreet Singh et. al.[2] In this study we also observed that there is a significant high prevalence of iron and cyanocobalamin deficiency among rural as well as urban populations, but cyanocobalamin deficiency is significantly high in rural population ranging upto 81% of females of reproductive age group dwelling from rural areas being deficient for serum Cyanocobalamin levels.

Iron is an essential element for nearly all living organisms.[12] Anaemia is a serious public health challenge in India with more than 50% prevalence across vulnerable groups such as pregnant women, infants, young children and adolescents.[13] In our study we found that there is a high prevalence of Iron deficiency and cyanocobalamin deficiency among the females of reproductive age group.

Addressing anaemia in women of reproductive age is a focus of the Decade of Action on Nutrition 2016-2025 and the commitments made by countries in the 2nd International Conference of Nutrition (ICN2) and its Framework for Action.[14] Despite of special emphasis on nutrition and various health programmes specially targeted to reduce anemia, deficiency of iron, cyanocobalamin as well as poor nutritional status seems to be highly prevalent in females of reproductive age group in our population.

Msemo OA et al did a community based cross sectional study of rural women of reproductive age in northeastern Tanzania and studied prevalence and risk factors of preconception anemia. All female residents aged 18–40 years were invited to the nearby health facility for screening. Baseline samples were collected to measure hemoglobin levels, serum ferritin, vitamin B12, folate, C-reactive protein, alanine amino-transferase, the presence of malaria, HIV, and soil transmitted helminth infections. Increased age, iron deficiency, malaria infection and inflammation were significant risk factors associated with preconception anemia, whereas increased mid-upper arm circumference was protective against anemia.[15]

Acharya et al did assessment of pattern, risk factors and treatment of iron deficiency and megaloblastic anemia in adult and pediatric population in a tertiary care hospital in South India. Study concluded that it helps in identifying the various risk factors and clinical manifestation of IDA which will in turn help in prevention of the disease by early assessment of the disease based on these factors. It also gives us an idea of the changes to be made in the treatment pattern and/or to provide counselling to patients regarding medication and food habits for better outcome of the disease.[16]

Soofi S et al studied prevalence and possible factors associated with anaemia, and vitamin B12 and folate deficiencies in women of reproductive age in Pakistan. In Pakistan, anaemia, and vitamin B12 and folate deficiencies are a severe public health concern among WRA. Our findings suggest that further research is needed on culturally appropriate short-term and long-term interventions within communities and health facilities to decrease anaemia, and vitamin B12 and folate deficiencies among Pakistani women.[17]

Ford ND et al studied factors associated with anaemia in a nationally representative sample of nonpregnant women of reproductive age in Nepal. Haemoglobin, biomarkers of iron status and other micronutrients, infection, inflammation, and blood disorders were assessed from venous blood. Soil-transmitted helminth and Helicobacter pylori infections were assessed from stool. Sociodemographic, household, and health characteristics and diet were ascertained by interview. Interventions that improve micronutrient status, ensure access to hormonal birth control, and replace dirt floors to reduce infection risk might help reduce anaemia in this population.[18]

CONCLUSION

This study has highlighted the Prevalence of Iron and cyanocobalamin deficiency determinants associated with poor nutritional status among females of reproductive age group. Underweight, overweight/ obesity and rural population were found to be more vulnerable for Iron and cyanocobalamin deficiency and poor nutritional status.

However, studies with a higher sample size are needed to study associated risk factors better and to consider the need for screening and supplementation of B12 and iron in reproductive age females. The genetic basis behind the Iron deficiency and low Cyanocobalamin levels needs to be explored in future studies.

Declarations

Funding: None **Conflicts of interest/Competing interests**: None **Availability of data and material**: Department of Medicine RKDF Medical College Bhopal **Code availability**: Not applicable **Consent to participate**: Consent taken **Ethical Consideration**: There are no ethical conflicts related to this study. **Consent for publication**: Consent taken.

