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Maternal knowledge and adherence to iron-rich diet: A multicenter cross-sectional study

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Abstract

Background: The high physiological demand for an iron in pregnancy depend on both the quantity and quality of diet that a woman takes. Inadequate intake of dietary iron, interference with iron absorption, and or increased demands during pregnancy can lead to iron deficiency anemia.

Purpose: To assess the relationship between maternal knowledge and adherence to an iron-rich diet.

Method: The study employed cross-sectional design, and the population of the study was pregnant women attending antenatal clinic in three tertiary hospitals of Kebbi State, Nigeria. Data were collected using 20 items researcher-constructed self-administered questionnaire generated from reviewed literatures and based on objectives of the study. Results were presented using frequency distribution and simple percentages. Chi-square statistical tool was used for testing the hypotheses using SPSS Version 27.

Results: Only 35.0% were able to give 3 examples of iron-rich foods. Majority of the respondents (76.7%) were not aware of foods that help the body absorb and use iron, and only 8.5% were able to mention 3 foods that help the body absorb and use iron. Moreover, 81.3% of the respondents did not know the beverages that decrease iron absorption, with only 2.1% that mentioned 3 examples of the beverages that decrease iron absorption. The least Mean adherence was found in eating insect food (Mean, 2.6/sd, 1.1), followed by eating organ meat and eating vitamin C-rich foods (Mean, 2.8/sd, 1.0 respectively), as well as eating flesh meat (Mean, 2.9/sd, 0.9). There was a significant association between the assessed demographic variables and adherence to iron-rich diet, $P < 0.01$ except age bracket in which $P < 0.05$.

Conclusion: There was a lack of knowledge regarding iron rich diet among the respondents. This knowledge deficit is more pronounced in not knowing foods that help the body absorb and use iron and food that decrease iron absorption.

Suggestions: There is a need for further efforts to educate pregnant women about iron-rich diet with an emphasis on foods that help the body absorb and use iron and foods that reduce iron absorption. Educating pregnant women about all aspects of pregnancy including health promotion and prevention of complications during pregnancy is primarily the role of midwives.

Keywords: Adherence; Diet; Iron-rich; Knowledge.

INTRODUCTION

The increased in physiological need for iron in pregnancy poses an increased in gastrointestinal iron uptake than in pre-pregnancy period. The high iron absorption in pregnancy is greater as the pregnancy advanced. This situation create demands for an iron-rich dietary intake, which in turn depend on both the quantity and quality of diet that a woman takes (Milman, 2020). A non-pregnant woman requires about 2000 mg of iron. Overall, normal pregnancy inceases the iron requirement by 2 to 3 fold and the folate requirement by 10 to 20 fold (Balcha, Eteffa, Arega Tesfu, & Abeje Alemayehu, 2023). The demand for absorbed iron is estimated to be increasing from 0.8 mg/day in early pregnancy to 7.5 mg/day in late pregnancy, and the average requirement through the pregnancy is 4.4 mg/day (Means, 2020). The increase in iron requirements predisposes pregnant women to development of anaemia, one of the intractable public health concerns, especially in developing countries. This is due to issues such as deficiency in iron and vitamins, poverty, lack of knowledge, and poor dietary habits among others (Adam, Ibrahim, & Elhardello, 2018). The commonest cause of anaemia is iron deficiency with evidence suggesting that up to 90% of maternal anaemia are due to inadequate intake of dietary iron (Appiah, Nkuah, & Bonchel, 2020).

