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RESEARCH ARTICLE

Community-based nutrition education and counselling provided during pregnancy: effects on knowledge and attitude towards iron-folic acid supplementation

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Abstract

Maternal malnutrition is pervasive throughout the world, notably in sub-Saharan Africa, including Ethiopia. This study examined the effect of community-based iron-folic acid supplementation (IFAS) nutrition education on IFAS knowledge and attitude among pregnant women in urban settings in South Ethiopia. A community-based quasi-experimental study was conducted among 198 randomly selected pregnant women attending antenatal care (ANC) (99 intervention and 99 control). We used a multistage sampling technique followed by systematic sampling to select the pregnant women. Pregnant women who participated in the intervention arm received six nutrition education sessions and counselling using a health belief model (HBM), while the control group received only routine ANC services. Baseline and endline data were collected during the ANC and compared. The data was analysed using statistical package for social sciences. Analyses of the effect of the intervention were done using difference-in-difference and generalised estimation equation to allow correlation of repeated observations over time. The results indicated a significant effect of intervention on maternal knowledge towards IFAS; with intervention, group levels increased by 35 percentage points ($P < 0.001$). The odds of being knowledgeable at the endpoint in the intervention group were 2.6 times higher than baseline (OR = 2.67, 95% CI 1.88–3.80). There was a significant ($P = 0.001$) change in proportion with a favourable attitude towards IFAS between the two time points. The community-based nutrition education intervention approach has significantly improved maternal knowledge and a favourable attitude towards IFAS among pregnant women. The HBM is effective in improving knowledge and attitude among pregnant women.

Key words: **Adherence: Attitude: IFA supplementation: Knowledge: Nutrition education**

Introduction

Anaemia affects nearly one-third of the world's population, contributing to the high burden of morbidity and mortality worldwide.[1] Women in low- and middle-income countries are the most affected. Anaemia is associated with adverse reproductive outcomes such as preterm birth, low birthweight, impaired child development, and low productivity in adults.[2] Anaemia before, during, and after pregnancy can thus affect the health and well-being of the women, but also of the offspring.[3,4] Despite significant achievements in maternal health-related programmes over the past decade and the attention given to anaemia prevention and treatment as illustrated by its inclusion in the World Health Assembly targets, the prevalence of anaemia has shown little to no reductions over the past decade.[5]

More than 32 million women in pregnancies are anaemic globally. Nearly half (46.3%) of these are in Africa.[6] One of the highest prevalences of anaemia in the world is recorded for the sub-Saharan Africa region, where approximately 57% of pregnant women are anaemic. Likewise, Ethiopia has one of the highest rates of micronutrient deficiencies, including anaemia, making it a serious public health concern.[7,8] Poor

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maternal nutrition prior to and throughout pregnancy is also significantly connected to an increased risk of maternal anaemia, mortality, and unfavourable birth outcomes such as low birthweight and preterm birth, although the mechanism for this link is complex.[9] Despite substantial achievements and hints of progress over the last decade, maternal undernutrition continues to be a major public health concern in Ethiopia.[10,11] In Ethiopia, 41% of pregnant women were anaemic, of which 20% were moderately anaemic, 18% were mildly anaemic and 3% were severely anaemic in 2016.[12] Maternal and child mortality rates also remain high, with 412 maternal deaths per 100,000 live births and 67 child deaths per 1,000 live births.[10] This could be associated with the high prevalence of undernutrition among pregnant women in Ethiopia, ranging from 14.4% to 47.9%.[13,14]

Iron-folic acid supplementation (IFAS) is the main intervention strategy targeting the reduction of anaemia in pregnant women. In Ethiopia, IFAS, as part of routine antenatal care (ANC) services, is the main strategy for preventing maternal mortality due to anaemia.[15] However, the compliance rate remains low and not at the required level to prevent anaemia during pregnancy. For example, according to the Ethiopia Demographic and Health Survey, <11% took an IFAS to the recommended period (≥90); about 12% took 60–89 pills; more than one-third (35.7%) took <60 pills, and around 42.2% did not take any iron tablets during their most recent pregnancy.[16] Several factors contribute to the non-adherence of recommended IFAS during pregnancy, including socio-economic factors, poor knowledge, attitude, ANC utilisation, and perceived side effects of iron-folic acid (IFA) pills.[17–19] This calls for addressing the factors responsible for low adherence to IFAS and developing locally appropriate mechanisms to mitigate them to increase IFAS coverage.

