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Maternal related factors associated with compliance to iron and folic supplementation among pregnant mothers in Machakos County

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Abstract

Iron is one of the essential nutrients that is responsible for synthesis of hemoglobin and whose demand increases during pregnancy. Iron and folate supplements are administered during pregnancy in order to cater for the increased demand during pregnancy to help supply the elements to both the fetus and the pregnant mother. According to the KDHS, 2014, in Kenya, the biggest challenge has been compliance to the supplements by the pregnant women, with only 14% of all pregnant women complying with the recommended schedule. This study therefore aims to examine the barriers that influence compliance to prenatal iron/folate supplementation among pregnant women in Machakos County. A facility based cross-sectional study was carried out in three sub-county hospitals within Machakos County. The facilities were randomly selected from seven sub-county hospitals. The study sampled a total of 204 pregnant women aged 18-49 years through systematic random sampling. Compliance to iron/folate was measured through Morisky medication compliance scale questionnaire. Data was collected through a structured questionnaire. Then organized and coded in to a computer software SPSS, version 24, for analysis. Logistic regression was done to assess possible associations and the strength of association was measured using odds ratio, with 95% confidence interval. Data was presented in forms of bar charts and tables. Three focus group discussions with health unit managers and administrators were done. The data from the focused group discussions was organized and emerging themes reported. Consent was sought before actual data collection.

Results: Majority of the respondents were between 21 years and 40 years, with a few above the age of 40 years. Expectedly 84% were married and 76% had secondary level of education. More than half of the mothers were casual workers and 69% of them received family support during pregnancy. Among the socio-demographic factors of the respondents, family support and level of education of the mother were significantly associated with adherence to iron and folate supplements. Compliance to the supplements was improved when the supplements were given in combined form. Provision of health education in pregnancy especially counseling on nutritional value of supplementing iron stores in the body and how to manage side effects of iron and folate supplements were significantly associated with compliance to iron and folate supplements. Past experience of the mothers' especially previous history of anemia, current haemoglobin level and bad obstetric history of the mother were found to increase compliance to the supplements. The study recommends the government of Kenya, through the County governments to develop policies on procurement and distribution of combined iron and folate supplement. This will promote availability of the drugs and improve compliance to the supplements.

Keywords: Stillbirth, antenatal care, delivery of still birth

Introduction

Iron deficiency anemia remains a common serious public health problem in the world. The World Health Organization (WHO) recommends that all pregnant women receive a standard dose of 30-40 mg iron and 400µg folic acid beginning as soon as possible during gestation (WHO, 2012) [19, 20]. In Kenya, the national policy recommends that pregnant women should be supplemented with 60/mg per day for iron and 400µg of folic acid daily for 180 days. The risk for iron deficiency anemia increases during pregnancy because the demand for iron is increased in pregnancy to cater for both the mother and the developing fetus. Due to this reason in countries where micronutrient deficiencies are common such as the developing nations iron supplementation is therefore recommended. (WHO, 2012) [19, 20]. Globally almost half of all pregnant women are anemic and the highest proportion of the affected population is in developing nations. Developed countries have a lower prevalence of anemic women in comparison with the developing nations (UNICEF, 2015) [15].

Iron is one of the essential nutrients that is responsible for synthesis of hemoglobin and whose demand increases during pregnancy and its supply can be inadequately supplied

through regular diet. Therefore, interventions which include iron supplementation which is administering iron along with folic acid in form of tablets to pregnant mothers is usually done with the aim of increasing hemoglobin concentrations to the best possible extent so that women do not reach term pregnancy with anemia (Titilayo & Agunbiade, 2014) [16].

Kenya, like most sub-Saharan Africa countries, has a national policy aiming at combating anemia in pregnancy. This includes the provision of ferrous sulfate and folic acid to all pregnant women. The recommended dose in Kenya is 60mg/day of ferrous sulfate and 400µg of folic acid once a day taken by mouth for 180 days of prenatal period, preferably with a meal. This dosage is usually supplied in a single combined iron and folic acid tablet (MOH, 2008).

The effectiveness of and success of the policy interventions on anemia prevention in pregnancy largely depends on the compliance to iron and folic acid tablets usage. Compliance is the extent to which a client correctly follows medical advice given to him/her. Many experts have come to believe that the major reason that the national supplementation programs have failed is non-compliance to iron and folate by pregnant women. Health system and patient factors determine adherence, and research has not been extensively done on these factors. Apparently, there is no clear cut-off for compliance but missing 2 or more doses consecutively is usually referred to as non compliance.

