RESEARCH ARTICLE

Effect of guided counseling on dietary practices of pregnant women in West Gojjam Zone, Ethiopia

Yeshalem Mulugeta Demilew[1]*, **Getu Degu Alene**[1], **Tefera Belachew**[2]

1 School of Public Health, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar, Ethiopia, **2** Department of Nutrition and Dietetics, Faculty of Public Health, Jimma University, Jimma, Ethiopia

* yeshalem_mulugeta@yahoo.com

Abstract

Background

In Ethiopia, although nutrition education has been given during pregnancy, most women have inadequate nutrient intakes. As a result, the prevalence of malnutrition is high during pregnancy. In this study, we set out to evaluate the effect of guided counseling based on the health belief model and the theory of planned behavior on the dietary practices of pregnant women.

Methods

A two-arm parallel cluster randomized controlled community trial was carried out among pregnant women in West, Gojjam Zone, Ethiopia from May 1, 2018, to April 30, 2019. A total of 346 and 348 pregnant women were recruited from the intervention and control clusters, respectively. Of which endline data were collected from 313 and 332 pregnant women in the intervention and control groups, respectively. Each woman in the intervention group attended four counseling sessions. Women in the control group attended the routine nutrition education given by the health care system. Data were collected using a structured questionnaire. McNemar test and Generalized Estimating Equations were used to evaluate the intervention effect.

Results

The average difference of appropriate dietary practice between the two groups was 30.7%. After controlling for the possible confounders, women in the intervention group had 7.2 times [AOR = 7.187, 95% CI: (4.49, 11.49)] higher odds of having appropriate dietary practices compared with the control group. Dietary diversity and meal frequency of counseled women were 7 [AOR = 6.994, 95% CI: (4.59, 10.66)] and 8 [AOR = 8.146, 95% CI: (5.377, 12.341)] times higher than dietary diversity and meal frequency of women in the control group, respectively.

Conclusion

Counseling based on the health belief model and the theory of planned behavior is an effective approach in increasing the proportion of women who had appropriate dietary practices. Thus, these findings suggest the need for employing trimester based counseling using the HBM and the TPB to improve the dietary practices of pregnant women.

Trial registration

The trial was registered in Clinical Trials.gov (NCT03627156).

Introduction

Poor maternal diet during pregnancy determines fetal growth, leading to low birth weight, which has negative repercussions on child survival and economic productivity later in life [1]. Despite its serious consequences, in Ethiopia, 13.5% of newborn babies weighed less than 2500g at birth. Moreover, the magnitude of maternal and child mortality is high in the country [2].

These maternal and childhood problems are hypothesized to be due to inadequate nutrient intake during pregnancy [3–6]. As reported by different scholars, diets of Ethiopian pregnant women were inadequate in quantity and poor in quality with low energy and nutrient content [3–5].

The primary determinant for poor nutrient intake is insufficient knowledge of pregnant woman on diet during pregnancy [3, 4, 7]. Since, improving maternal diet is the most appealing and sustainable strategy for promoting maternal and child health [8], the Ethiopian government recommends nutrition counseling during pregnancy [9].

Health professionals and health extension workers give nutrition education to pregnant women during antenatal care visits and in the community. They have been educating pregnant women to take one additional meal from foods available at home compared to their meals before pregnancy. Despite this, the existing nutrition education which is given by the health system isn't successful in bringing behavior change [10].

This lack of success in the existing nutrition education may be due to poor counseling practices of health professionals and health extension workers. Because, the routine practice is advising pregnant women to eat one additional meal from foods available at home compared to their meals before pregnancy [11, 12].

This type of education is unclear to the women since what is available at home is not specific and varies across households. Moreover, taking one additional meal may not be enough for all pregnant women as nutrient requirements vary for different women and the trimester of pregnancy. Furthermore, dietary habits are also different from woman to woman. Therefore, modifying the method of nutrition education seems to have a paramount benefits to improve maternal nutrition [13].

Guided counseling is a type of behavior change intervention using professional guidance on change of behavior based on models and theories [14]. Health promotions that are supported by behavioral models and theories bring positive results on improving the dietary practices of pregnant women [15–18]. Evidence suggests the need for using multiple theories to change unhealthy behavior as the causes are multifactorial in nature [15, 19]. In this study,

pregnant women were counseled based on the health belief model (HBM) and the theory of planned behavior (TPB) [13, 20].