Pregnant women should receive nutrition education and counselling at every ANC visit. In Ethiopia, 62% of pregnant women received at least one ANC visit for their most recent birth, and 66% of these women reported receiving nutritional education and counselling, although the quality and extent of the counselling were unknown.[10] Nutrition education is critical in nutrition behaviour change attempts because it improves participants' nutrition and food literacy. Food literacy encompasses both nutrition literacy and the capacity to apply that knowledge to make sound decisions, whereas nutritional literacy is the set of skills required to comprehend and analyse information about food and its nutrients.[20] In addition, nutrition education interventions that enhance maternal nutritional status are among the most successful mother–and-child health promotion techniques.[21]

Studies show that the use of nutrition education interventions has improved knowledge, awareness, and adherence to micronutrient supplementation, including IFAS.[22,23] For effective intervention, it needs to be locally feasible, simple, and practically implemented through the existing healthcare system. Previous observational studies on maternal nutritional status have been undertaken in Ethiopia, and nutrition interventions are advocated,[24,25] such as counselling on the consumption of nutrient-rich, locally available foods, food and nutrient supplementation (for example, IFA, calcium, and multiple micronutrients), as well as on weight to ensure a healthy weight gain. However, evidence on the effect of HBM-based nutrition education (IFAS) during pregnancy is lacking in the context of low-income countries, including Ethiopia. Therefore, we aimed to assess the effect of nutrition education and counselling on the knowledge and attitude towards IFAS of pregnant women in rural settings in southern Ethiopia.

Methods and materials

Study design, study setting, and participants

A pre-posttest quasi-experimental design consisting of an intervention and control group was employed. Both the control and intervention groups completed baseline and endline testing; the intervention group was the only group that received nutrition education and home-to-home counselling. The study was conducted in Butajira town administration, southern Ethiopia; 135 km from Addis Ababa. The main means of livelihood in the district is rain-fed agriculture, which is characterised by the production of subsistence crops. The study population included all first- and early-second-trimester pregnant women attending ANC in Butajira town. The study was conducted from January to April 2021. The study included pregnant women before 16 weeks of gestation who were permanent residents of the study area. Pregnant women with diabetes mellitus or hypertension (HTN) were not included in the study.

Sample size estimation and techniques

The sample size was determined by using the formula for comparison of two population proportions for the intervention and control groups.

$$n = \frac{(Z_1 + Z_2)^2 \times 2p(1-p)}{(P_2 - P_1)^2}$$

The following assumptions were considered when estimating the required minimum sample sizes: the expected proportion of pregnant women with good knowledge (P1) was 0.77 and P2 was 0.52.[26] We wanted to detect an absolute increase of 25% in the intervention arm at the 5% significance level and 80% power. The calculated sample size was multiplied by 1.5 to adjust for the design effect and a 10% loss to follow-up; the final sample size became 198 (99 pregnant women allocated for each group). Data on births compiled by urban health extension workers was used to estimate the number of pregnant women in each *kebeles*. Butajira town was chosen at random. Butajira town has five *kebeles* (01, 02, 04, and 05). Two *kebeles* (03 and 05) were randomly selected and allocated to the intervention and control groups. Pregnant women residing in 05 received the intervention, whereas those residing in 03 did not receive the nutrition education interventions. Using a probability proportional to size allocation, the sample size was assigned to each cluster. A systematic sampling technique was used to select pregnant women. In the event that a woman missed her interview due to being out of home, the next eligible pregnant woman in the serial number was contacted. The pregnant

