



Maternal knowledge on iron and folic acid supplementation and associated factors among pregnant women in a rural County in Kenya



Mary Wanjira Kamau*, Waithira Mirie, Samuel Thuo Kimani

School of Nursing Sciences, College of Health Sciences, University of Nairobi, P.O. Box 19676-00202, Nairobi, Kenya

ARTICLE INFO

Keywords:

Iron and folic acid supplementation (IFAS)
Maternal knowledge
Pregnant women
Information source
Anaemia control
Nutrition

ABSTRACT

Background: Iron and folic acid supplementation (IFAS) programme is a key global intervention for control of anaemia in pregnancy. Due to persistently high anaemia rates during pregnancy, Kenya, adopted IFAS programme in 2010 as a high impact nutrition interventions to control anaemia in pregnancy. Despite free provision of IFAS tablets, compliance has remained low over the years. Studies have associated high maternal knowledge with higher supplement use.

Objective: To determine maternal IFAS knowledge and associated factors, including socio-demographic characteristics, source of IFAS information and their relationship with IFAS knowledge, among pregnant women in Kiambu County.

Methods: This was a cross-sectional study involving 364 pregnant women aged 15–49 years. Using two stage sampling, one sub-County was selected and five public health facilities. A pre-tested structured questionnaire consisting of socio-demographic data, source of IFAS information and maternal IFAS knowledge was used. Descriptive and inferential statistics were computed using STATA.

Results: Of 364 respondents interviewed, although 67.3% had heard of IFAS, 40.9% (149) scored highly on IFAS knowledge. Despite health care providers (63%) being most reported source of information, highest level of knowledge was among women who obtained information from brochures (91%) and community health workers (CHWs) (87%). Women aged ≥ 30 years, married, multiparous and earning \geq USD 100 were most likely ($p \leq 0.05$) to score high.

Conclusions: Maternal IFAS knowledge was fair and was associated with maternal age, marital status, parity, employment, monthly income, availability of brochures and support from CHWs. Strengthening provision of IFAS learning materials and enhancing CHWs involvement is recommended.

1. Introduction

Anaemia in pregnancy is among the most important contributing factors to the global burden of disease (Mulambah, Siamba, Ogotu, Siteti, & Wekesa, 2014) with iron deficiency anaemia contributing more than half of the cases. Generally, anaemia affects over 80% of women in some African Countries (Waweru, Mugenda, & Kuria, 2009). Kenya has high prevalence rates of anaemia in pregnancy, ranging between 40% and 53% (Mulambah et al., 2014; Waweru et al., 2009). Approximately 6 out of every 10 pregnant women are anaemic (MoH, 2013a), with resultant 1 in 10 maternal deaths and 2 in 10 perinatal deaths in Kenya (MoH, 2013b).

Iron and folic acid supplementation (IFAS) programme is a key global intervention (WHO, 2013) for control and prevention of anaemia in pregnancy. Notable benefits of IFAS include reduced maternal-child

morbidity and mortality as well as low birth weight (MoH, 2012a; MoH, 2013b; Mungen, 2003). Despite the documented benefits of IFAS, poor compliance hinders its success with resultant poor maternal-child outcomes (Mungen, 2003; Pena-Rosas & Viteri, 2006).

Kenya adopted the IFAS programme in 2010 as one of the high impact nutrition interventions to control micronutrient deficiency and specifically address anaemia in pregnancy. In 2012, Kenya shifted from using separate iron and folate tablets to a combined in order to reduce tablets burden and thus enhance utilization, with the programme targeting to achieve 80% coverage by 2017 (MoH, 2013b). Currently, IFAS is routinely provided through public health facilities, free of charge, for daily use throughout pregnancy by women attending antenatal care (ANC) clinic. Despite free provision of IFAS, compliance has remained low over the years. The 2014 demographic health survey reported that only about 8% pregnant women took IFAS for 90 days or more

* Corresponding author.

E-mail addresses: kwanjira@uonbi.ac.ke (M.W. Kamau), mirie@uonbi.ac.ke (W. Mirie), tkimani@uonbi.ac.ke (S.T. Kimani).

<https://doi.org/10.1016/j.ijans.2019.01.005>

Received 20 September 2018; Received in revised form 18 January 2019; Accepted 20 January 2019

Available online 21 January 2019

2214-1391/ © 2019 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

nationally (KNBS & Macro ICF, 2015). It is not clear whether the low IFAS compliance was related to low knowledge among the pregnant women.

Studies have associated nutritional knowledge with supplement use, thus low compliance with low level of IFAS awareness among women, among other factors (Ghimire & Pandey, 2013; Popa et al., 2013). Information and training on importance of supplementation during pregnancy is associated with better IFAS utilization (Gebremedhin, Samuel, Mamo, Moges, & Assefa, 2014; Pal, Sharma, Sarkar, & Mitra, 2013) in terms of longer duration (Yekta, Ayatollahi, Pourali, & Farzin, 2008) and increased compliance (Maina-Gathigi, Omolo, Wanzala, Lindan, & Makokha, 2013), eventually leading to more effective supplementation (Aguayo et al., 2005). A Kenyan study found that only half of the respondents (45–58%) received any information about supplementation (Maina-Gathigi et al., 2013; Yekta et al., 2008) while in Iran, participants knowledge on anaemia was obviously poor (Yekta et al., 2008). Combining communication with supplementation greatly improved compliance and decreased anaemia prevalence among adolescents in Tanzania (Muro, Gross, Gross, & Wahyuniar, 1999).

