Annals of Community Health (AoCH) pISSN 2347-5455 | eISSN 2347-5714

An Indexed (Index Medicus, DOAJ and More), Peer Reviewed, Quarterly, International Journal focusing exclusively on Community Medicine and Public Health

ORIGINAL ARTICLE

Dietary Correlates of Anemia and Iron and Folic Acid Supplementation among Antenatal Women in Rural Kozhikode, Kerala

Meera S. Nair[1], Priya Chandran[2], Anirudh V. Mutalik[3]

ABSTRACT

Background: Anemia is one of the most common nutritional disorders in pregnancy which takes a heavy toll in terms of ill-health, premature death, and loss of earnings, making it a matter of great concern needing prioritization. **Objectives:** The objectives of the study were to assess the dietary factors associated with anaemia, and 'iron and folic acid' supplementation among antenatal women. **Materials and Methods:** A cross-sectional study was conducted among 295 antenatal women in all three trimesters residing in 6 selected panchayats of Kozhikode district. Cluster sampling method was adopted. Hemoglobin estimation was done and data were collected by direct interview using a pretested semistructured questionnaire after written informed consent. **Results:** Dietary factors such as irregular intake of iron-rich foods, 'iron and folic acid' supplementation tablets, and iron-folic acid tablets intake, in combination with calcium supplementation; were found to be significantly associated with anemia. Nutritional supplementation through Anganwadi was found to be 'protective'. Regular intake of green leafy vegetables, fish, jaggery, and ragi was seen to have a protective effect on anemia, which was found to be statistically significant. **Conclusion:** The high prevalence of anemia in pregnancy needs obligatory supplementation of iron and folic acid tablets not only to pregnant women but also to adolescent girls along with correction of other nutritional deficiencies by improving the consumption of diversified foods and timely intervention for anemic women.

Key words: Anemia, diet, iron supplementation, pregnancy

INTRODUCTION

Anemia is a global public health problem, especially more pronounced in vulnerable groups like antenatal women. The worldwide prevalence of anemia in pregnancy is 41.8%.[1] Various factors like defects in red cell production, or its increased damage or blood loss, or a blend of these can result in anemia. Nutritional deficiencies pertaining to intake of iron, folate, Vitamin B12, and Vitamin A, inflammation, parasitic infections, and disorders that affect hemoglobin synthesis, erythrocyte production, or survival can lead to anemia.[2]

Iron deficiency is believed to be the most widely recognized reason of anemia globally. Nearly 50% of all cases of anemia among pregnant and non-pregnant females, and 42% of cases in children globally are due to iron deficiency anemia.[1]

Iron deficiency is higher among females due to iron losses during the menstrual period and excessive iron demands of a developing fetus during pregnancy. The iron demand during pregnancy is nearly twice that of non-pregnant state.[2] Once iron stores from mother are reduced, she becomes anemic, and iron transfer to the developing fetus is compromised.[3]

[1]Department of Community Medicine, KMCT Medical College, Manassery, Mukkam, Kozhikode- 673602, (Affiliation-Kerala University of Health Sciences, Thrissur), Kerala, India
[2]Department of Community Medicine, Government Medical College, Kozhikode, (Affiliation- Kerala University of Health Sciences, Thrissur), Kerala, India
[3]Department of Community Medicine, KMCH Institute of Health Sciences and Research, Coimbatore, Tamil Nadu, (Affiliation- The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu), India

Correspondence: Dr. Meera S. Nair, Department of Community Medicine, KMCT Medical College, Manassery, Mukkam, Kozhikode - 673 602, (Affiliation-Kerala University of Health Sciences (KUHS), Thrissur), Kerala, India. Mobile: +91-9497550559, or +91-8848659675. E-mail: doctormeerasnair@gmail.com

How to cite: Nair MS, Chandran P, Mutalik AV. Dietary Correlates of Anemia and Iron and Folic Acid Supplementation among Antenatal Women in Rural Kozhikode, Kerala. Ann Community Health 2021;9(2):138-142.