Globally, anemia in pregnancy affects more than 32 million pregnant women (Birhanu, Chapleau, Ortolano, Mamo, Martin, & Dickin, 2018). This means that approximately 38% of pregnant women and girls experience it (Daru, Allotey, Peña-Rosas, & Khan, 2017). In Southeast Asia, the Eastern Mediterranean, and Africa, 38.9% to 48.7% of pregnant women are anemic (World Health Organization, 2015). In pregnancy, anemia is described as a hemoglobin level <11 g/dl at sea level (World Health Organization, 2014). Iron deficiency anemia is the most common cause of anemia, with approximately 90% of anemia in pregnancy being due to inadequate iron intake (Appiah et al., 2020). Iron deficiency anemia is a condition that occurs due to inadequate dietary iron intake, impaired iron absorption, and/or increased requirements during pregnancy (Gebremariam, Tiruneh, Abate, Engidaw, & Asnakew, 2019). Anemia is associated with increased maternal and neonatal

health problems, including general fatigue, low birth weight, preterm birth, postpartum hemorrhage, intrauterine growth restriction, perinatal death, and stillbirth (Appiah et al., 2020; Frayne & Pinchon, 2019).

In low- and middle-income countries, anemia in pregnancy is a major cause of poor pregnancy outcomes and maternal mortality. Anemia is associated with maternal and child mortality and is responsible for up to 20% of maternal deaths (Yismaw, Tulu, Kassie, & Araya, 2022; Birhanu et al., 2018). The ongoing burden of anemia may be due to dietary and environmental reasons (Ramachandran, Dash, Adaikaladorai, Aridass, Zachariah, & Manoharan, 2023). Previous studies have identified dietary reasons including low bioavailability of dietary iron, inadequate selection and consumption of iron-rich foods, and intake of iron absorption inhibitors such as foods rich in phytate and polyphenols (Varghese, Swaminathan, Kurpad, & Thomas, 2019). This may be due to a variety of socio-cultural factors including poor dietary knowledge, and poor dietary habits (Frayne & Pinchon, 2019).

However, Adherence to anemia prevention strategies plays a major role in the prevention and treatment of anemia among pregnant women whose iron requirement increases due to physiologic demands (Balcha et al., 2023). One important and frequently used measure of maintaining diet quality is diet diversity. Diet diversity is an assessment of varieties of consumed foods within the classes of foods in the last 24 hours (Marias & Glasauer, 2014; Olumakaiye, 2013). In pregnancy this measure is coupled with the iron supplementation, intake of iron-rich foods, nutritional counseling, and use of clean water among others (Balcha et al., 2023; Appiah et al. 2020). However, most of the research studies on anaemia in pregnancy centered around the iron supplementation, giving less emphases on other aspects such as nutritional aspect. Few studies have investigated the dietary practices of pregnant women regarding the consumption of iron rich foods (Adam, 2015; Adjei-Banuah, Aduah, Ziblim, Ayanore, Amalba, & Mogre, 2021; Harika, Faber, Samuel, Kimiywe, Mulugeta, & Eilander, 2017; Wemakor, 2019).

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Although anemia has been identified as a global public health problem for several years, no significant progress has been observed, and the prevalence of the disease remains high globally (Bizuneh & Azeze, 2022). In the context of clinical practice, side effects of iron supplementation such as gastrointestinal reactions hamper its compliance (Fouelifack, Sama, & Sone, 2019; Assefa, Abebe, & Sisay, 2019; Kassa, Awraris, Daba, & Tenaw, 2019). There are reports that non-compliance with iron-folic acid supplementation is a major problem that can negatively impact maternal and fetal health (Sendeku, Azeze, & Fenta, 2020). Poor maternal compliance with the regimen is a major reason for the ineffectiveness of anemia prevention and control strategies (Berarti, Gebrie, & Beyene, 2023).

This means that an iron-rich diet can be an alternative to increase serum iron levels during pregnancy (Sunuwar, Sangroula, Shakya, Yadav, Chaudhary, & Pradhan, 2019). Consuming foods containing adequate amounts of fruits and vegetables can be a good choice to supply micronutrients to the pregnant mother's body system, rather than relying on supplementation (Oguntunde, Charyeva, Cannon, Sambisa, Orobato, Kobo, & Sadauki, 2015). Lack of knowledge about dietary patterns is a barrier to achieving good choices. Previous studies have suggested that poor dietary knowledge is a major reason for micronutrient deficiencies in low- and middle-income countries (Darnton-Hill & Mkpuru, 2015). Nutrition education interventions are some strategies that can be used to improve nutritional knowledge of pregnant women to adhere to an iron-rich diet. However, such nutritional education interventions can only be effective if there are data reporting dietary practices and related factors in pregnant women related to the consumption of iron-rich foods (Adjei-Banuah et al., 2021). Therefore, information on pregnant women's dietary practices related to iron-rich foods is needed as a stimulus for further research.