Increasing awareness on IFAS, adequate counselling and community education among pregnant women has been found to improve its compliance (Popa et al., 2013). Limited knowledge/lack of information among health care providers in many aspects of education and counselling reported in Kenya is a set-back that adversely affects IFAS utilization (MoH, 2013a). Previous studies were done while iron and folate tablets were separate tablets (Berti et al., 2011). It took time to get the combined IFAS tablet in supply in all public facilities. Little information is available on IFAS after introduction of the combined IFAS tablet. Even though studies have determined sources of IFAS information among pregnant women (Al-Akhfash, Abdulla, Osman, Abdulgafar, & Almesned, 2013), the relationship between the source of IFAS information and the level of IFAS knowledge is less explored. Furthermore, data on maternal knowledge and challenges of utilization of IFAS in Kenyan health facilities, is scarce. Since knowledge is associated with practice and limited knowledge has been reported among Kenyan health workers (MoH, 2013a), relationship between information source and level of knowledge would help determine which sources of information to strengthen, to improve maternal knowledge and subsequently IFAS utilization. Consequently, there is need to determine the IFAS knowledge level among pregnant women while using the combined IFAS tablet whose supply is now in the list of the essential drugs in the country. Therefore, the aim of this study was to determine maternal knowledge on IFAS and associated factors. The specific objectives were to determine the following among pregnant women in Kiambu County, Kenya (1) the level of maternal knowledge on IFAS (2) the source of IFAS information and (3) the relationship between maternal IFAS knowledge and socio-demographic factors and (4) the relationship between maternal IFAS knowledge and source of IFAS knowledge.

2. Materials and methods

This was a cross-sectional study conducted between June and October 2016 involving pregnant women, from Kiambu County in Kenya. The study population consisted of 364 pregnant women aged 15–49 years, of up to 33 weeks of pregnancy gestation. A two stage cluster sampling was used: Sub-County stage to select one Sub-County and health facility stage to select five of its public health facilities for the study. The sampling frame consisted of all the Sub-Counties in Kiambu County. A criteria was used at each stage. The Sub-County with existing functional (active) community units formed the basis for the study, meaning its community health volunteers were actively involved in providing community health services to community members. All the major health facilities: with highest client/patient population and with existing and functional (active) community units were used for the study. These major health facilities were considered because of the low turn-over of antenatal clients in public health facilities in Lari Sub-

County.

All pregnant women who attended antenatal care in selected health facilities were eligible for the study. Consecutive sampling, which is considered the best type of non-probability sampling with best representation of entire population, was used to include all accessible pregnant women as part of the sample. Thus, all pregnant women who met the inclusion criteria were informed about the study and those who provided a verbal and written informed consent to participate in the study were recruited. All ethical procedures were observed, consistent with our other publications (Kamau, Kimani, & Mirie, 2018; Kamau, Mirie, & Kimani, 2018).

Ethical approval of the study was granted by Kenyatta National hospital/University of Nairobi Ethics and Research Committee (KNH-ERC/A/90 protocol number – P706/11/2015). Research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI/P/18/81499/2231). Authority to conduct the study was obtained from all authorities involved namely Kiambu County, Lari Sub-county and health facilities authorities. Participation in the study was purely voluntary and in line with the ethical requirement of non-coercion whereby, participants were free either not to participate or to discontinue participation without facing any adverse consequences.

All study participants provided their individual verbal and written informed consent before participating in the study. Informed consent was obtained from each respondent by reading to them information contained in the consent form. Study participants were provided with information about the study and any questions they had answered by providing further clarification before seeking their consent to participate. The informed consent form contained adequate information on: aim of the study and methods to be used, institutional affiliations of the research and their contact information, anticipated benefits (no monetary compensation but would benefit from IFAS), potential risks (no risks involved apart from being interviewed), right to abstain from participating in the study, or to withdraw from it at any time, without reprisal, and measures to ensure privacy and confidentiality of information provided. All those who agreed to participate signed a consent certificate.

A structured questionnaire consisting of 22 closed ended questions including; 11 on socio-demographic data, 2 on information sources, and 9 on maternal knowledge, was developed and pretested for data collection. Before actual data collection, the questionnaire was pre-tested at Kiambu hospital, a health facility that was not included in the actual data collection. To ensure reliability of the questionnaire, we adopted a test retest method where a repeat pre-test was conducted after two weeks. Cohen's kappa statistic was used to measure the level of agreement of the results from the pre-tests. All the questions with a kappa value above 0.7 after comparison of the two pre-test results were included in the final questionnaire. To ensure validity, the questionnaire was shared and discussed with experts from the Ministry of Health, division of nutrition, and the study supervisors. The obtained feedback was used to refine the questionnaire and improve its quality to ensure it tested what was intended (Kamau, Mirie et al., 2018).

The questionnaires were administered by trained research assistants to all pregnant women who met the inclusion criteria and consented to the study. Five research assistants were recruited with a background in health, specifically degree nurses and nutritionists, to assist in conducting the study. They were trained before the pre-testing to ensure all aspects of ethical conduct of research were covered including quality data collection and management. Research assistants were trained on data collection methods, interviewing skills, ethics in research conduct and how to relate to respondents. The researcher also trained them on how to ask respondents questions in a respectful and clearly understood manner, without posing any bias and to ensure they got correct information for each question. They respectfully approached pregnant women after being attended at antenatal care clinic, established rapport with them and requested for their time to explain about the study.