Nutritional anemia results from insufficient intake or bioavailability of nutrients needed for the synthesis of hemoglobin and erythrocytes.[4] Dietary uptake of iron influences the iron status of young ladies. The dietary patterns and consumption of foodstuff having enhancers or inhibitors of absorption of iron play a noteworthy part in iron status throughout pregnancy. A diet that lacks nutrients bears adverse effects on health of mother and development of the fetus such as pre-term births, low birth weight, and postpartum hemorrhages.[5]

Prevalence of anemia among antenatal women in India is 50.4% as per National Family Health Survey-4,[6] whereas in rural Kerala, it is 22.5%[7] and in the district of Kozhikode, it is 32%.[8]

National iron plus initiative recommends iron-folic acid (IFA) supplementation of 100 mg elemental iron and 500 μg of folic acid every day for at least 100 days starting after the first trimester at 14–16 weeks of gestation for all pregnant women followed by the same dose for 100 days postpartum, irrespective of their anemic status.[9] Government initiatives targeted at iron supplementation have contributed to lowering anemia to some extent among antenatal women, but dietary factors resulting in anemia remain unaddressed.

Despite various iron supplementation programs, anemia continues to be the major cause of morbidity both for mother and the fetus. In view of the above facts, it is imperative to explore the dietary factors contributing to anemia among pregnant women.

MATERIALS AND METHODS

A community-based cross-sectional study was conducted from February 2016 to January 2017 in six selected panchayaths in Kozhikode district, situated in Northern Kerala, India. Registered pregnant ladies of all three trimesters staying in the chosen Primary Health Centre (PHC) area were included. Those having disorders of coagulation were excluded from the study.

Sample size was calculated using the formula $n = 4pq/d^2$, where p is the prevalence, q=1-p, d is the allowable error. p was taken as 40.6% (40.6% pregnant women in rural Kozhikode were anemic),[10] d = 17% of p. The estimated sample size was 197. By applying design effect of 1.5, the sample size was estimated to be 295. Accounting for non-response rate of 10%, 330 were taken as the final sample size.

Out of 75 panchayats in Kozhikode district, six panchayats were selected by simple random method. Each panchayath was considered as a cluster. List of all eligible pregnant women was obtained from the antenatal register maintained by Junior Public Health Nurse at the PHC/subcenter. Fifty-five participants from each cluster were selected from the antenatal register at the PHC by simple random sampling.

Data regarding details of diet and IFA supplementation were collected using a pretested semi-structured questionnaire by house to house visits. To assess the diet, food frequency method was used. They were asked to attend the PHC/subcenter for hemoglobin estimation on a fixed day. Hemoglobin estimation was done by photometric method using Humacount 30TS automated hematology analyzer in an ISO-certified laboratory on the same day. Those pregnant women who could not be met on 1st day were visited a 2nd time. If inspite of two visits, they could not be contacted, they were not included in the study.

Classification of Severity of Anemia in Pregnancy (WHO criteria)[11]

Description of the anemic status	Hemoglobin level (g/dl)
Anemia	<11
Mild anemia	10–10.9
Moderate anemia	7–9.9
Severe anemia	< 7

Data were analyzed using SPSS 18 software. Chi-square test was used for statistical analysis.

$P < 0.05$ was considered statistically significant.

Ethical clearance of the study protocol was obtained from Institutional Ethical Committee. Written informed consent was taken from the participants. Permission was obtained from District Medical Officer, Kozhikode. Confidentiality of study participants was maintained.

RESULTS

A total of 295 antenatal women were studied. The age distribution of antenatal women ranged from 18 to 39 years. Each and every woman was literate and educated. Most (96.3%) of the subjects were homemakers.

The prevalence of anemia in the study group was 40%. Among the anemic females, 90 (30.5%) were mildly anemic, whereas 28 (9.5%) were moderately anemic and there were no cases of severe anemia.

In this study, 98.5% were having mixed dietary habits. The remaining were pure vegetarians. All of them had a cereal-based diet. Intake of food items once a week or more was considered as regular intake and occasionally or not consuming was taken as an irregular intake for statistical purposes. Regular intake of green leafy vegetables, fish,

jaggery, and ragi was seen to have a protective effect on anemia ($P \leq 0.01$) [Table 1]

One hundred fourteen (38.6%) pregnant women receive supplementary nutritive foods from Anganwadi under the Integrated Child Development Services Scheme, introduced by the Government of India [Table 2]. They avail wheat, rava, Bengal gram, jaggery, and ragi as supplementary nutrition. Those pregnant women who were receiving supplementation from Anganwadi had less chance of developing anemia ($P \leq 0.05$).