Even though interventions are often designed in both national and international level to combat anemia in pregnancy by the introduction of iron supplements, complying to the regimen of taking the drugs on daily basis and with the recommended dosage remains to be a challenge. According to the Kenya Demographic Health Survey of 2014, compliance to iron/folate supplements by pregnant women in Kenya was low. Nationally only 14% of the pregnant women took Iron supplements more than 90 days of the recommended 180 days. The statistics revealed that 5% of the respondents took supplements for 60-89 days, 53% took the supplements for fewer than 60 days and 30% reported that they did not take iron supplements at all during their last pregnancy. Machakos county lies within eastern Kenya and the KDHS 2014 statistics revealed that in eastern province only 13.6% of the respondents reported taking iron supplements for more than 90 days during their last pregnancy. Records from the district health information

systems in Machakos County revealed that in the year 2016/2017, among the pregnant women visiting the antenatal clinics 6% had severe anemia and 19% had moderate to mild anemia in pregnancy respectively. These numbers were noted to be significantly higher in comparison with numbers in the previous years.

Methodology

A cross-sectional study design was used to establish maternal related factors affecting compliance to iron and folate supplement among pregnant mothers attending their antenatal clinics in selected hospitals within Machakos County. This design was used because it provided relevant facts and opinions of individuals. The study targeted 200 pregnant mothers attending antenatal clinics in maternal child health (MCH) departments within the selected hospitals in Machakos County, Kenya. The mothers participated either in structured questionnaire or focused group discussion but not both. The key informants included nurse in charges with midwifery background among the selected hospitals. The study was conducted in Yatta, Kangundo and Mwala sub-county hospitals within Machakos County. Purposive sampling technique was used to select the hospitals.

The participants were selected using systematic random sampling, whereby after calculating K^{th} value, the research was selecting every fourth pregnant mother who met the inclusion criteria. In focus group discussion, pregnant mothers who had not participated in structured questionnaire were selected. The sampled mothers participated in FGD using FGD guide on factors affecting compliance of iron and folate supplements. Key informants were selected purposively from the MCH in charges because they had firsthand knowledge on IFAS. A pretest was carried out to determine reliability of the questionnaires. Reliability analysis was subsequently done using Cronbach's Alpha which measured the internal consistency by establishing if certain item within a scale measures the same construct. This was assured through counter checking the completely filled questionnaires after data collection in order to identify and correct any error that might have occurred which enhanced accuracy and consistency of the tool. After coding of the results in SPSS, reliability was tested and found Cronbach's alpha to be at 0.865.

Table 1: Reliability analysis

Scale	Cronbach's Alpha	Number of Items
Maternal related factors influencing compliance to iron and folate supplements	0.865	6

This was evident enough that the tool was reliable. To ensure validity, the questionnaire was tested, issues which were not clear were clarified, all questions were thoroughly scrutinized by technical persons and those which were not necessary were deleted. Those questions that needed to be rephrased were edited accordingly before the study was commenced. Content validity was ensured through thorough proof reading and peer review of the tool before it was subjected to the respondents. Continuous supervision from the supervisors added value to the validity of the tool.

Qualitative data was collected using structured interviews which were recorded, transcribed into verbatim then subjected to thematic analysis. Quantitative data was collected using the structured questionnaires. The questionnaire featured both closed and open-ended

questions. A combination of both qualitative and quantitative questions was used to collect data. Data collected was cleaned, edited, coded and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 24. Data was then summarized using descriptive statistics such as frequencies and presented by use of tables, figures, and narration. Analysis of contingency tables was done to establish relationship between variables and Chi Square was used to test the relationship between variables. Results from FGDs and KIIs were arranged in general categories identified in the discussion guidelines then coded, common themes were identified, inferences made from each theme and conclusions drawn during thematic analysis.

Approval to conduct the study was given by Kenyatta University Ethics and Review Committee and the authority

to undertake the study was sought from the National Commission for Science, Technology and Innovation. Permission to carry out research was sought from County Director of Health services, Medical superintendent from each selected Hospitals were informed. The nursing officers in charges of the selected hospitals were informed. The questionnaires were administered to the respondents upon obtaining an informed consent. To ensure privacy, names and other means of identity were not used during the data collection. The researcher ensured that all information obtained was kept under lock and key and was only used for the purpose of the study.