Those who agreed had the consent form read to them and they were given an opportunity to seek further clarifications about the study. Those who consented to participate in the study then signed a consent certificate and were interviewed. Research assistants checked each questionnaire for completeness before releasing the participant. There was close supervision and support of the research assistants by the researcher to ensure high quality data collection and utmost adherence to data collection procedures, sampling procedures and research ethics, such as; proper administration of informed consent and proper recording. The researcher checked the questionnaires daily for omissions and possible erroneous entries to ensure that each question was answered clearly and was correctly recorded. Data was carefully entered into the computer and cleaned then analysis was done. The hard copies of data were kept under lock and key whereas the soft copy was password protected and backed up daily.

To assess the level of maternal knowledge on IFAS, statements were computed by summing up all relevant 40 Likert scale items (5 on benefits, 7 on possible side-effects of IFAS, 6 on managing side effects, 6 on effects of iron/folate deficiency, 7 on features of anaemia, 7 on dietary sources that increase blood levels, an item on frequency of taking IFAS and an item on duration of taking IFAS). A correct response for each item was scored as “1” and “0” for the incorrect response. All the scores for each participant were summed up and the participants’ level of knowledge was then classified as either high or low using the median as the cut-off point: high IFAS knowledge included all scores above the median value and low IFAS knowledge included all scores below the median value. To determine the factors associated with maternal IFAS knowledge, a cross tabulation of the above data was carried out against socio-demographic characteristics, parity and source of information reported.

3. Results

3.1. Socio-demographic characteristics of study respondents

Of the 364 respondents interviewed, 67.7% were aged 19–29 years, with the mean age of 25 years. Whereas about half (54.5%) of the respondents had attained secondary education, about a third (34.6%) had completed secondary education and only 5.8% had attained tertiary level of education. A majority (84.1%) of the respondents were married and half (50.3%) had 1–2 children. Regarding economic activity, the respondents reported being housewives (27.4%), self-employed (25.1%), casual labourers (22.4%), and only 2.8% on formal employment respectively. Only 7.8% of them reported earning more than 100 USD per month (Table 1).

3.2. Maternal knowledge on iron and folic acid supplementation

Of the respondents, more than half (67.3%) reported having heard of IFAS. When the knowledge scores were computed, the distribution of the scores was approximately normal with mean 6.24 (SD = 3.64) and median 6.00. The level of knowledge on IFAS among respondents was varied, with less than half (40.9%) scoring high.

Disparities in the content of IFAS pregnant women were knowledgeable about were noted. The pregnant women were most knowledgeable on food sources of iron/folate, benefits of IFAS and effects of not taking enough iron/folate as compared to side-effects or their mitigation. Whereas only 3.3%, 8% and 8.3% did not know any food sources of iron/folate, IFAS benefit and effects of not taking enough iron/folate respectively, almost half (48.7%) did not know any IFAS side-effect while about three-quarters (74.1%) did not know how to manage IFAS side-effects. The most reported IFAS benefit was increasing blood levels (69.2%), followed by making foetus grow healthy (38.4%). In addition, the most reported sign/symptom of anaemia was dizziness (48.3%) followed by body weakness (34.1%) while 18.1% did not know any sign/symptom of anaemia.

Table 1
Socio-demographic characteristics the respondents.

Socio-demographic variables	n	(%)
<i>Age in years (n = 356):</i>		
≤ 18	28	7.9
19–29	241	67.7
≥ 30	87	24.4
<i>Education Level (n = 361):</i>		
Primary	143	39.6
Secondary	197	54.5
Tertiary	21	5.8
<i>Occupation (n = 362):</i>		
Formal employment	10	2.8
Self-employed	106	29.2
Casual labourer	81	22.4
Unemployed	165	45.6
<i>Marital Status (n = 364):</i>		
Married	306	84.1
Single	58	15.9
<i>Average income in USD (n = 351):</i>		
Below 100	325	92.6
100 and above	26	7.4
<i>Pregnancy parity (n = 363):</i>		
0	120	33.1
1–2	182	50.1
3–4	45	12.4
5+	16	4.4

3.3. Relationship between maternal knowledge on IFAS and socio-demographic characteristics of respondents

Table 2 shows the relationship between socio-demographic characteristics and level of knowledge on IFAS among pregnant women. Highest level of IFAS knowledge was found among pregnant women with the following characteristics: formally employed (70%), earning USD 100 and above (61.5%), with 5 children and above (57.1%), aged 30 years and above (54.6%), pregnancy parity of 3/4 (57.8%) as well as 1/2 (48.3%) and with tertiary education (47.6%). The level of maternal IFAS knowledge progressively increased with increase in age, level of education and pregnancy parity of respondents.

Multivariate regression analysis revealed that respondents aged 30 years and above were most likely (OR = 5.54; 95%CI, 1.93–15.94; P = 0.001) to have high knowledge on IFAS compared to those below 30 years. In addition, married respondents were likely (OR = 2.20; 95%CI, 1.17–4.17; P = 0.015) to be more knowledgeable than those unmarried. Furthermore, those who earned USD 100 and above per month were more likely (OR = 2.53; 95%CI, 1.11–5.74; P = 0.027) to have high knowledge on IFAS compared to lower earners. Similarly, pregnant women whose parity was 1 and above were more likely to have high IFAS knowledge than those whose pregnancy parity was zero as shown in Table 2. Therefore, the level of IFAS knowledge was influenced by maternal age, marital status, pregnancy parity and average monthly income.

3.4. Sources of IFAS information and relationship with maternal IFAS knowledge

Various sources of IFAS information were reported by pregnant women. Of the respondents who had heard of IFAS (67.3%), their main source of information was from the health care providers (63%) (Fig. 1). Other sources of information were: brochures (11%), community health workers (10%), radio (8%), television (5%) and friend/neighbour (3%).