Our study found universal consumption of IFA tablets among antenatal. Two hundred forty-nine (84.4%) of them take folic acid or IFA tablets regularly (took on daily basis). Irregular intake was found in 46 (15.6%) women. Forgetfulness was cited as the most common reason (58.6%) for non-adherence, followed by side-effects (41.1%). Side-effects included vomiting (21.7%), constipation (10.8%), and burning sensation in abdomen (8.6%).

Pregnant women who took folic acid or IFA tablets daily were taken as regular intake. In this study, antenatal women who had regular intake of folic acid tablets or IFA tablets had a significant reduced risk of developing anemia, demonstrating the need for prophylactic supplementation of iron during this period.

In our study, 46 (15.6%) antenatal women had developed side effects to IFA tablets. Anemia was more common in women who had experienced the side effects of IFA tablets (58.7%), which is statistically significant.

It was observed that 54 (18.3%) pregnant women took IFA tablets along with calcium supplements or milk. The prevalence of anemia was found to be more in antenatal women who had taken IFA tablets along with calcium supplements or milk ($P \leq 0.01$) [Table 3].

DISCUSSION

In our study, 84.4% antenatal women take folic acid or IFA tablets regularly. Irregular intake was found in 15.6% women. The high compliance rate obtained in this study may be related to high literacy rates among women in Kerala[12] and good penetration of health services. There are 97.3% literate women in the reproductive age group in rural Kerala and 99.3% in rural Kozhikode. The district data also show high compliance, 74.6% in Kozhikode and 82.5% in rural Kozhikode.[13]

Forgetfulness is the most common reason (59.5%) for irregular intake of folic acid or IFA tablets. Similar results were obtained by Gautam *et al*., the major reason for non-adherence to iron supplementation was forgetfulness (71.7%), followed by side-effects (43.4%).[12] Gebremedhin *et al*. reported that among pregnant women who were prescribed iron supplements, the compliance rate was 74.9% and reasons for non-adherence were side-effects (63.3%) and forgetfulness (16.7%).[13]

Regular intake of green leafy vegetables, fish, jaggery, and ragi showed a protective effect against anemia ($P \leq 0.01$).

Regular intake of pulses and meat was also protective against anemia but not statistically significant. Fish and meat contain haem iron which can be absorbed easily. So that may be the cause of higher prevalence in occasional consumers of fish and meat.

Table 1: Anemia in relation with frequency of consumption of different types of food items

Type of food item consumption (Frequency -≥once/week vs. <once/week)	Regular intake Number (%)	Irregular intake number (%)	Anemia		
			Odds ratio	95% CI	*P* value
Green leafy vegetables	265 (89.8%)	30 (10.2%)	0.137	0.054–0.348	<0.001
Pulses	217 (73.5%)	78 (26.5%)	0.761	0.451–1.284	0.306
Fish	207 (70.1%)	88 (29.9%)	0.556	0.336–0.922	0.022
Meat	105 (35.5%)	190 (64.5%)	0.725	0.443–1.188	0.202
Milk	153 (51.8%)	142 (48.2%)	1.559	0.974–2.495	0.064
Fruits	219 (74.2%)	76 (25.8%)	0.619	0.365–1.048	0.073
Jaggery	67 (22.7%)	228 (77.3%)	0.428	0.232–0.786	0.005
Ragi	61 (20.6%)	234 (79.4%)	0.510	0.275–0.945	0.031
Tea after meals (>once/day vs. ≤once/day)	280 (95%)	15 (5%)	1.353	0.451–4.064	0.589

Table 2: Anemia in relation to supplementation from Anganwadi

Characteristics	Total *n*=295	Anemia *n* (%)	Normal *n* (%)	Odds ratio	95% CI	*P* value
Supplementation from Anganwadi						
Receiving	114	34 (29.8%)	80 (70.2%)	0.491	0.299–0.806	0.005
Not receiving	181	84 (46.4%)	97 (53.6%)			

Table 3: Anemia in relation to FA/IFA tablets intake, its side-effects, and IFA intake along with calcium supplementation or milk