RESEARCH METHOD

The study applied descriptive approach and employed cross-sectional design to collect information about maternal knowledge and adherence to iron-rich diet. The population of the study was

pregnant women attending antenatal clinic in three tertiary hospitals of Kebbi State, Nigeria. The hospitals were Federal Medical Center Birnin-kebbi, Sir Yahaya Memorial Hospital Birnin Kebbi, and Kebbi Medical Center Birnin Kebbi. Pregnant women that could not respond to questions due to ill-health were excluded from the study.

A consecutive sampling technique was used for the study. This involves selecting participants based on their availability or accessibility. Data were collected within the period of three month, from January 2024 to March 2024. After removing the questionnaires that were unanalysable owing to non-completion or selecting more than one option, the sample obtained was 331.

Data were collected using 20 items researcher-constructed self-administered questionnaire generated from reviewed literatures and based on objectives of the study. It contains 3 sections, Section A, B and C. Section A contains a list of 4 questions related to demographic data of the participants, section B contains a list of 8 questions pertaining to maternal knowledge regarding the iron-rich diets. Section C contains a list of 8 questions of adherence to iron-rich diet. The validity of the questionnaire was ascertained through vetting by three experience scholars. Corrections were made based on their observations and recommendations including recasting and addition of items and correcting typographical errors. The items that were inadequate or confusing in eliciting the relevant information were identified and adjusted. The reliability of the questionnaire was ascertained using Cronbach's Alpha with 40 copies of the questionnaires. The reliability index was found to be 0.82.

The researcher obtained permission from the hospital research and ethical committee. Three research assistants were employed and assisted with the data collection after receiving guidance on how to assist in collecting the data from the respondents. As for those that do not understand English language, interviewer administered method was used in collecting data from them using the local language they understand.

The collected data of the administered questionnaire were grouped based on the frequency of responses. The respondents' characteristics,

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knowledge about iron-rich diet, and adherence to iron-rich diet were organized using frequency distribution and simple percentages. Chi-square statistical tool was used for testing the hypotheses using SPSS (Statistical Package for Social Sciences Version 27).

Research ethical approval was obtained from Kebbi State Health Research Ethical Committee with the assigned number: 107:003/2024. Permission to conduct the study was sought and obtained from the

management of the three hospitals and heads of maternity units of the three hospitals. Written informed consent was obtained from the study participants individually after they have demonstrated understanding of the study procedures, risks and voluntariness. Confidentiality of all the information obtained from the participants was maintained during and after the study.

RESEARCH RESULTS

Table 1. Maternal Knowledge About Iron-Rich Diet (N=331)

Items	Yes (n/%)	No (n/%)		
Do you ever heard about a dietary mineral called iron?	190/57.4	141/42.6		
Do you know that iron can be taken in the food?	184/55.6	147/44.4		
Do you know some examples of iron-rich food?	161/48.6	170/51.4		
If yes for the question above, please give 3 examples of iron-rich foods	NA (n/%) 170/51.4	1 (n/%) 22/6.6	2 (n/%) 23/6.9	3 (n/%) 116/35.0
Do you know foods that help the body absorb and use iron	Yes (n/%) 77/23.3	No (n/%) 254/76.7		
If yes for the question above, please give 3 examples food that help the body absorb and use iron	NA (n/%) 254/76.7	1 (n/%) 37/11.2	2 (n/%) 12/3.6	3 (n/%) 28/8.5
Do you know beverages that decrease iron absorption	Yes (n/%) 62/18.7	No (n/%) 269/81.3		
If yes for the question 11 above, please give 3 examples of food that decrease iron absorption	NA (n/%) 269/81.3	1 (n/%) 46/13.9	2 (n/%) 9/2.7	3 (n/%) 7/2.1