Utilization measurement

The study adopted self-reported measurement of medication compliance and Morisky medication compliance scale was used to measure compliance to iron and folic acid. If a mother reported missing taking iron supplements once or more times, they were considered non-compliant. However, self-reported compliance is the only measure that is able to distinguish between intentional and non-intentional non-compliance to medication, which all have different underlying causes and require different interventions. The study did not employ measurement of hemoglobin levels to assess the compliance of iron/folate supplementation because control of co-founders was not possible. The factors that affect hemoglobin levels other than iron/folate supplements are known to be many and may include; diet, diseases, drugs, the device used in measurement, site of blood draw, position of body, time of hemoglobin measurement among others.

Response Rate

The study targeted a sample size of 212212 nurses working in maternity departments from which 200 filled in and returned the questionnaires making a response rate of 94.3%. This response rate was satisfactory to make conclusions for the study as it acted as a representative. According to Mugenda and Mugenda (2003), a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. Based on the assertion, the response rate was excellent.

Results

Demographic characteristics of the participants

The ages of the respondents ranged from 18 to 45 complete years with a mean age of 29 years. More than half of the participants (86.6%) were aged between 21 and 40 years of age, while the remaining (22%) were below 20 years and 8.5% aged above 40 years, however the compliance to iron and folate varied across the ages.

Majority of the respondents were mothers who were married (84%), while the remaining were single and others separated or cohabiting, (13%) and (3%) respectively. Most of the respondents were Christians by denomination (95%) while the remaining participants (5%) belonged to Muslim denomination. The Christians included 65% who belonged to Catholic Church followers, 13% Seventy-day Adventists (SDA), Christians and, 17% Protestants.

The level of education was reported to vary from informal to tertiary level. 2.5% had informal education, 14.5% had primary education, with a majority of respondents 76% having secondary level of education. A few respondents

(7%) reported to have attained tertiary level of education. On occupation of the mothers, 8.5% were farmers, 61% casually employed, 26.5% had their own businesses and 4% had formal employment. The researcher probed more on occupation of the husband or the supporting partner. Majority of the husbands or supporting partners were also found to be casually employed (55%), 8% were farmers, 21% formally employed, and 16% in business. Majority of the mothers (69%) reported to be having supportive families and partners while a few (31%) were depending on their own means.

Table 1: Demographic characteristics of the mothers

	Variable	Frequency	Percentage
Age	<20	44	22
	21-30	90	45
	31-40	49	24.5
	>41	17	8.5
Marital status	Married	168	84
	Single	26	13
	Divorced/widowed/cohabiting	6	3
Denomination	Christian	190	95
	Muslim	10	5
Level of education	Informal	5	2.5
	Primary	29	14.5
	Secondary	152	76
	Tertiary	14	7
Occupation	Farmer	17	8.5
	Casual employment	122	61
	Formal employment	8	4
	Business	53	26.5
Receives family support	Yes	138	69
	No	62	31

Maternal age and level of adherence to iron and folate supplements

On analysis, out of 44 participants who were below 20 years of age, only 26 were found to be compliant. Out of the 90 participants who were between 21-30 years old only 33 of them were found to comply to iron and folate supplements. Forty-nine of the respondents were aged between 31-40 years and only 21 of them were complying with the instructions given and took the supplements daily. Those who were above 41 years of age were 17 and 5 of them were complying. On Chi square, age was not a significant predictor of iron and folate adherence χ^2 (3, N = 200) = 7.403, $p \geq 0.05$. The results are shown in table 3.

Religion of the mother and adherence to iron and folate supplements

The religion of the respondents was assessed and the affiliation of the respondents was not significantly associated with adherence to iron and folate supplements. Out of 190 respondents who were Christians, relatively have of them (80) were adhering to iron and folate supplements. 10 of the respondents were Muslims and half of them were adhering while the other half was non-adhering χ^2 (1, N = 200) = 0.242, $p \leq 0.746$. The results are shown in table 3.