The highest level of knowledge was found among those whose sources of information were brochures (91%) and community health workers (87%) despite the two not being the main source of

Table 2
Maternal knowledge on IFAS in relation to socio-demographic characteristics of respondents.

Socio-demographic variables	IFAS Knowledge Level		OR (95% CI)	P-Value
	Low IFAS Knowledge	High IFAS Knowledge		
	n(%)	n(%)		
<i>Age in years (n = 356):</i>				
≤ 18	23 (82.1)	5 (17.9)	Ref.	Ref.
19–29	151 (62.7)	90 (37.3)	2.74 (1.01–7.47)	0.048 [†]
≥ 30	39 (45.4)	48 (54.6)	5.54 (1.93–15.94)	0.001 [†]
<i>Education Level (n = 361):</i>				
Primary	85 (59.9)	57 (40.1)	Ref.	Ref.
Secondary	107 (54.9)	88 (45.1)	1.23 (0.79–1.9)	0.361
Tertiary	11 (52.4)	10 (47.6)	1.36 (0.54–3.40)	0.517
<i>Occupation (n = 362):</i>				
Formal employment	3 (30.0)	7 (70.0)	3.41 (0.85–13.67)	0.083
Self-employed	58 (55.2)	48 (44.8)	1.19 (0.72–1.94)	0.5
Casual labourer	54 (66.7)	27 (33.3)	0.72 (0.41–1.26)	0.248
Unemployed	98 (59.4)	67 (40.6)	Ref.	Ref.
<i>Marital Status (n = 364):</i>				
Married	173 (56.5)	133 (43.5)	2.20 (1.17–4.17)	0.015 [†]
Single	42 (72.3)	15 (27.7)	Ref.	Ref.
<i>Average income (n = 351):</i>				
≤ 10,000	199 (61.2)	126 (38.8)	Ref.	Ref.
Above 10,000	10 (38.5)	16 (61.5)	2.53 (1.11–5.74)	0.027 [†]
<i>Pregnancy parity (n = 363):</i>				
0	85 (70.8)	35 (29.2)	Ref.	Ref.
1–2	94 (51.7)	83 (48.3)	2.41 (1.40–4.18)	0.002 [†]
3–4	19 (42.2)	26 (57.8)	1.74 (0.99–3.04)	0.054 [†]
5+	9 (56.3)	7 (43.8)	2.73 (1.39–5.36)	0.004 [†]

* Significant at P < 0.05; Ref. – Reference variable.

information about IFAS (Fig. 2), when high and low levels of IFAS knowledge were computed for each source of information.

4. Discussion

The main findings from this study are: (1) Less than half (40.9%) of the respondents had high IFAS knowledge even though more than half (67.3%) of them had heard of IFAS (2) The main source of IFAS information was health care providers (3) Respondents who reported brochures and community health workers as their source of IFAS information had the highest IFAS knowledge levels (4) A respondent was likely to have high knowledge on IFAS if she was aged 30 years and above, was married, multiparous and had a monthly income of USD 100 or above (5) The level of maternal IFAS knowledge progressively increased with increase in age, level of education and number of pregnancies a respondent had.

Findings show that less than half of the pregnant women had high IFAS knowledge despite more than half having heard of IFAS. This indicates that quite a number of women have heard of the word “IFAS” but do not have the details on IFAS. About a third (32.7%) of the women had not heard of IFAS. This could either mean that there is a huge number of women who are either unaware of IFAS or do not have accurate information on IFAS despite having heard of it. Many women were unaware of the side-effects of IFAS and those who knew how to mitigate these side-effects were even fewer. Since many women stop taking iron-folate tablets due to side-effects, it is important that mothers are provided with accurate information and properly counselled. This would increase their level of knowledge on IFAS and ultimately improve compliance (Gebremedhin et al., 2014). These findings are similar to a study among Saudi females where, even though 88% had heard of folic acid, only 53.8% of them had accurate information about its benefits (Al-Akhfash et al., 2013). This calls for more approaches to enhance health education and counselling to give mothers detailed IFAS information including actual name, importance, supplementation

duration, maintaining supplementation, side-effects/challenges and more importantly how to handle these side-effects/challenges. This will eventually increase maternal knowledge on IFAS and consequently its utilization.

Though majority reported their source of information as the health care provider, their level of knowledge was not the highest. When analysed by source, mothers who got the information from brochures/leaflets had the highest level of knowledge followed by those whose source of information was community health workers then television. Limited knowledge and/or lack of information among health care providers about IFAS and poor counselling skills reported in Kenya (MoH, 2013a) is a set-back to IFAS knowledge and utilization among pregnant women. Possible explanations for this finding may include (a) those whose source of information was brochures may have been the ones with highest level of education and therefore took time to understand the information (Al-Hossani, Abouzeid, Salah, Farag, & Fawzy, 2010; Alozie Arole, Puder, Reznar, Eby, & Zhu, 2003; Nawapun & Phupong, 2007; Popa et al., 2013) (b) brochures/leaflets act as a reference material that mothers can always use to remind themselves (c) community health workers are closer to the community leading to better interpersonal communication skills than health care providers hence better explanation to women about IFAS (d) information passed through brochures and televisions is usually prepared by professionals who know how to be effective in reaching the community with messages (e) health care providers are overworked and may therefore provide inadequate counselling leading to low knowledge levels (Galloway et al., 2002; MoH, 2013a) (f) health care providers may not be updated with IFAS information. This calls for more refresher trainings on IFAS among health care providers, to enhance their IFAS knowledge, now that they are the most common source of IFAS information. There is also need to constantly provide pregnant women with Information, Education and Communication (IEC) materials on IFAS which they can always refer to and refresh their IFAS knowledge.