Key: F=frequency, NA=not applicable, 1=gave 1 example, 2=gave 2 examples, 3=gave 3 examples

Table 1. indicates that over half of the respondents heard about a dietary mineral, iron, and that iron can be taken in the food (57.4 and 55.6 respectively). However, less than half of the respondents (48.6%) were knowledgeable about examples of iron-rich food, and only 35.0% were able to give 3 examples of iron-rich foods. Majority of the respondents (76.7%) were not aware of foods that help the body absorb and use iron, and only 8.5% were able to mention 3 foods that help the body absorb and use iron. Moreover, 81.3% of the respondents did not know the beverages that decrease iron absorption, with only 2.1% that mentioned 3 examples of the beverages that decrease iron absorption.

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Table 2. Maternal Adherence to Iron-Rich Diet (N=331)

Items	SD (n/%)	D (n/%)	A (n/%)	SA (n/%)	M/sd
I eat organ meat at least twice a week and once in a weekend	49/14.8	67/20.2	114/34.4	101/30.5	2.8/1.0
I eat flesh meat at least twice a week and once in a weekend	33/10.0	74/22.4	115/34.7	109/32.9	2.9/0.9
I eat insect foods at least twice a week and once in a weekend	79/23.9	63/19.0	93/28.1	96/29.0	2.6/1.1
I eat fish and/or seafood at least twice and once in a weekend	37/11.2	61/18.4	83/25.1	150/45.3	3.1/1.0
I eat legumes at least twice a week and once in a weekend	26/7.9	26/7.9	135/40.8	144/43.5	3.2/0.9
I eat green leafy vegetables at least twice a week and once in a weekend	21/6.3	34/10.3	108/32.6	168/50.4	3.3/0.9
I eat iron fortified foods at least twice a week and once in a weekend	37/11.2	51/15.4	108/32.6	135/40.8	3.0/1.0
I eat vitamin C-rich foods at least twice a week and once in a weekend	48/14.5	74/22.4	111/33.5	98/29.6	2.8/1.0

Keys: SD=strongly disagree, D=disagree, A=agree, SA=strongly agree, sd=standard deviation.

Table 2. shows that most of the respondents either agree or strongly agree on adherence to iron-rich food. The Mean of each items was found to be greater than 2.4 (60%) (Maximum of 4.0 [100%]) toward adherence to iron-rich diet. The least Mean was found in eating insect food (Mean, 2.6/sd, 1.1), followed by eating organ meat and eating vitamin C-rich foods (Mean, 2.8/sd, 1.0 respectively), as well as eating flesh meat (Mean, 2.9/sd, 0.9).

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Table 3. Association between Levels of Adherence and Respondents' Characteristics (N=331)

Variables	Levels of Adherence			X ²	P
	Low (n=42)	Moderate (n=160)	High (n=129)		
Age (n/%)					
≤19	12/28.6	52/32.5	21/16.3	17.6	0.01
20-27	17/40.5	61/38.1	62/48.1		
28-35	10/23.8	34/21.3	22/17.0		
≥36	3/7.1	13/8.1	24/18.6		
Education level (n/%)					
Non-formal	10/23.8	11/6.9	13/10.1	25.9	0.00
Primary	8/19.0	11/6.9	21/16.3		
Secondary	7/16.7	53/33.1	49/38.0		
Tertiary	17/40.5	85/53.1	46/35.6		
Social-economic status (n/%)					
Upper	0/0	13/8.1	15/11.6	24.9	0.00
Middle	31/73.8	130/81.3	75/58.2		
Lower	11/26.2	17/10.6	39/30.2		
Occupation (n/%)					
Artisan	18/42.9	51/31.9	53/41.1	27.1	0.00
Business	8/19.0	46/28.7	34/26.4		
Civil servant	6/14.3	37/23.1	40/31.0		
Farming/Animal rearing	10/23.8	26/16.3	2/1.5		

Table 3 revealed that there was a significant association between the assessed demographic variables and adherence to iron-rich diet, $P < 0.01$ except age bracket in which $P < 0.05$.