The HBM is an interpersonal model of health applied to encourage positive behavior [21]. It explains the reason why some people take measures to promote health, while others don't. Its structure consists of perceived susceptibility, severity, benefits, and barriers to a specific behavior. Cues to action and self-efficacy are also components of the HBM [13, 16, 20, 21].

The first element of the TPB is an intention that directly affects a given behavior. Other elements of this theory are attitude, subjective norms, and behavioral control. These constructs affect the intention of women to words having a healthy diet [22, 23]. Hence, this intervention was designed to evaluate the effect of guided counseling based on the HBM and the TPB on improving the dietary practices of pregnant women.

Methods

Study setting, design, and participants

This study was carried out in West Gojjam Zone, Amhara Region, Ethiopia. The number of estimated pregnant women was 61,072. Pregnant women before 16 weeks of gestation who had planned to stay in the study area until delivery were enrolled in this trial. Women with hypertension or diabetes mellitus were excluded from the study. The full description of the study area and participants is described elsewhere [12].

A two-arm parallel cluster randomized controlled community trial was conducted from May 1, 2018, to April 30, 2019. The study was carried out in accordance with the Declaration of Helsinki and the requirement of good clinical practice [24].

The sample size was determined by the G power 3.1.9.2 program with a power level of 85% for Fisher's exact test with a 5% alpha. The expected proportion of pregnant women with appropriate dietary practice (P1) was 0.393 [4]; while P2 was 0.547 [10, 25], assuming a difference 15.4% between p1 and P2. Since cluster randomization was used, the calculated sample size was multiplied by 2 to adjust the design effect and a 10% loss to follow up was added. The final sample sizes were **356** in the intervention and control groups each.

Investigators developed a CONSORT flow diagram and CONSORT checklist of the trial in accordance with the Consolidated Standards of Reporting Trials Statement (additional file1) [26]. The CONSORT flow diagram is described elsewhere [27]. The trial was registered in the Clinical Trials.gov (NCT03627156). The trial was registered after starting recruitment of the study participants due to network problems to collect data in non-fasting and non-feasting days because in Ethiopia there is fasting after Mid-August. The Institutional Review Board of Bahir Dar University gave an approval letter to conduct this trial (protocol number: 92/18-04). Before the implementation of the trial, each woman provided written informed consent (fingerprint for women who couldn't read and write).

Recruitment, randomization and intervention allocation

A randomized cluster sampling technique was used in this study. "*Kebele*" (the smallest administrative unit) was taken as a cluster. Cluster randomization was used to avoid counseling message contamination since women in the same cluster had a high probability of meeting and discussing nutrition messages. Moreover, to reduce the likelihood of communicating women in the intervention and control clusters, there were non-selected clusters (buffer zone) between the two groups [28]. From the seven woredas, three (*Bahir Dar Zuria*, *South Achefer*, and *Burie Zuria Woredas*) were selected by a simple random sampling (SRS) method.