Iron and folic acid supplementation (IFAS) is the most common

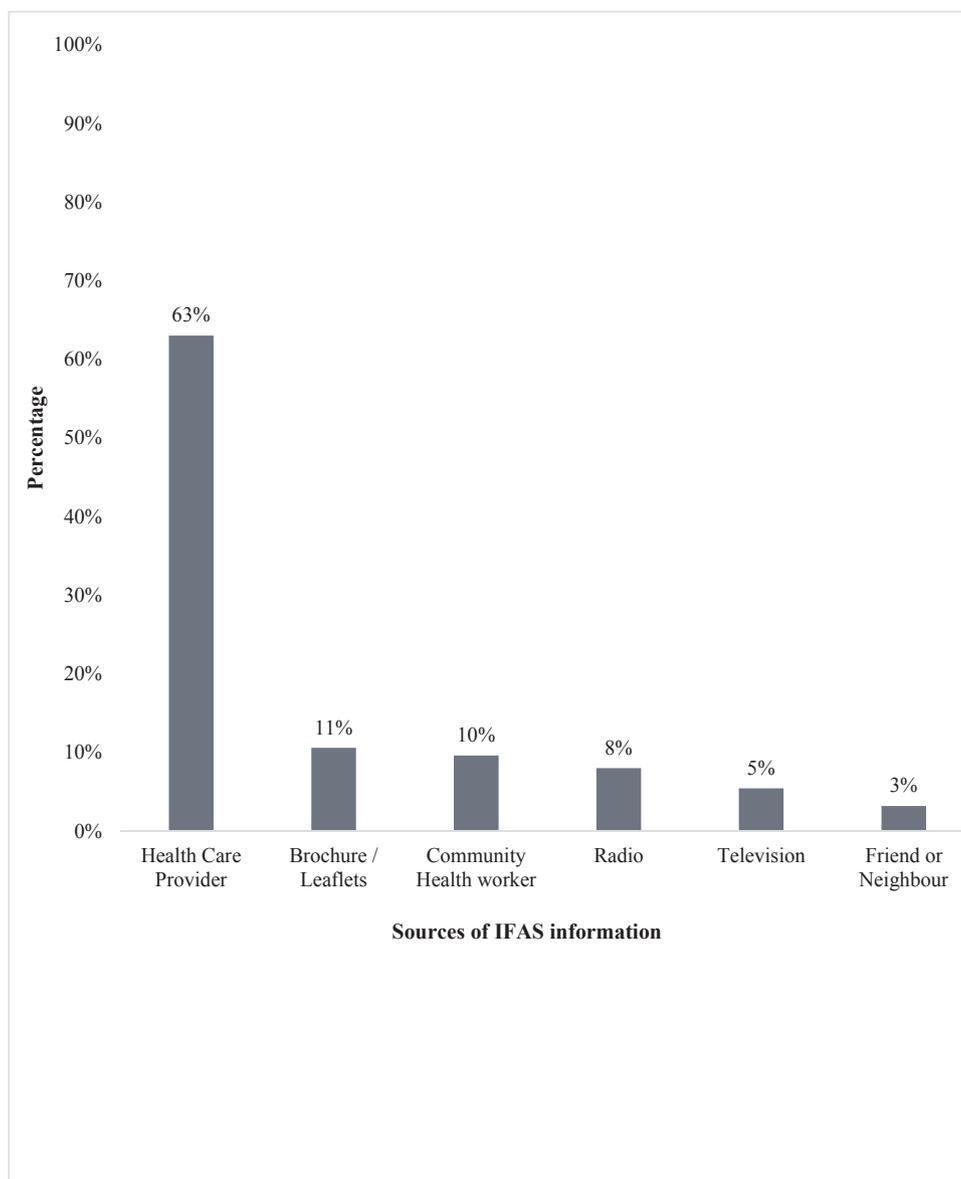


Fig. 1. Sources of information on IFAS.

strategy used to control iron deficiency anaemia (WHO, 2012; Wiradnyani, Khusun, Achadi, Ocviyanti, & Shankar, 2016). Its uptake is affected by several factors, among them maternal knowledge. For a long time, it has been stated that health workers are the greatest source of health information for clients and patients (Al-Akhfash et al., 2013; Seck & Jackson, 2008). Though community health workers are expected to be an important source of health information (MoH, 2012b, 2013a; Nisar, Michael, & Ali, 2014), their contribution was less than from brochures. This probably is an indicator of the quality of training and technical capacity of the community health workers. If properly trained and facilitated, they could play a vital role in increasing uptake of health interventions like IFAS as well as acting as a credible source of health education (Saprii, Richards, Kokho, & Theobald, 2015).

In relation to socio-demographic characteristics, it was noted that a respondent was likely to have high knowledge on IFAS if she was aged 30 years and above, was married, had pregnancy parity of 1 and above and had an average monthly income of USD 100 or above. In addition, the level of maternal IFAS knowledge in this study progressively increased with increase in age, level of education and subsequent number of pregnancies that a woman had. Married women are likely to get more family support especially from their spouses than the single

women. This probably encourages them to be more pro-active and seek more information making them more knowledgeable. As Tinago, Annang Ingram, Blake, and Frongillo (2017) stated, the importance of family support in IFAS knowledge and use cannot be overemphasized (Tinago et al., 2017). This is related to the number of pregnancies that a woman has had, which gives them more exposure to get IFAS information as they attend ANC clinics throughout each pregnancy hence makes them more knowledgeable. Though majority of the mothers were young, mean age being 25 years, their knowledge on IFAS was considered low/moderate until after the age of 30 years. This may be explained by the relatively low level of education (primary school) since this may impact access to information and their level of comprehension (Nawapun & Phupong, 2007).