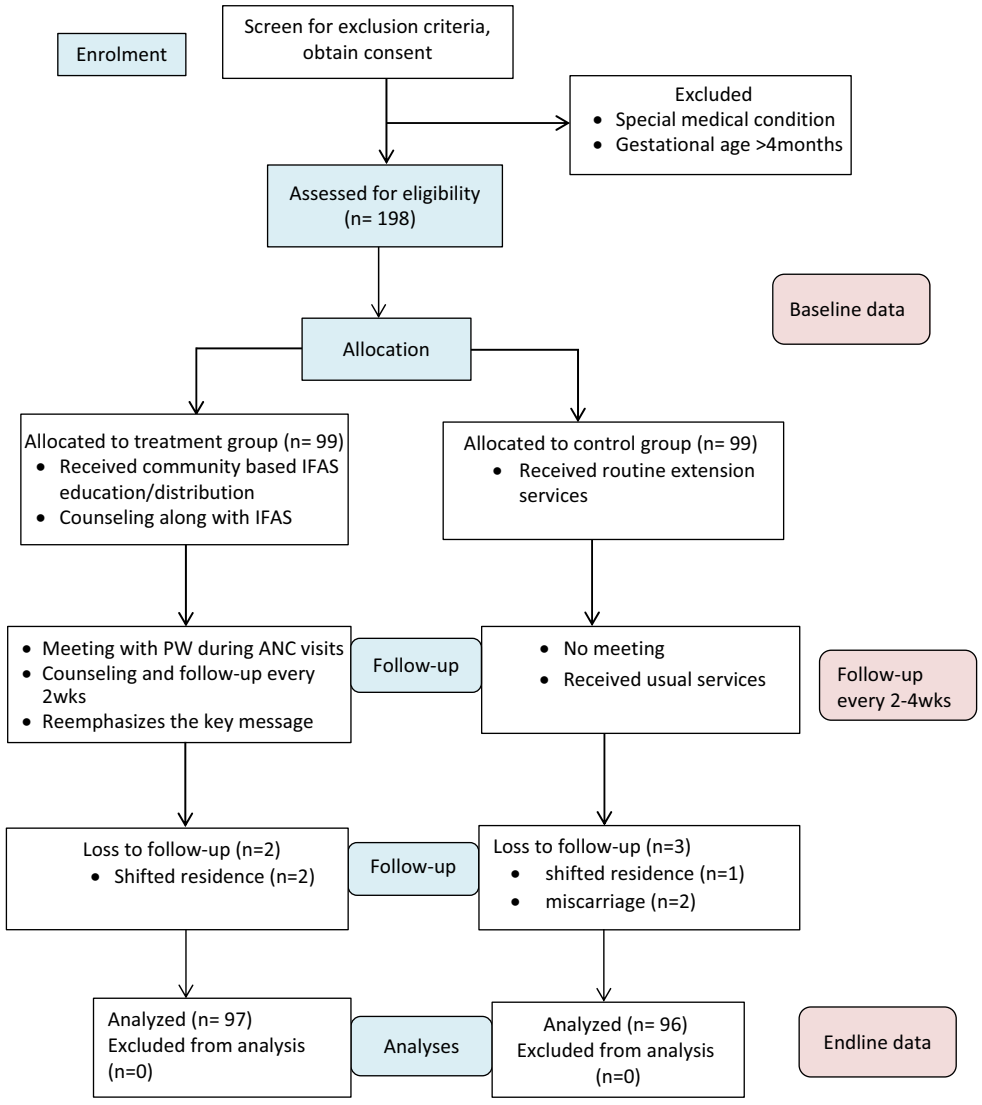

Fig. 1. Flow diagram showing the effect of community-based nutrition education and counselling targeting knowledge and attitude towards IFAS among pregnant women. IFAS, iron-folic acid supplementation.

woman, who had been absent from the interview, was contacted the next day. The gestational age was calculated by asking about the beginning day of the last menstrual period, and the pregnancy was confirmed using a urine human chorionic gonadotropin test (Fig. 1).

The intervention

Pregnant women in the intervention group were organised into three groups of 33 pairs of those living near each other; education sessions were located near participants' homes and held on days when participants had some free time. Nutrition education was delivered in Amharic. An organised work schedule, counselling cards, and nutrition education were provided to the intervention group. The core messages for the lessons were generated utilising the health belief model (HBM).[27,28] It was modified in the recommendation to the Ministry of Health, Ethiopia.[29]

For the intervention and control groups, baseline and endline assessments were collected. Following the gathering of baseline data, intervention groups were placed in groups at a nearby village and received nutrition education regularly, once every two weeks, for a period of three months (six sessions) for 30–45 min per session. Four nurses with Bachelor of Science (BSc) degrees delivered nutrition education, while two Master of Science (MSc) specialists supervised the nutrition education sessions. The core contents of the session were: increasing knowledge about iron-rich food sources, IFAS (how to take the IFAS, when to take it and how to absorb it more, foods rich in iron and folic acid, common side effects and their management; and enhancers/inhibitors of iron/folic absorption), iodised salt, meal frequency, and portion size with increasing gestational age; food groups; taking day rest; reducing heavy workloads; enhancers and inhibitors of iron absorption; increasing utilisation of health services; and interrupting the intergenerational life cycle of malnutrition; increasing pregnant women's perceptions of undernutrition and factors leading to it; poor eating practices causing inadequate dietary intake and disease.