DISCUSSION

The study was on knowledge and adherence to iron-rich diet among pregnant women attending antenatal clinic in three tertiary hospitals. The findings revealed that over half of the respondents were not having knowledge of examples of iron-rich food, though over half were knowledgeable about iron being taken in the food. Only about one-third of the respondents were able to correctly mentioned 3 examples of iron-rich foods. About three-fourth of the respondents were not knowledgeable about foods that help the body absorb and use iron, and less than one-fifth of the respondents were able to correctly mentioned 3 examples of food that help the body absorb and use iron correctly. Moreover, about four-fifth of the respondents were not having knowledge of

beverages that decrease iron absorption. These findings are in contrast with the findings of a study conducted in Ghana where it was found that 90.5% of the respondents knew examples of iron-rich foods. However, in agreement with this study, the study in Ghana found that only 16.3% of the respondents knew the foods that help the body absorb and use iron; also only 9.1% of the respondents knew beverages that decrease iron absorption (Adjei-Banuah et al., 2021). The difference could have been from differences in the two areas of the study. It indicates the need for healthcare professionals in settings of this study to intensify efforts toward educating pregnant women about iron-rich foods. However, the settings of the two studies need to put

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more efforts on educating pregnant women about foods that help the body absorb and use iron and food that decrease iron absorption. Educating pregnant women about all aspect of pregnancy including health promotion and prevention of complications during pregnancy is mainly the role of midwives. The midwives have the responsibility of motivating pregnant women to make healthy choices (Dayyani, Lou, & Jepsen, 2022).

The results of this study from the individual items of adherence indicate that “agreed” and “strongly agreed” on adhering to iron-rich diet were having the highest percentage. When consolidated, about half of the respondents were having moderate level of iron-rich diet adherence. This was followed by high adherence. These findings are in agreement with the finding of a study conducted in Sri Manakula Vinayagar Medical College Hospital, Puducherry, India, where it was found that about half of the respondents had special diet during pregnancy (Nivedita & Shanthini, 2016). Also, a study conducted in Pawi district of Ethiopia found that 52.7% of the pregnant women had good adherence to anemia prevention strategies, including iron-rich diet adherence (Balcha et al., 2023). Contrary to the findings of this study, a study on knowledge of anemia in pregnancy and nutritional practices among pregnant women in Ebonyi State, Nigeria found that only 36.3% and 34.8% of the respondents indicated always adding meat/poultry/fish and green leafy vegetables respectively in their diets (Umoke, Umoke, & Odo, 2022). The difference with this study is that the study from Ebonyi state asked for adherence always, while this study asked for at least thrice a week and once during weekends.

The level of adherence to iron-rich diet among the respondents of this study was found to be mostly moderate to high. The mean and Standard Deviation of each item were favorable (Mean greater than 2.5, Maximum 4.0) towards adherence to iron-rich diet. Contrary to previous findings, which were 4.4% of participants had consumed organ meat and 29.0% had consumed meat within 24-hour recall. However, in line with this finding, that 70.6% had consumed fish and/or seafood, and 67.1% had consumed green leafy vegetables within 24-hour recall (Adjei-Banuah et al., 2021). The difference between these two

studies is that this study asked for adherence at least three times a week and once during the weekend, while the previous one asked for 24-hour recall. The lowest score obtained in this study was found in insect food consumption. This could be due to the culture and tradition of the people in the study area who consider insect food consumption to be unimportant for adults (Adjei-Banuah et al., 2021). From the results of this study it can also be seen that the respondents' compliance with an iron-rich diet is quite high even though their knowledge of an iron-rich diet is very low. It could be that the respondents consume the food only for pleasure, not to prevent anemia and without knowing the benefits of what they eat. In this case, the respondents' compliance with an iron-rich diet is just a coincidence. If their interest in food is not directed at foods containing iron, they will not comply.