Marital status of the mother and adherence to iron and folate supplements

On marital status, 168 participants were married and 100 of them were not adhering to iron and folate supplements. Out of 26 respondents who were single, 12 were non-adhering to iron and folate supplement. Half of those who were not married or single were adhering while the other half was not

adhering to iron and folate supplement χ^2 (2, N = 200) = 1.789, $p \leq 0.409$. The results are shown in table 3.

Level of education of the mother and adherence to iron and folate supplements

The level of education was varied among the participants. Five respondents who were having informal education were found to be non-adhering to iron and folate supplement.

29 of the participants had a primary level of education and 26 of them were not adhering to iron and folate supplement. These findings reveal that lower level of education is associated with non-adherence iron and folate supplement. Majority of the respondents (76%) were having secondary level of education. Out of the 152 respondents with secondary level of education 78 of them were adhering to iron and folate supplement. For those who had tertiary level of education 8 out of 14 were adhering to iron and folate supplements. Increase in level of education shows positive association to adhering to iron and folate supplement χ^2 (3, N = 200) = 19.573, $p \leq 0.000$. The results are shown in table 3.

Occupation of the respondent and adherence to iron and folate supplements

Majority of the respondents (122) reported to be casually employed, out of all these 69 were non-adhering to iron and folate supplements. Out of 17 farmers, 9 were non-adhering to the supplements. 8 of the respondents were having formal employment and five of them were non-adhering to iron and folate supplements. Out of 53 who were operating business, 32 were non-adhering to the supplements. The findings reveal that, the occupation of the respondents was not significantly associated with adherence to iron and folate supplements χ^2 (3, N = 200) = 0.450, $p \leq 0.930$. The results are shown in table 3.

Receipt of family support and level of adherence to iron and folate supplements

In this study it was evident that some participants received family support during pregnancy while others did not. 62 of the respondents reported not to be supported while 138 of them revealed to be supported. Out of the 138 who were supported, half of them were adhering to iron and folate supplement. Of the 62 who were not supported, few of them (16) were found adhering to the supplement. This implies that lack of family support increases chances of non-adhering to iron and folate supplements. On Chi-square, there was a significant association between receiving family support and adherence to iron and folate supplements χ^2 (1, N = 200) = 10.247, $p \leq 0.001$. The results are shown in table 3.

The respondent reported

My husband is very keen in reminding me to take IFAS so as to take care of our unborn child. He gives me money to come to the clinic and buys for me the advised fruits and vegetables.

(Respondent 2, 28-year-old mother)

On regression, the variables were entered stepwise and probability of F-to-remove value set at >0.1 . In Model one, the variable was contributing 28% of the association while in model two the variables were contributing 35%. Therefore, inclusion of both receiving family support and

level of education variables in the model made it fit and meet the assumption for regression model fitness. The model was significant at 0.002. Level of education of the mother and receiving family support were significant socio-demographic factors affecting adherence to supplements.

Maternal knowledge on consequences of low blood and adherence to iron and folate supplements

Majority of the respondents were knowledgeable on the consequences of low blood in pregnancy. In this study, 152 respondents were knowledgeable and more than half of them (80) were adhering to iron and folate supplements. Out of 48 respondents who were ignorant of the consequences, only five were adhering to iron and folate supplements. This indicates that there is a strong association between knowledge and practice. In this study, knowledge on consequences of low blood in pregnancy was significantly associated with adherence to iron and folate supplements χ^2 (1, N = 200) = 26.603, $p \leq 0.000$. The results are shown in table 3.

Source of information on consequences of low blood in pregnancy and adherence to iron and folate

On analysis, there were those respondents who got the information from the health workers, from friends and from the media. 96 of the respondents got information from the health workers and among them 49 were adhering to iron and folate supplements. 62 participants got information from the media and amongst them only 25 were adhering to iron and folate supplements. There were also those who got information from friends, 11 out of 42 were found to adhere to the supplements. The results reveal that the source of information was significant in determining adherence to iron and folate supplements χ^2 (2, N = 200) = 7.558, $p \leq 0.023$. The results are shown in table 3.

Duration of taking supplements and compliance to the supplements

Majority of the mothers (86%) reported to have taken the supplements for a period of 1-2 months. 14% had taken the supplements for about three months. On their current gestation, 91.5% reported to have been taking tablet supplements while 8.5% had been taking syrup for iron supplement and tabs for folate supplement. In the same study, reported to have been taking iron and folate supplements separately while 76% had been using a combined tablet. On both formulations of the supplements, 89% reported to have had side effects from the supplements. Some of the side effects reported were; nausea 21%, bad taste 23.5%, smell like blood 28%, 16.5% had heart burn and the remaining had no side effects.