Nutrition education sessions included presentations, discussions, demonstrations, and picture-based exercises. Key messages, realistic activities, and the GALIDRAA (greet, ask, listen, identify, discuss, recommend, agree, and make follow-up appointments) processes were all identified by the trainers as crucial counselling abilities. After the pregnant women were enrolled, reasonable attempts were made to encourage their retention and full follow-up for the duration of the trial by providing them with incentives to reduce missing data. Periodic conversations about compliance with the intervention during routine meetings and home visits by trainers served to retain interest in the study. Moreover, home visits were planned to lessen the strain of follow-up visits among pregnant women.

Outcomes

The primary outcome of this study was the knowledge and attitude towards IFAS supplementation.

Data collection tools and procedures

A pretested interviewer-administered structured questionnaire, including 9 variables on socio-demographic data (age, education level of women, occupation of women, marital status, educational level of husband, occupation of husband, religion, family size and ethnicity), 19 variables on socio-economic data (source of drinking water, kind of toilet facility, household facility (radio, television, mobile phone, table etc.), type of fuel, materials of floor, materials of exterior walls, materials of roof, number of rooms, ownership of agricultural land and its size, ownership of livestock and number, bank or microfinance saving etc.), 9 on obstetric and health-related variables, 9 on IFA supplementation knowledge, 12 Likert scale questions on attitudes, and 3 on reasons for missing the dose of IFAS, was developed and used for data collection. Baseline data on IFA knowledge, attitude, and compliance at the IFA level were collected. To address any potential bias in data collection, training of five research assistants on research ethics and protocol as well as quality data was done at an adjacent *kebele* where the research questionnaires were pretested.

To assess the level of knowledge about IFAS during pregnancy, respondents were asked nine questions: whether they had heard of IFAS or not, the benefits of IFAS; the frequency of use of IFAS; the duration of taking IFAS; the side effects; the management of side effects; the effect of iron or folate deficiency; the signs and symptoms of anaemia; and food sources for iron during pregnancy. A correct answer for each item was scored as '1', and an incorrect answer was scored as '0'. A summation of all the scores for each participant was done, then converted into a percent score. Based on the percent, those who scored above the average value (50%) were considered to have good knowledge, and those who scored below the average value were considered to be less knowledgeable.[30] Attitude towards IFA supplementation by pregnant women was assessed using 12 Likert scale items. A correct answer for each item was recorded as 5, and a negative attitude was scored as '1'. The participants were considered to have a positive attitude if they scored 70% or above and were otherwise unfavourable or negative.[30,31] Though data on intake and compliance with IFAS were collected, the present study mainly focused on knowledge and attitudes towards IFAS.

To check the reliability of the questionnaires used in this study, a test-retest method was used in pretesting, whereby a repeat pretest was conducted after one week, and Cohen's kappa statistic was used to assess the level of agreement of the results from the two pretests. All the questions repeated resulted in a kappa value >0.7; hence, all the questions were retained. To ensure the validity of the questionnaire, it was shared and discussed with experts from the regional health bureau and the field supervisors. The feedback obtained from the experts and the pretesting results were used to refine the questionnaire and improve its quality.

Data management and analysis

The data were entered, cleaned, coded, and analysed using Statistical Package for Social Science version 22.0 software. The Kolmogorov–Smirnov test was used to check the normality of the distribution. The characteristics of respondents were also described in both the intervention and control groups. The wealth index was computed using principal component analysis as a composite indicator of living standards based on ownership of selected household assets, size of agricultural land, number of livestock, materials used for housing construction, ownership of improved water and sanitation facilities, and household possessions.[10] The wealth index values were calculated by summing up the scores of sixteen components. Ultimately, three categories (low, medium, and high) were generated by splitting the wealth index values into three equal classes.