Moreover, there was significant associations between the assessed demographic variables and adherence to iron-rich diet across all the variables. It is shown that three-fifth of the respondents aged ≥ 36 were having the highest percentage in high level of adherence compared to other age brackets. This age bracket was also having the lowest percentage in low level of adherence. It is in agreement with the finding that the respondents from the age bracket ≤ 19 were having the lowest percentage in high level of adherence. Thus, age might have influenced the adherence level of the respondents. The higher the age the higher the adherence. This has been pointed out by a systematic review, that higher and middle age have positive effect on adherence (Mathes, Jaschinski, & Pieper, 2014).

Though, there was a significant association between the level of adherence and level of education, the percentages of adherence did not show an increase with increased in education level. This is evident in which over half of the respondents with primary education as their highest level of education had high level of adherence while respondents with tertiary education as their highest level of education had less than one-third that had high level of adherence. This further support the assertion that respondents eat their food for pleasure not for the purpose of preventing anaemia and without having knowledge of the advantage of what they are eating. However, several studies have found that level

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of education is related to medication and other treatment adherence (Zhu, Wen, He, Feng, Xu, & Liu, 2023; Uchmanowicz, Chudiak, Uchmanowicz, Rosińczuk, & Froelicher, 2018; Damiani, Basso, Acampora, Bianchi, Silvestrini, Frisicale, & Ricciardi, 2015). Other factors such as economic status may be an intervening variable on that relationship. Adherence to a specific diet could be related to economic stance of an individual to afford the diet irrespective of the educational level.

The respondents from lower class of economic status were found to have highest percentage in low level of adherence to iron-rich diet. The same class of economic status also had the lowest percentage in moderate level of adherence to iron-rich diet. These make respondents from upper class of economic status to have the highest percentage of the respondents with moderate and high levels of adherence to iron-rich diet, followed by respondents from middle class of economic status irrespective of the fact that respondents from the lower class of economic status were having highest percentage in high level of adherence to iron-rich diet. This finding is consistent with previous research showing that household income is related to components of family food quality. In the same study, the food quality index was also found to be positively associated with high income (Thomas, Coneyworth, & Welham, 2023).

Farmers among the respondents were found to have the highest percentage of low adherence to iron-rich diet, and the lowest percentage of high adherence to iron-rich diet. Civil servant respondents had the highest percentage of high adherence to iron-rich diet. Thus, farming was found to be negatively associated with adherence to iron-rich diet, while civil service was positively associated with it. This finding is in contrast to a previous study on differences in pre-pregnancy diet quality by occupation among employed women where it was found that women in agricultural occupations had higher quality diets compared to other occupations (Zaganjor, Carmichael, Agopian, Olshan, & Desrosiers, 2020). Another study conducted in Japan, also found that pregnant women's occupation was not associated with their nutrient intake (Murakami, Miyake, Sasaki, Tanaka, Ohya, & Hirota, 2009). However, both of these studies

assessed general dietary intake, while this study specifically assessed iron-rich diet.

CONCLUSION

Lack of knowledge of respondents about iron-rich diet. Lack of knowledge of respondents about iron-rich diet is more evident in ignorance about foods that help the body absorb and use iron and foods that reduce iron absorption. There was a significant relationship between the demographic variables assessed and adherence to iron-rich diet in all variables.

SUGGESTIONS

There is a need for further efforts to educate pregnant women about iron-rich diet with an emphasis on foods that help the body absorb and use iron and foods that reduce iron absorption. Educating pregnant women about all aspects of pregnancy including health promotion and prevention of complications during pregnancy is primarily the role of midwives.

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