Since level of education is a determinant of formal employment and income, high level of IFAS knowledge among these groups may be as a result of their level of education (Al-Hossani et al., 2010; Lacerte, Pradipasen, Temcharoen, Imamee, & Vorapongsathorn, 2011; Nisar et al., 2014; Popa et al., 2013; Taye, Abeje, & Mekonen, 2015; Titaley, 2014). However, due to the very few numbers of respondents formally employed, it was difficult to get any significance results on multivariate analysis. Higher levels of education increases general exposure which

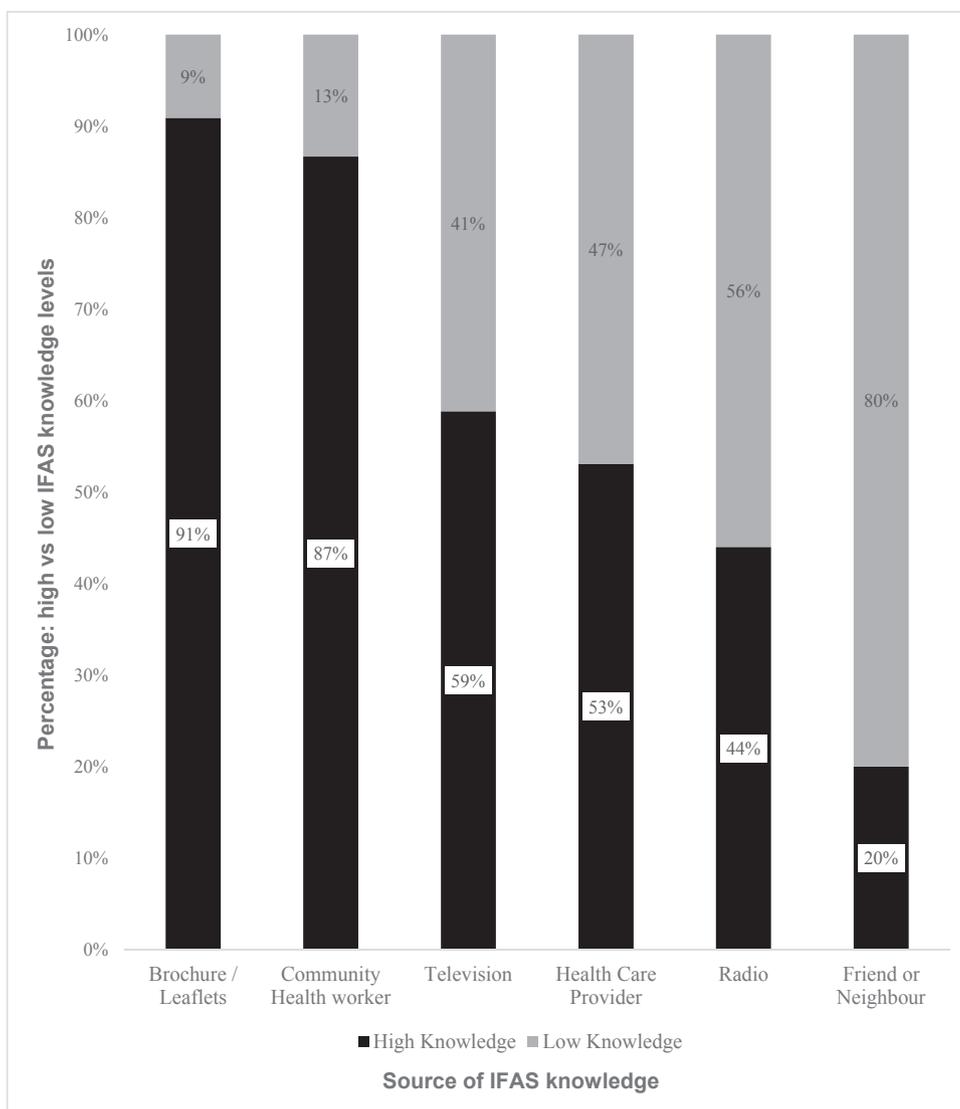


Fig. 2. Level of knowledge on IFAS based on the source of information.

strengthens general understanding and consequently demand for appropriate health services (Sanghvi, Harvey, & Wainwright, 2010). In addition, women with high level of education tend to start families and child-bearing later in life because they spend more time in school. These findings could also be due to the maternal experience that women get with advance in age and subsequent pregnancies leading to higher level of IFAS knowledge compared to their younger counterparts or those pregnant for the first time.

This study had some limitations despite the wealth of knowledge it was able to generate on IFAS. The study relied heavily on verbal reports on IFAS, which may have introduced some recall bias and subjectivity. However, this challenge was minimized through proper interviewing and double questioning, whereby the same issue was asked in two different forms as two different questions, for example, a question on parity and another one on both living and dead children, to identify any inconsistencies in the reports and thus clarify appropriately. Further, respondents' participation in the study was purely voluntary, their rights were respected and the ethical requirement for non-coercion was keenly observed. This study looked at factors associated with IFAS knowledge that are related mostly to socio-demographic characteristics and information provision, therefore, studies on other factors related to other settings are highly recommended. Finally, the study involved only one Sub-County which may affect generalizability of the study findings.