Characteristics	Total *n*=295 (%)	Anemia *n* (%)	Normal *n* (%)	Odds ratio	95% CI	*P* value
FA/IFA intake						
Regular	249	85 (34.1%)	164 (65.9%)	0.204	0.102–0.408	<0.001
Irregular	46	33 (71.7%)	13 (28.3%)			
Side-effects of FA/IFA tablets						
Present	46	27 (58.7%)	19 (41.3%)	2.467	1.300–4.684	0.005
Absent	249	91 (36.5%)	158 (63.5%)			
IFA intake along with calcium supplementation or milk						
Yes	54	34 (63.0%)	20 (37.0%)	3.177	1.722–5.863	<0.001
No	241	84 (34.9%)	157 (65.1%)			

IFA: Iron folic acid

Adequate and regular intake of iron-rich foods such as green leafy vegetables such as spinach, drumstick leaves, Colocasia leaves, and fenugreek leaves is advisable. Foodstuff rich in haem iron such as fish is recommended. Ragi is rich in iron and so is jaggery. Hence, those who take food items prepared out of jaggery and ragi regularly are less prone to develop anemia.

Regular milk intake is a risk factor for anemia ($P \leq 0.01$). This may be due to the fact milk contains calcium which is an inhibitor of iron absorption. Frequent tea consumption after meals is a risk factor for anemia, although not statistically significant. Reason for anemia is due to the interference of dietary bioavailability of iron by the tannin contents of tea/coffee.

In a study done by Baig-Ansari *et al*.,[14] consumption of meat and fruits were protective against anemia. Obse *et al*.[15] pointed out that adequate intake of vegetables was protective against anemia, whereas taking tea after meals regularly was more likely to develop anemia.

In this study, those pregnant women who availed supplementary nutrition from Anganwadi had significantly less chance of developing anemia, inspite of them being economically disadvantaged. To cover the whole population of antenatal irrespective of economic status, food fortification with iron is an ideal long-term strategy. Dietary habits of the population are an important consideration in selecting food for fortification. As per our study, diet followed in Kerala is predominantly cereal-based; hence, fortification of cereals like rice and atta can be tried. The existing ICDS platform can be utilized for the supply of fortified food.

In support of the findings of this study, Cheema *et al*.[16] and Viveki *et al*.[17] pointed out that regular intake of iron supplements was protective against anemia.

As per National Guidelines for Calcium supplementation during Pregnancy and Lactation,[18] Calcium tablets are to be taken twice a day (total 1 g calcium/day) starting from 14 weeks of pregnancy up to 6 months post-partum. Anemia was found to be more among mothers who consumed calcium supplements or milk along with iron supplements. Consumption of iron supplements and calcium supplements or milk containing calcium together should be spaced out and asked to be consumed at different times of the day to avoid this interference of calcium on iron absorption.[18] There is evidence supporting the same.[19]

CONCLUSION AND RECOMMENDATIONS

Nutritional deficiencies play an important role in anemia among antenatal women. Dietary factors such as irregular intake of iron-rich foods and IFA supplementation tablets, IFA tablets taken along with calcium supplementation, were found to be significantly associated with anemia. Receiving Anganwadi supplementation was found to be protective. Iron and folic acid supplementation should be ensured throughout the life cycle irrespective of hemoglobin status. It is of paramount importance to extend nutritional education regarding various foods rich in iron and folic acid, usage of iron-fortified foods and motivation regarding compliance to take IFA tablets for preventing anemia among pregnant women which can be done by health workers and other paramedical staff during house visits. The improper dietary intake combined with the presence of iron absorption inhibitors which serve to reduce the bioavailability of iron needs to be addressed. As forgetfulness was the main reason for not taking IFA tablets regularly, reminders/notification messages can be set up which might be helpful to overcome it to a large extent. In addition, adolescent girls need to be well informed about the health benefits of iron supplementation and to avail benefits of Weekly Iron and Folic acid Supplementation program. The high prevalence of anemia in pregnancy needs obligatory supplementation of IFA tablets not only to pregnant women but also to adolescent girls along with correction of related nutritional deficiencies by improving

the consumption of diversified foods and a well-timed intervention for anemic women.

Limitation

Recall bias might have occurred in eliciting variables related to the food frequency. All efforts were made to try to obtain the correct food frequency details

ACKNOWLEDGMENT

The authors are extremely thankful to staff of the health centers for providing all necessary assistance to conduct the study. Our sincere thanks to all the study participants without whose support and cooperation, it would have been impossible to complete the study.

FUNDING

No funding sources.

CONFLICTS OF INTEREST

Nil.