REFERENCES

1. Kumari, Rekha et al. “Prevalence of Iron Deficiency and Iron Deficiency Anaemia in Adolescent Girls in a Tertiary Care Hospital.” Journal of clinical and diagnostic research: JCDR vol. 11,8 (2017): BC04-BC06. doi:10.7860/JCDR/2017/26163.10325
2. Singh G, Atif P, Kaur M et al. “Prevalance of B12 in North Indian vegetarian population – A Clinical study.” Saudi journal of medicine, 2019 Mar 3, DOI:10.36348/sjm. 2019.v04i03.011
3. Meshram I, Balakrishna N, Sreeramakrishna K, Rao KM, Kumar RH, Arlappa N, et al. Trends in nutritional status and nutrient intakes and correlates of overweight/obesity among rural adult women (≥18–60 years) in India: National Nutrition Monitoring Bureau (NNMB) national surveys. Public Health Nutrition. 2016;19(5):767–76. doi:10.1017/S1368980015002268
4. Meh C, Sharma A, Ram U, Fadel S, Correa N, Snelgrove JW, Shah P, Begum R, Shah M, Hana T, Fu SH, Raveendran L, Mishra B, Jha P. Trends in maternal mortality in India over two decades in nationally representative surveys. BJOG. 2022 Mar;129(4):550-561. doi: 10.1111/1471-0528.16888. Epub 2021 Sep 15. PMID: 34455679; PMCID: PMC9292773.
5. Young MF, Nguyen P, Tran LM, Avula R, Menon P. A Double Edged Sword? Improvements in Economic Conditions over a Decade in India Led to Declines in Undernutrition as Well as Increases in Overweight among Adolescents and Women. J Nutr. 2020 Feb 1;150(2):364-372. doi: 10.1093/jn/nxz251. PMID: 31618429.
6. Pawlak, Roman et al. “Iron Status of Vegetarian Adults: A Review of Literature.” American journal of lifestyle medicine vol. 12,6 486-498. 16 Dec. 2016, doi:10.1177/1559827616682933.
7. Rizzo, Gianluca et al. “Vitamin B12 among Vegetarians: Status, Assessment and Supplementation.” Nutrients vol. 8,12 767. 29 Nov. 2016, doi:10.3390/nu8120767.
8. Shalini T, Pullakhandam R, Ghosh S, Kulkarni B, Rajkumar H, Sachdev HS, Kurpad AV, Reddy GB. Prevalence of Vitamin B12 and Folate Deficiencies in Indian Children and Adolescents. Nutrients. 2023 Jul 3;15(13):3026. doi: 10.3390/nu15133026. PMID: 37447351; PMCID: PMC10346745.
9. Samuel, Tinu Mary et al. “Vitamin B (12) intake and status in early pregnancy among urban South Indian women.” Annals of nutrition & metabolism vol. 62,2 (2013): 113-22. doi:10.1159/000345589
10. National family health survey 5 data published on NFHS website.
11. Barney AM, Abraham VJ, Danda S, Cherian AG, Vanitha S. Prevalence of Cyanocobalamin deficiency and its associated risk factors among pregnant women of rural South India: A community-based cross-sectional study. Indian J Community Med 2020; 45:399-404.
12. Ganz T. Hepcidin, a key regulator of iron metabolism and mediator of anemia of inflammation. Blood. 2003 Aug 1;102(3):783-8. doi: 10.1182/blood-2003-03-0672. Epub 2003 Mar 27. PMID: 12663437.
13. Bellad, Asha, Radhika Kapil, and Aakriti Gupta. "National guidelines for prevention and control of iron deficiency anemia in India." Indian Journal of Community Health 30.1 (Supp) (2018): 89-94.
14. World Health Organization. "Strategies to prevent anaemia: recommendations from an expert group consultation, New Delhi, India, 5-6 December 2016." (2016).
15. Msemo OA, Bygbjerg IC, Møller SL, Nielsen BB, Ødum L, Perslev K, Lusingu JP, Kavishe RA, Minja DT, Schmiegelow C. Prevalence and risk factors of preconception anemia: A community based cross sectional study of rural women of reproductive age in northeastern Tanzania. PLoS one. 2018 Dec 18;13(12):0208413.
16. Acharya Dr LD. Assessment of pattern, risk factors and treatment of Iron Deficiency and Megaloblastic Anemia in Adult and Pediatric population in a tertiary care hospital in South India.
17. Soofi S, Khan GN, Sadiq K, Ariff S, Habib A, Kureishy S, Hussain I, Umer M, Suhag Z, Rizvi A, Bhutta Z. Prevalence and possible factors associated with anaemia, and vitamin B12 and folate deficiencies in women of reproductive age in Pakistan: analysis of national-level secondary survey data. BMJ open. 2017;7(12).
18. Ford ND, Bichha RP, Parajuli KR, Paudyal N, Joshi N, Whitehead Jr RD, Chitekwe S, Mei Z, Flores-Ayala R, Adhikari DP, Rijal S. Factors associated with anaemia in a nationally representative sample of nonpregnant women of reproductive age in Nepal. Maternal & child nutrition. 2022 Jan; 18:12953.