Homogeneity of study groups at baseline was determined by comparing categorical variables of both intervention and control groups using the chi-square test. The analysis of the effect of the intervention was done using a difference-in-difference (DID) (percentage point change) to compare outcomes between intervention and control groups before (baseline) and after (endline) intervention. The intervention effect was measured by the odds ratio and 95% confidence level of the interaction term between study groups (intervention and control) and period of study (baseline and end line) in the multivariate logistic regression model. A $P < 0.05$ was considered statistically significant. Since the same respondents who participated in the baseline were also those who participated in the endline assessment, the analysis considered using a paired analysis with repeated measures instead of treating the respondents in the baseline and endline as independent groups. Therefore, the generalised estimation equation (GEE) was applied in addition to allow correlations of these repeated observations over time since data are collected on the same participants across successive points in time.[32,33]

The ethical statement

Expedited ethical clearance was obtained from Hawassa University Institutional Review Board (Ref. No. IRB/040/13). The purpose of the study was explained in a formal letter to the district administration. Prior to enrolment in the study, informed consent was obtained from each mother.

Table 1. Baseline characteristics of pregnant women in the intervention and control groups

Variables	IG (n=99)		CG (n=99)		
Age in year	n	%	n	%	P value[a]
15–24	50	50.5	46	46.5	0.774
25–34	46	46.5	45	45.5	
35–44	3	3.0	8	7.9	
Religion					
Orthodox	28	28.3	27	27.3	0.682
Muslim	59	59.6	53	53.5	
Protestant	12	12.1	19	19.2	
Mother education					
No formal education	49	49.5	62	62.6	0.570
Primary education	35	35.4	28	28.3	
Secondary and above	15	15.2	9	9.1	
Occupation					
Housewife	68	68.7	64	64.6	0.981
Merchant	8	8.1	12	12.1	
Government employee	6	6.1	8	8.1	
Self-employee	12	12.1	11	11.1	
Husband occupation					
Merchant	35	35.4	33	33.3	0.984
Government employee	23	23.2	19	19.2	
Self-employee	14	14.1	24	24.3	
Farmer	18	18.2	13	13.1	
Daily labourer	9	9.1	10	10.1	
Family size					
<4	66	66.7	72	72.7	0.151
≥4	33	33.3	27	29.3	
House hold wealth index					
High	26	26.3	30	30.3	0.749
Medium	40	40.4	38	38.4	
Low	33	33.3	31	31.3	
Gravidity					
Primi-gravida	34	34.3	27	27.3	0.280
Multigravida	65	65.7	72	72.7	
Parity					
1	27	42.2	28	38.9	0.569
2–4	30	46.9	38	52.8	
>4	7	10.9	6	8.3	

[a] X^2 test.

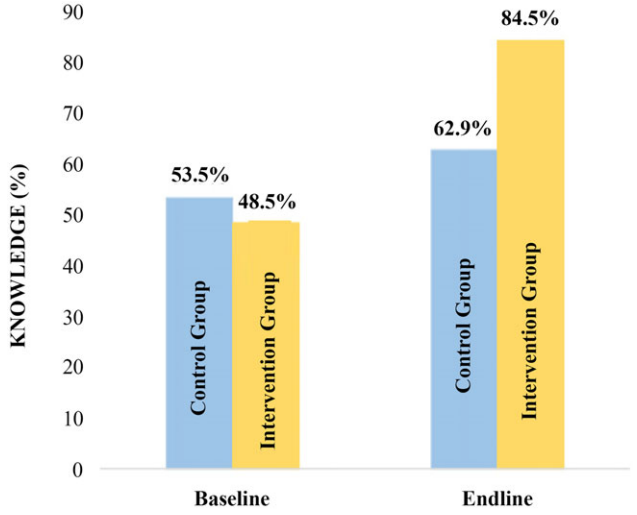

Fig. 2. Maternal knowledge towards IFAS during study period for both the control and intervention groups. IFAS, iron-folic acid supplementation.

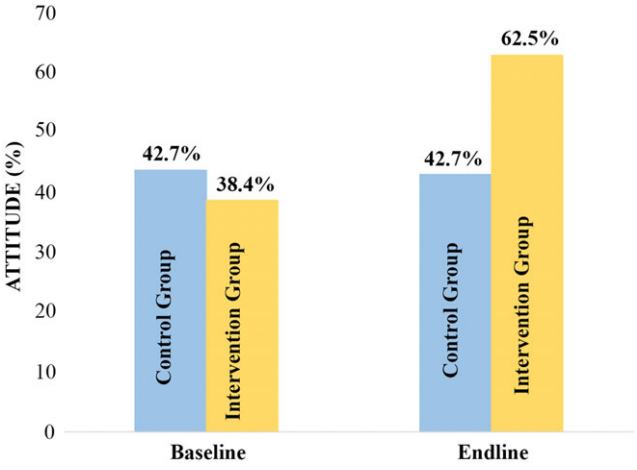

Fig. 3. Maternal attitude towards IFAS during study period for both the control and intervention groups. IFAS, iron-folic acid supplementation.