When I take the medication daily I experience hurt burn. Sometimes I vomit after taking the medication.

(Respondent 4, 24 year mother from Kangundo level four hospital).

Taking these drugs leaves me uncomfortable, when I take it in the morning, I feel that I cannot perform well during the day (Respondent 7, a 27-year-old mother from Mwala sub county hospital)

The brown tablets (ferrous sulphate) have a bad taste and smell, they taste like blood" (Respondent 1, 22-year-old mother from Matuu level four hospital).

The duration in which the mother had taken the iron and folate supplement was not significantly associated with

adherence to the supplements. Majority (172) had taken the supplements for 1-2 months, 97 of them were not adhering to the supplements. 26 had taken the supplements for 3 months but still a low proportion of 9 participants had adhered to taking the supplements as recommended $\chi^2 (2, N = 200) = 0.793, p \leq 0.673$. The results are shown in table 3.

Formulation of supplement taken and adherence to the supplement

The respondents reported that, the supplements were given in two different formulations. One group was getting the supplements in separate doses; iron supplement separate from folate supplement while the other was given combined tablets with both supplements. Those who received the supplements separately were 51, and out of these only 6 were found to adhere to the daily intake of the supplements. Among the 149 respondents who were taking combined tablets, 79 were found to be adhering. This revealed a significant association between combining the supplements and adherence $\chi^2 (1, N = 200) = 26.463, p \leq 0.000$. There was a strong association between formulation of the supplements (if combined or separate) and adherence to iron and folate supplements (Spearman's Rho = 0.364).

The findings revealed that the formulation also comes in different sizes which could also affect the compliance of IFAS.

The size of this new drug that I have received today (Aristofol Fe) is too big, I am scared of its big size (Respondent 4, a 20-year-old respondent from Kangundo level four hospital).

However, the focused group discussion with the health workers revealed that there are inconsistencies in the tablet preparations that are supplied to the health facilities.

Sometimes the supply we receive in the hospital consist of fixed dose combination of IFAS and other times single doses of both iron and folate packed separately. So by the time a pregnant mother completes the ANC clinic, she has to switch between the single and fixed dose combinations. Most of the times when we are supplied with the single doses, we at times have stock outs of either iron or folic acid

so you only dispense one and the mothers have to buy the drug that is not available. You cannot be sure if they will buy (Respondent 5, a nurse from Mwala level four hospital).

Perceived benefits and adherence to iron and folate supplements

The respondents who were aware of the benefits of taking the supplements were found to adhere to the intake of the supplements than those who were ignorant. On benefits of taking iron/ folate supplements, majority (86%) knew them. 69.5% of the mothers reported to take the supplements to increase their blood, 8% reported to take the supplements to increase blood and prevent abnormalities, 10% took the supplements to prevent abnormalities and the remaining reported that they didn't know the benefits of taking the supplements. Among 41 respondents who were ignorant of the benefits, only 5 were found to be adhering to the intake of the supplements. Relatively half the number of the participants, (80) of those who knew the benefits were found to be adhering to the intake of the supplements $\chi^2 (1, N = 200) = 19.381, p \leq 0.000$. The results are shown in table 3.

Knowledge on signs and symptoms of anemia

The mothers were asked to respond to six statements about anemia in pregnancy. Majority of the respondents (76%) knew the consequences. Among the consequences identified, 46% reported fatigue, 10% reported leg swelling, 6% headache, 14% dizziness and 24% didn't know.

Some beverages are associated with malabsorption of iron from the intestines. In this study, majority 71% didn't know which beverages affects absorption of iron from the duodenum. 13.5% reported tea to be associated with malabsorption and the remaining 15.5% reported coffee to be associated with malabsorption of iron. Majority of the respondents (48%) reported to have gotten this information from health workers, 31% got the information from media and 21% got their information from family friends and relatives.