5. Conclusion

Maternal knowledge on IFAS among pregnant women was fairly reasonable with nearly half scoring high. Factors that promoted maternal IFAS knowledge include advanced maternal age and experience, multi-parity, formal employment, higher levels of education and income, provision of Information, Education and Communication (IEC) materials and support from Community Health Workers (CHWs). This underscores need to support antenatal iron and folic acid supplementation by empowering and educating women through provision of IEC materials and enhancing CHWs involvement as well as refresher IFAS trainings of health care providers. There is need to expand policies on distribution of client-targeted IFAS IEC materials and formal involvement of CHWs in implementation of IFAS programme.

6. Data availability statement

The data underlying this study is available from Open Science Framework Dataset 1: Knowledge and counselling DOI 10.17605/osf.io/x8tj3.

This dataset is available under a CCO 1.0 Universal license.

Funding

This study was supported by the Consortium for Advanced Research Training in Africa (CARTA). CARTA is jointly led by the African Population and Health Research Center and the University of the Witwatersrand and funded by the Carnegie Corporation of New York (Grant No – B 8606.R02), Sida (Grant No:54100029), the DELTAS Africa Initiative (Grant No: 107768/Z/15/Z).

Ethical approval details

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Approval for scientific and ethical issues was sought and granted by Kenyatta National hospital/University of Nairobi Ethics and Research Committee (KNH-ERC/A/90 protocol number – P706/11/2015). Research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI/P/18/81499/22319).

Informed consent

Informed consent was obtained from all individual participants included in the study.

Acknowledgements

Our gratitude to all study participants in Lari Sub-County for their time and willingness to share their experiences. We thank the Sub-County Health Management Team for their great support in implementing this study, especially by the Public Health Officer in-charge of the community health strategy. We are grateful for the dedicated performance of the field and data management staff. We thank Consortium for Advanced Research Training in Africa (CARTA) for sponsoring this study.

Declaration of interest statement

The authors declare that they have no conflict of interest regarding the publication of this paper.