REFERENCES

1. World Health Organization. The Global Prevalence of Anaemia in 2011. Geneva: World Health Organization; 2015. Available from: http://www.apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf?ua=1&ua=1. [Last accessed on 2018 Jul 11].
2. Ministry of Health and Family Welfare, Government of India. National Iron-Plus Initiative Guidelines for Control of Iron Deficiency Anaemia. National Rural Health Mission, Ministry of Health and Family Welfare, Government of India; 2013.
3. Gambling L, Danzeisen R, Fosset C, Andersen HS, Dunford S, Srai SK, *et al*. Iron and copper interactions in development and the effect on pregnancy outcome. J Nutr 2003;133:1554S-6.
4. Balarajan Y, Ramakrishnan U, Ozaltin E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. Lancet 2011;378:2123-35.
5. Bivolarska AV, Gatseva PD, Maneva AI. The role of eating habits on the iron status of pregnant women. J Am Coll Nutr 2016;35:118-24.
6. International Institute for Population Sciences, India Fact Sheet, National Family Health Survey 2015-16 (NFHS-4); 2016a. Available from: http://www.rchiips.org/nfhs/pdf/NFHS4/India.pdf. [Last accessed on 2019 Sep 02].
7. International Institute for Population Sciences, State Fact Sheet Kerala, National Family Health Survey 2015-16 (NFHS-4); 2016. Available from: http://www.rchiips.org/nfhs/pdf/NFHS4/KL_factsheet.pdf. [Last accessed on 2019 Sep 02].
8. International Institute for Population Sciences, District Fact Sheet, Kozhikode, Kerala. National Family Health Survey 2015-16 (NFHS-4); 2016. Available from: http://www.rchiips.org/nfhs/FCTS/KL/KL_factsheet_591_Kozhikode.pdf. [Last accessed on 2019 Sep 02].
9. Kapil U, Bhadoria AS. National iron-plus initiative guidelines for control of iron deficiency anaemia in India, 2013. Natl Med J India 2014;27:27-9.
10. International Institute for Population Sciences, District Fact Sheet, Kozhikode, Kerala. District Level Household Survey 4 Kozhikode Report; 2012-2013. Available from: https://www.nrhm-mis.nic.in/DLHS4/Kerala/District%20Factsheets/Kozhikode.pdf. [Last accessed on 2018 Feb 07].
11. WHO-Haemoglobin Concentrations for the Diagnosis of Anaemia and Assessment of Severity. Available from: http://www.who.int/vmnis/indicators/haemoglobin.pdf?ua=1. [Last accessed on 2019 Oct 11].
12. Gautam VP, Bansal Y, Taneja DK, Ingle GK, Virender P. A study on compliance to iron-folic acid therapy and its effects on anaemia during pregnancy. Indian J Prev Soc Med 2005;36:102-7.
13. Gebremedhin S, Samuel A, Mamo G, Moges T, Assefa T. Coverage, compliance and factors associated with utilization of iron supplementation during pregnancy in eight rural districts of Ethiopia: A cross-sectional study. BMC Public Health 2014;14:607.
14. Baig-Ansari N, Badruddin SH, Karmaliani R, Harris H, Jehan I, Pasha O, *et al*. Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. Food Nutr Bull 2008;29:132-9.
15. Obse N, Mossie A, Gobena T. Magnitude of anemia and associated risk factors among pregnant women attending antenatal care in Shalla Woreda, West Arsi Zone, Oromia Region, Ethiopia. Ethiop J Health Sci 2013;23:165-73.
16. Cheema HK, Bajwa BS, Kaur K, Joshi H. Prevalence and possible risk factors of anaemia in different trimesters of pregnancy. Int J Contemp Med Res 2016;3:1194-7.
17. Viveki RG, Halappanavar AB, Viveki PR, Halki SB, Maled VS, Deshpande PS. Prevalence of anaemia and its epidemiological determinants in pregnant women. Al Ameen J Med Sci 2012;5:216-3.
18. Ministry of Health and Family Welfare, Government of India. National Guidelines for Calcium Supplementation during Pregnancy and Lactation. Maternal Health Division. New Delhi: Ministry of Health and Family Welfare, Government of India; 2014.
19. Hallberg L, Brune M, Erlandsson M, Sandberg AS, Rossander-Hulten L. Calcium: Effect of different amounts on nonheme- and heme-iron absorption in humans. Am J Clin Nutr 1991;53:112-9.