Results

In this study, 99 pregnant women received nutrition education and counselling as well as IFAS, while 99 pregnant women received usual ANC services. Five pregnant women left the study. Among them, two participants could not be followed up; one shifted residence, and two had abortions (Fig. 1).

There was no significant difference between the intervention and control groups regarding age, parity, educational level, ethnicity, religion, occupation, family size, gravidity, parity, and socio-economic level (Table 1). Both knowledge and attitude scores were lower in the intervention group at baseline compared to the control. However, there were no statistically significant differences between the two groups in terms of knowledge and attitudes toward IFAS (Figs. 2 and 3).

Effect of nutritional education intervention on maternal knowledge of IFAS

Figure 2 shows a comparison between baseline and endline levels of maternal knowledge towards IFAS for both control and intervention groups. The improvement was 35 percentage points in the intervention group (from 48.5% to 84.5%) compared to 7.3 percentage points (from 53.5% to 62.9%) in the control group. The intervention had a net effect of a 27.7 percentage point (35–7.3) improvement in IFAS knowledge level. Therefore, it did yield a statistically significant difference (95% CI: 0.001, 0.015) since the DID between the two groups was <0.001

Factors associated with maternal knowledge on IFAS

GEE results to assess the effect of the intervention and other potential factors on maternal IFAS knowledge are shown in Table 2. There was a highly significant ($P < 0.001$) change in levels of IFAS knowledge between the two time points: the odds of being knowledgeable at endline in the intervention group were 2.6 times that at baseline (OR = 2.67, 95% CI 1.88–3.80), adjusting for other socio-demographic factors. Household economic status significantly influenced maternal knowledge; households with low income ($P = 0.006$) were less likely to be knowledgeable than households with medium income ($P = 0.002$).

Table 2. Factors associated with pregnant women knowledge on iron-folic acid supplementation

Variables	OR (95% CI)	P value
Intervention Vs. control	1.429 (0.905, 2.257)	0.125
End line Vs. Baseline	2.674 (1.882, 3.799)	<0.001[b]
Intervention (group, time)[c]	4.745 (2.410, 9.341)	<0.001[b]
Age		
15–24	1	
25–34	1.029 (0.594, 1.785)	0.918
35–44	1.471 (0.517, 4.188)	0.469
Woman education		
No formal education	1	
Primary education	1.288 (0.722, 2.301)	0.392
Secondary & above	0.705 (0.261,1.907)	0.491
Woman occupation		
Housewife	0.868 (0.353, 2.134)	0.758
Merchant	1.352 (0.328, 5.577)	0.677
Government employee	0.724 (0.156, 3.353)	0.679
Self-employee	0.522 (0.168, 1.617)	0.260
Daily labourer	1	
Family size		
<4	1	
≥4	0.835 (0.456,1.530)	0.560
Household wealth index		
Low	0.444 (0.250, 0.788)	0.006[a]
Medium	2.722 (1.442, 5.137)	0.002[a]
High	1	
Gravidity		
Primi-gravida	1	
Multigravida	1.248 (0.692, 2.249)	0.462
ANC visit		
1st visits	1	
2nd visits	0.905 (0.538, 1.522)	0.707

[a]Statistically significant at $P < 0.05$.
[b]Statistically significant at $P < 0.001$.
[c]DID.

Effect of nutritional education intervention on maternal attitudes towards IFAS

Figure 3 shows comparison of maternal attitude towards IFAS between baseline and endline by study group. There was an increase in the proportion of pregnant women who had a favourable attitude towards IFAS during the study period, across the study groups. The increase was higher at 25.8 percentage points (from 37.1% to 62.9%) in the intervention group compared to 0 percentage points (from 42.7% to 42.7%) in the control group. The intervention had a net of 25.8 percentage points (25.8–0.0) of improvement in positive attitude towards IFA supplementation.

Factors associated with favourable maternal attitudes towards IFAS

GEE results to assess the effect of the nutrition education intervention and other potential factors on maternal attitudes towards IFAS are presented in Table 3. There was a significant ($P < 0.001$) change in proportion of those who had a favourable attitude towards IFAS between the two time points: the odds of having a favourable attitude towards IFAS at endline were 1.6 times that of baseline (OR = 1.62: 95% CI 1.08, 2.42), adjusting for other socio-demographic factors. The number of pregnancies significantly influenced maternal attitude; multiparous women were more likely to acquire a favourable attitude.