References

- Aguayo, V. M., Kone, D., Bamba, S. I., Diallo, B., Sidibe, Y., Traore, D., ... Baker, S. K. (2005). Acceptability of multiple micronutrient supplements by pregnant and lactating women in Mali. *Public Health Nutrition*, 8(1), 33–37.
- Al-Akhfash, A. A., Abdulla, A. M., Osman, A. M., Abdulgafar, J. I., & Almesned, A. A. (2013). Maternal knowledge and use of folic acid among Saudi females. *Saudi Medical Journal*, 34(11), 1173–1178.
- Al-Hossani, H., Abouzeid, H., Salah, M. M., Farag, H. M., & Fawzy, E. (2010). Knowledge and practices of pregnant women about folic acid in pregnancy in Abu Dhabi, United Arab Emirates. *East Mediterranean Health Journal*, 16(4), 402–407.
- Alozie Arole, C. N., Puder, K. S., Reznar, M., Eby, E., & Zhu, B. P. (2003). Folic acid awareness in Michigan, 1996–1999. *Obstetrics and Gynecology*, 102(5 Pt 1), 1046–1050.
- Berti, C., Biesalski, H. K., Gartner, R., Lapillonne, A., Pietrzik, K., Poston, L., ... Cetin, I. (2011). Micronutrients in pregnancy: Current knowledge and unresolved questions. *Clinical Nutrition*, 30(6), 689–701. <https://doi.org/10.1016/j.clnu.2011.08.004>.
- Galloway, R., Dusch, E., Elder, L., Achadi, E., Grajeda, R., & Hurtado, E. (2002). Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. *Social Science and Medicine*, 55. [https://doi.org/10.1016/s0277-9536\(01\)00185-x](https://doi.org/10.1016/s0277-9536(01)00185-x).
- Gebremedhin, S., Samuel, A., Mamo, G., Moges, T., & Assefa, T. (2014). 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*, 14, 607. <https://doi.org/10.1186/1471-2458-14-607>.
- Ghimire, N., & Pandey, N. (2013). Knowledge and Practice of Mothers Regarding the Prevention of Anemia during Pregnancy, in Teaching Hospital, Kathmandu. *Journal of Chitwan Medical College*, 3(3), 4. <https://doi.org/10.3126/jcmc.v3i3.8631>.
- Kamau, M., Kimani, S., & Mirie, W. (2018). Counselling on iron and folic acid supplementation (IFAS) is associated with improved knowledge among pregnant women in a rural county of Kenya: A cross-sectional study [version 1; referees: Awaiting peer review]. *AAS Open Research*, 1(21). <https://doi.org/10.12688/aasopenres.12891.1>.
- Kamau, M. W., Mirie, W., & Kimani, S. (2018). Compliance with iron and folic acid supplementation (IFAS) and associated factors among pregnant women: Results from a cross-sectional study in Kiambu County, Kenya. *BMC Public Health*, 18(1), 580. <https://doi.org/10.1186/s12889-018-5437-2>.
- KNBS, & Macro ICF (2015). *Kenya Demographic and Health Survey 2014*. Nairobi: KNBS.
- Lacerte, P., Pradipasen, M., Temcharoen, P., Imamee, N., & Vorapongsathorn, T. (2011). Determinants of adherence to iron/folate supplementation during pregnancy in two provinces in Cambodia. *Asia-Pacific Journal of Public Health*, 23(3), 315–323. <https://doi.org/10.1177/1010539511403133>.
- Maina-Gathigi, L., Omolo, J., Wanzala, P., Lindan, C., & Makokha, A. (2013). Utilization of folic acid and iron supplementation services by pregnant women attending an antenatal clinic at a regional referral hospital in Kenya. *Maternal Child Health Journal*, 17(7), 1236–1242. <https://doi.org/10.1007/s10995-012-1120-x>.
- MoH. (2012). Accelerating reduction of iron deficiency anaemia among pregnant women in Kenya: Plan of action 2012–2017. Nairobi.
- MoH. (2012). IFAS Dialogue guide for health care providers. Nairobi.
- MoH. (2013). National Iron and Folic Acid Supplementation; Communication Strategy, 2013–2017. Nairobi.
- MoH. (2013). National Policy Guideline on combined iron and folic acid (IFA) supplementation for pregnant mothers in Kenya. Nairobi.
- Mulambah, C. S., Siamba, D. N., Ogutu, P. A., Sיתי, D. I., & Wekesa, A. W. (2014). Anaemia in pregnancy: Prevalence and possible risk factors in Kakamega County, Kenya. *Science Journal of Public Health*, 2(3), 216–222.
- Mungen, E. (2003). Iron supplementation in pregnancy. *Journal of Perinatal Medicine*, 31(5), 420–426. <https://doi.org/10.1515/JPM.2003.065>.
- Muro, G. S., Gross, U., Gross, R., & Wahyuniar, L. (1999). Increase in compliance with weekly iron supplementation of adolescent girls by an accompanying communication programme in secondary schools in Dar-es-Salaam, Tanzania. *Food and Nutrition Bulletin*, 20(4), 435–444.
- Nawapun, K., & Phupong, V. (2007). Awareness of the benefits of folic acid and prevalence of the use of folic acid supplements to prevent neural tube defects among Thai women. *Archives of Gynecology and Obstetrics*, 276(1), 53–57. <https://doi.org/10.1007/s00404-006-0305-1>.
- Nisar, Y., Michael, J. D., & Ali, M. M. (2014). Factors associated with non-use of antenatal iron and folic acid supplements among Pakistani women: A cross sectional household survey. *BMC Pregnancy Childbirth*, 14(1), 305.
- Pal, P. P., Sharma, S., Sarkar, T. K., & Mitra, P. (2013). Iron and folic acid consumption by the ante-natal mothers in a rural area of India in 2010. *International Journal of Preventive Medicine*, 4(10), 1213–1216.
- Pena-Rosas, J. P., & Viteri, F. E. (2006). Effects of routine oral iron supplementation with or without folic acid for women during pregnancy. *Cochrane Database Systematic Reviews*, 3, CD004736. <https://doi.org/10.1002/14651858.CD004736.pub2>.
- Popa, A. D., Nita, O., Graur Arhire, L. I., Popescu, R. M., Botnariu, G. E., Mihalache, L., & Graur, M. (2013). Nutritional knowledge as a determinant of vitamin and mineral supplementation during pregnancy. *BMC Public Health*, 13, 1105. <https://doi.org/10.1186/1471-2458-13-1105>.
- Sanghvi, T. G., Harvey, P. W., & Wainwright, E. (2010). Maternal iron-folic acid supplementation programs: Evidence of impact and implementation. *Food and Nutrition Bulletin*, 31(2 Suppl), S100–S107.
- Saprii, L., Richards, E., Kokho, P., & Theobald, S. (2015). Community health workers in rural India: Analysing the opportunities and challenges Accredited Social Health Activists (ASHAs) face in realising their multiple roles. *Human Resources for Health*, 13, 95. <https://doi.org/10.1186/s12960-015-0094-3>.
- Seck, B. C., & Jackson, R. T. (2008). Determinants of compliance with iron supplementation among pregnant women in Senegal. *Public Health Nutrition*, 11(6), 596–605. <https://doi.org/10.1017/S1368980007000924>.
- Taye, B., Abeje, G., & Mekonen, A. (2015). Factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara: A cross-sectional study. *The Pan African Medical Journal*, 20, 43. <https://doi.org/10.11604/pamj.2015.20.43.4894>.
- Tinago, C. B., Annang Ingram, L., Blake, C. E., & Frongillo, E. A. (2017). Individual and structural environmental influences on utilization of iron and folic acid supplementation among pregnant women in Harare, Zimbabwe. *Maternal & Child Nutrition*, 13(3), <https://doi.org/10.1111/mcn.12350>.
- Titaley, C. R. (2014). Factors associated with not using antenatal iron/folic acid supplements in Indonesia: The 2002/2003 and 2007 Indonesia Demographic and Health Survey. *Asia Pacific Journal of Clinical Nutrition*, 23(4), <https://doi.org/10.6133/apjcn.2014.23.4.10>.
- Waweru, J., Mugenda, O. M., & Kuria, E. (2009). Anaemia in the context of pregnancy and HIV/AIDS: A case of Pumwani maternity hospital in Nairobi Kenya. *African Journal of Food Agriculture Nutrition and Development*, 9(2), 748–763.
- WHO (2012). *Guideline: Daily iron and folic acid supplementation in pregnant women*. Geneva: World Health Organization.
- WHO (2013). *Essential Nutrition Actions: Improving maternal, newborn, infant and young child health and nutrition*. Geneva: World Health Organization.
- Wiradnyani, L. A. A., Khusun, H., Achadi, E. L., Ocviyanti, D., & Shankar, A. H. (2016). Role of family support and women's knowledge on pregnancy-related risks in adherence to maternal iron-folic acid supplementation in Indonesia. *Public Health Nutrition*, 19(15), 2818–2828. <https://doi.org/10.1017/S1368980016001002>.
- Yekta, Z., Ayatollahi, H., Pourali, R., & Farzin, A. (2008). Predicting factors in iron supplement intake among pregnant women in urban care setting. *Journal of Research in Health Sciences*, 8(1), 39–45.