Table 2: Maternal knowledge and utilization of iron and folate supplements

Variable	Category	Frequency	Percentage
Duration on iron/ folate supplement in this pregnancy	1-2 months	172	86
	3 months	28	14
Type of supplement	Tablet	183	91.5
	Syrup	17	8.5
If supplement were separate or combined	Separate	48	24
	Combined	152	76
Ever experienced side effects from the supplements	No	22	11
	Yes	178	89
Side effects experienced	Nausea	42	21
	Bad taste	47	23.5
	Smell like blood	56	28
	Heart burn	33	16.5
Knows signs and symptoms of anemia	Yes	152	76
	No	48	24
Signs and symptoms of anemia identified	I don't know	48	24
	Dizziness	28	14
	Leg swelling	20	10
	Fatigue	91	46
	Headache	12	6
Beverages affecting absorption of iron from intestines	I don't know	142	71
	Tea	27	13.5
	Coffee	31	15.5

Source of information about anemia in pregnancy	Health worker	96	48
	Media	62	31
	Friends/ relatives	42	21
Knows benefits of iron/ folate supplements	Yes	172	86
	No	28	14
Reasons for taking supplements	To increase blood	139	69.5
	To increase blood and prevent birth abnormality	16	8
	To prevent birth abnormality	20	10
	I don't know	25	12.5

On binary regression analysis, four variables were entered into the model for stepwise regression. These included the variables that were significant on Chi-square; knowledge on consequences of low blood in pregnancy, source of the information about the consequences of low blood, if the supplements were separated or combined and knowledge on benefits of iron and folate supplements in pregnancy. Entry

was set at 0.05 and removal at 0.10. After forward stepwise regression, only knowledge on consequences of low blood in pregnancy, combination of the supplement and knowledge on benefits of iron and folate supplements were found to be significantly associated with adherence to iron and folate supplements.

Table 3: Summary of maternal related factors influencing compliance to iron and folate supplements

Variable	Category	Level of adherence		df	P value
		Adherence	Non-adherence		
Age	<20	26	18	3	P=0.060 $\chi^2=7.403$
	21-30	33	57		
	31-40	21	28		
	>41	5	12		
Religion	Christian	80	110	1	P=0.746 $\chi^2=0.242$
	Muslim	5	5		
Marital status	Married	68	100	2	P=0.409 $\chi^2=1.789$
	Single	14	12		
	Divorced/ widowed	3	3		
Level of education	Informal	0	5	3	P=0.000 $\chi^2=19.573$
	Primary	3	26		
	Secondary	78	74		
	Tertiary	8	6		
Occupation of respondent	Farmer	8	9	3	P=0.930 $\chi^2=0.450$
	Casual	53	69		
	Formal employment	3	5		
	Business	21	32		
Family support	Yes	69	69	1	P=0.001 $\chi^2=10.247$
	No	16	46		
Knowledgeable on consequences of low blood in pregnancy	Yes	80	72	1	P=0.000 $\chi^2=26.603$
	No	5	43		
Source of information about consequences of low blood in pregnancy	Health worker	49	47	2	P=0.023 $\chi^2=7.558$
	Media/internet	25	37		
	Friends/relatives	11	31		
If the supplement were separate or combined	Separate	6	45	1	P=0.000 $\chi^2=26.463$
	Combined	79	70		
Knew the benefit of the supplements	Yes	80	79	1	P=0.000 $\chi^2=19.381$
	No	5	36		

Discussion of results

Majority of the respondents were between 21 years and 40 years, with a few above the age of 40 years. There was a weak association between age of the respondent and adherence to iron and folate supplements (Spearman's Rho =0.192). These findings contradict those by Jikamo *et al.*, 2018 who found age to be a predictor factor to adherence to iron and folic acid supplementation. The explanation for this could be due to the fact that the latter study was done in developed nation where access to information is readily available and literacy levels are much higher. In another study by Bekere *et al.*, (2015) [2] age was also predicted to be a significant factor influencing adherence to iron and folate supplements. Expectedly 84% were married and 76% had secondary level of education. There was a strong association between level

of education and adherence to iron and folate supplements (Spearman's Rho=0.313). These findings concur with other studies done in India by Agrawal *et al.*, 2015. Level of education increases awareness and understanding on the importance of macronutrients for the development of the fetus. It was expected that the more a mother was educated the more responsive they became. Bekere *et al.*, 2015 [2], reported that level of education of the mother was significantly associated with adherence to iron and folate. This was also supported by a study by Mary *et al.*, (2018) [7]. More than half of the mothers were casual workers and 69% of them received family support during pregnancy. There was a weak association between occupation of respondent and adherence to iron and folate supplements (Spearman's Rho =0.047). Kiwanuka *et al.*, 2017 [6] similarly reported

that formal employment was not associated with compliance to iron and folic acid supplementation. In contrast Nisar *et al.*, 2014^[12], reported that higher proportions of women of low income were not complying with iron and folic acid supplementation. This could be explained by the fact that low socioeconomic women tend to have low level of education and therefore could understand less the importance of iron supplementation.