Table 3. Factors associated with pregnant women attitude on iron-folic acid supplementation

Variables	OR (95% CI)	P value
Intervention Vs. Control	1.349 (0.912, 1.995)	0.134
End line Vs. Baseline	1.619 (1.082, 2.423)	0.019[a]
Interaction (Group, time)[b]	2.207 (1.245, 3.911)	0.007[a]
Maternal knowledge on IFAS		
Good knowledge	1.30 (0.63, 1.84)	0.11
Poor knowledge	1	
Age		
15–24	1	
25–34	1.122 (0.695, 1.811)	0.638
35–44	1.757 (0.544, 5.678)	0.346
Woman education		
No formal education	1	
Primary education	1.136 (0.548,2.356)	0.732
Secondary & above	1.123 (0.724, 1.743)	0.605
Husband education		
No formal education	1	
Primary education	0.831 (0.511, 1.351)	0.455
Secondary & above	0.793 (0.451, 1.396)	0.422
Woman occupation		
Housewife	0.304 (0.070, 1.330)	0.114
Merchant	0.236 (0.047, 1.176)	0.078
Government employee	0.349 (0.057, 2.127)	0.253
Self-employee	0.389 (0.084, 1.805)	0.228
Daily labourer	1	
Family size		
<4	1	
≥4	1.143 (0.662, 1.974)	0.632
Household wealth index		
Low	0.631 (0.371, 1.075)	0.090
Medium	1.311 (0.793, 2.166)	0.291
High	1	
ANC Visit		
1st visits	1	
2nd visits	1.373 (0.898, 2.100)	0.143
Gravidity		
Primi-gravida	1	
Multigravida	1.737 (1.097, 2.751)	0.019[a]

[a]Statistically significant at $P < 0.05$.
[b]DID.

Discussion

The main aim of the present study was to assess the effect of the community-based nutrition education intervention and counselling based on HBM among pregnant women on knowledge and attitude towards IFAS and to reduce negative impacts on women and neonates in Butajira town, southern Ethiopia. Both knowledge and attitude scores were lower in the intervention group at baseline compared to the control. This may be due to the sensitisation variations that occurred during the initial exposure to the questionnaire and the recall ability differences between the intervention and control groups in answering the baseline questions. The key findings of the present study were, nutrition education and counselling using HBM improved maternal knowledge and positive attitude towards IFAS among pregnant women. At the end of the study, the majority of pregnant women in the intervention group had heard of IFAS, compared with less than half of them who had not heard about IFAS at the baseline of the study. In addition, there was an improvement in the proportion of pregnant women who scored high IFAS knowledge in the intervention group. This shows that

it is possible to improve the knowledge of pregnant women of IFAS and related consequences during pregnancy through HBM-based nutrition education compared to routine health education through health extension workers.

Several previous studies have shown that a greater proportion of pregnant women were reached and counselled as well as attained more positive behavioural change of IFAS as compared to routine health services alone.[30,34,35] Even though the study settings were different from the present study, our finding is in line with the previous studies.[36–38] The possible explanation might be that nutrition education leads to favourable attitudes and, thus, changes in nutrition behaviour.

Pregnant women who were from low-socio-economic households were less likely to be knowledgeable than upper-socio-economic women. This may be explained by the pregnant women with high income are more likely to have attained high educational level and hold formal employment, or own good income generating activities.[39–41] Formal education creates opportunities for women to have better knowledge and access to information about personal healthcare including IFAS and benefits of supplements, and pregnancy related health specifically.[22,42] The present findings are consistent with the studies conducted in Ethiopia and Kenya where there was a positive association between household socio-economic status and nutritional knowledge of pregnant women.[30,43] This calls for more opportunities to empower women since economically empowered women use increased number of IFA supplementation than the poorest women as evidenced in studies conducted in Indonesia[44] Tanzania[45] and Ethiopia.[16]

Effective community-based nutrition education to affect behaviour change not only should provide knowledge, but also should change beliefs in order to bring about behaviour change. The attitude and perception of pregnant women are based on the information they have, which in turn dictates their practices. We had assessed the attitudes of mothers towards IFAS, and the result revealed a significant change in the attitude score regarding IFA supplementation in the intervention group over the comparison group. There was an overall positive change in the beliefs, opinions, and perceptions of pregnant women towards IFAS during this study. These findings are consistent with nutrition education intervention studies done among women that demonstrated a significant improvement in overall positive health beliefs and practices in relation to IFAS.[25,36,37] The result of the study found that there was no association between increased maternal knowledge and attitude towards IFAS. Several factors may explain this apparent incongruence. These findings can be explained by the fact that by giving adequate information about the benefits of IFAs and the consequences of not taking them during pregnancy, there is a high possibility that pregnant women can develop a positive attitude and perception towards IFAS. The significant improvement in knowledge and positive attitude towards IFAS among the intervention group may be related to the repetition of the key messages of nutrition education during the study period with individual counselling[46] as repetition of messages remained longer in memory according to the information process theory.[47] A previous study found a significant favourable effect of using HBM constructs during prenatal counselling to encourage healthy behaviour.[48] This could be because women who attend nutrition education using the HBM believe that the repercussions of malnutrition are severe, and they also believe that they are perceived to suffer the consequences of malnutrition. In addition, the pregnant women perceived that the benefits of consuming IFA outweighed the hurdles to obtaining it and its side effects. Their perspective can then influence their attitude and actions.

The present study has a number of strengths and limitations that need to be considered when interpreting the findings. First, the study participants were only followed during their pregnancy period, giving a limited time for follow-up. Second, the intervention was conducted without randomisation. However, the effect of non-randomisation was minimised by the use of a control group. Another limitation is that the findings may be prone to recall bias and subjectivity because the study mainly relied on verbal reports from the interviewees. Lastly, the findings may not be extrapolated to other setting in the country with different socio-demographic characteristics since the study was limited to one town.

Notwithstanding the above limitations, the present study has a significant practical implication for improving maternal knowledge and attitude towards IFAS, which will avert the risk of developing anaemia during pregnancy and related birth defects in order to achieve the Sustainable Development Goal (SDG-2). The findings indicated that tailoring current nutrition policies, strategies, and initiatives is justified to integrate the health behaviour model into nutrition education within Ethiopia's current health system. Moreover, this approach has a significant positive impact on improving pregnant women's attitudes towards IFAS, which will in turn increase IFAS intake and decrease maternal and child mortality rates in Ethiopia. Furthermore, beyond the health extension workers (HEWs), there is a need to explore and strengthen other strategies for creating awareness and educating pregnant women on IFAS benefits and consequences that can complement HEWs' activities, as HEWs have wide-ranging responsibilities for community-based health promotion. Their workload is diverse, and they spend time on activities relating to family health, disease prevention and control, hygiene, and sanitation, as well as other community-based activities.[49] Community health leaders (CHLs) provide such an opportunity since they are also able to closely follow-up pregnant women and provide health and nutrition education at the community level, as revealed in this and elsewhere.[30,44] However, CHLs' effectiveness is exceedingly dependent on proper training and continuous supportive supervision. If properly trained and facilitated, CHLs could play a vital role in increasing the knowledge and attitude of pregnant women and increasing maternal health service utilisation.[30,50] Although large-scale community-based studies with a larger sample size are needed to assess the cost-effectiveness of CHL-based interventions, training CHLs in IFAS, routine monitoring, and integrating their operation in a wider framework that promotes maternal health are critical.

Conclusion and implications

The community-based nutrition education intervention approach has significantly improved maternal knowledge and a favourable attitude towards IFAS among pregnant women. The HBM is effective in improving knowledge and attitude among pregnant women. It is necessary to integrate theory-based nutrition education interventions with the economic empowerment of pregnant women. Moreover, existing health facilities in Ethiopia can provide a link between community and health facilities, which is a feasible opportunity for providing information and raising women's awareness of IFAS benefits during pregnancy, as well as distributing IFAS in order to increase IFAS intake. We strongly recommend that HBM-based nutrition interventions be widely implemented because of the well-structured primary healthcare systems in Ethiopia. To realise this approach, health workers need to be properly trained and closely supervised.

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Authors' contributions

AA and MR conceptualised and designed the study and conducted statistical analysis, MR supervised the field data collection, and AA and MR did the interpretation and wrote the manuscript. AA and MR reviewed manuscript drafts. Both authors read and approved the final version of the manuscript.

Competing interest

There are no competing interests for any author.

Data sharing

Data are available upon reasonable request from the corresponding author.

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