The occupation of the husband or the supporting partner was also not significantly predicting adherence to iron and folate supplements $\chi^2(3, N = 200) = 3.842, p \leq 0.279$. Soraya *et al.*, 2017^[15] did not however report any correlation between spouse income and level of compliance to IFAS among the study respondents.

Among the socio-demographic factors of the respondents, family support and level of education of the mother were significantly associated with adherence to iron and folate supplements. There was a very weak association between religion and adherence to iron and folate supplements (Spearman's Rho = 0.035). Similar findings were reported by Gebre *et al.*, 2015^[3] in a study done in Ethiopia. There was a weak association between marital status and adherence to iron and folate supplements (Spearman's Rho = 0.095). These findings are centrally to others done by Martin *et al.*, 2016^[10] who found married mothers more compliant to IFAS as a result of support from their husbands.

There was a moderate association between family support and adherence to iron and folate supplements (Spearman's Rho = 0.226). Those who received family support were 0.348 more likely to adhere to iron and folate supplements than those who didn't (OR = 0.348, CI [0.18-0.673]). Family support is key and similar findings have recorded that nuclear family mothers to be less compliant compared to their married counterparts Manasa *et al.*, 2019; Rai *et al.*, 2016^[19, 13].

The mothers who had adequate knowledge on consequences of low haemoglobin levels had higher adherence levels for iron and folate supplements compared to those who lacked the knowledge. There was a strong association between knowledge on consequences of anemia in pregnancy and adherence to iron and folate supplements (Spearman's Rho = 0.365). Iuga *et al.*, 2015 recorded similar findings in their study where mothers who had more knowledge on the consequences of anemia during pregnancy were more compliant to IFAS supplements. In another study Negussie *et al.*, (2018)^[11] found that education level of the mother and knowledge on benefits of IFAS was significantly associated with adherence to the supplements.

It was also revealed that the mothers who got health education about these consequences from health workers were more adhering to the supplements than those who read on their own. There was a weak association between source of information about consequences of anemia in pregnancy and adherence to iron and folate supplements (Spearman's Rho = 0.194). Findings by Saprii *et al.*, 2015 reported contradicting findings where source of information was associated with higher compliance. The difference could be explained that their study settings involved the use of community health volunteers to link and issue IFAS supplements to pregnant women. If well utilized community health volunteers can help improve uptake of IFAS supplements.

The study found out that the mothers were issued with two formulations of the supplements; there were those who

received the supplements in separate and there were those who received the supplements in a combined form. The mothers who received a combined form of the supplements were found to adhere to use of the supplements than those who received the two supplements separately. It was also evident from the findings that the mothers who knew the benefits of adhering to the supplements were more likely to adhere to their use than the mothers who were ignorant of the benefits of the supplements. There was a strong association between perceived benefits of taking iron and folate supplement and adherence to iron and folate supplements (Spearman's Rho = 0.311). Other studies have shown a correlation between perceived benefits of IFAS and compliance in intake Klevor *et al.*, 2016^[5]; Zavaleta *et al.*, 2014^[21]. Messages should target on promoting the therapeutic values of IFAS so that the supplements are taken even in the absence of anemia during pregnancy.

Conclusion

Based on the research findings the following conclusions were made; maternal knowledge on consequences of low haemoglobin levels, source of information about the consequences and perceived benefits of taking the supplements were significant predictors of iron and folate supplement compliance. Compliance was improved when the supplements were given in combined form. Provision of health education in pregnancy especially counseling on nutritional value of supplementing iron stores in the body and how to manage side effects of iron and folate supplements were significantly associated with compliance to iron and folate supplements.

Recommendation

The County government of Machakos should develop policies and strategies to promote provision of health education to all pregnant mothers attending antenatal clinics in health facilities within the county. The nurses in various health facilities should ensure all mothers are counseled on nutritional value and benefits in pregnancy and on management of side effects of iron and folate supplements if any.

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