Clusters (Kebele) were also selected using the SRS method. The numbers of selected clusters were ten in *Bahir Dar Zuria Woreda* and six clusters each in *South Achefer* and *Burie Zuria*
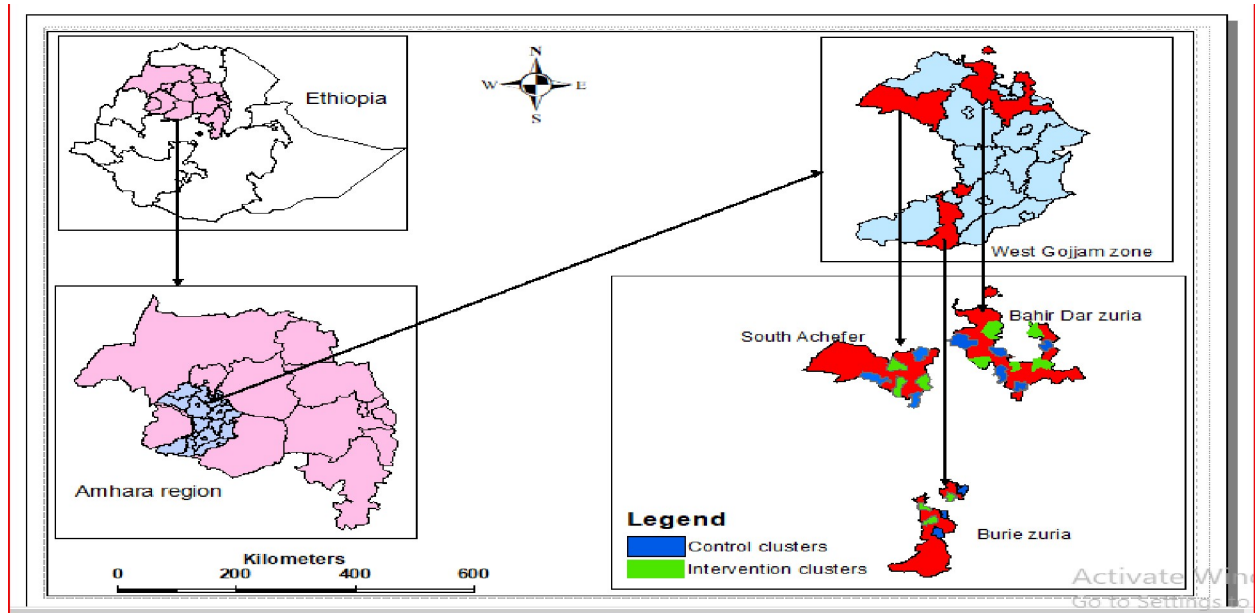
Fig 1. Study clusters in the study area.

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Woredas. Lastly, an equal number of clusters in each woreda were randomly allocated as an intervention clusters and control clusters using the SRS (lottery) method (Fig 1). Eligible pregnant women were screened through the house to house survey using the first date of the last menstrual period and a pregnancy test. All pregnant women in selected clusters who fulfill the inclusion criteria were enrolled in the trial.

Intervention

The intervention package for this study was community-based guided counseling using the HBM and the TPB. The counseling guide was prepared based on the recommendations of the World Health Organization and Ministry of Health of Ethiopia [29, 30]. Increasing meal frequency and portion size with increasing gestational age and taking diversified meals were the core contents of the counseling guide. Consumption of iron/folic acid supplementation, iodized salt use, reducing of a heavy workload, taking day rest, use of impregnated bed nets, and health services were also the key messages of the counseling guide.

The consequences of taking an inadequate amount and less diversified meal, susceptibility to and severity of the consequences of taking a less diversified meal, benefits of taking a healthy diet and barriers for taking a balanced diet were also discussed during counseling. The counselors assessed attitude, subjective norms, self-efficacy, perceived control, intention, knowledge, and dietary practices of women during each counseling session (Fig 2). Then, they counseled the women based on the identified gaps and women's socioeconomic status.

Counseling was given monthly using a counseling guide with core contents. Individual nutrition counseling was given through a home visit on non-working days (religious holidays and weekends). Each counseling session lasted for 40 to 60 minutes. Each woman attended four counseling sessions throughout her entire pregnancy. During counseling, counselors used a client-centered approach to identify women's dietary practices and their specific needs in terms of nutrition. Counselors first asked the women about their income, nutrients needed during pregnancy, and their dietary practices. Then, they considered women's nutrient

demand, income, and identified gaps. They allowed the women to choose from recommendations that were based on locally available, affordable and acceptable foodstuffs.

The first counseling was given before 16 weeks of gestation, focused on basic nutrition, food groups, food selection, preparation, meal frequency, portion size and iodized salt utilization. The second and third counseling sessions were given during the second trimester of pregnancy and covered the entire contents of the counseling guide. The last counseling was given based on the identified gaps during the early third trimester of pregnancy.

Leaflets with core messages in Amharic (local language) and appropriate pictures were prepared and delivered to each pregnant woman in the intervention group. Anyone at home or in the neighborhood who could read was suggested to read the leaflet for the woman who couldn't read.

Women in the control group received nutrition education given by the health system. Pregnant women from both the control and intervention groups attended ANC services. Counseling and supervision of the counseling process were done by six BSc nurses and three MSc nutritionists, respectively. The counselors had previous experience of giving counseling services. A three-day intensive training was given to the counselors and supervisors using a counseling guide. The guide included ethical issues, maternal nutrition, HBM, and TPB constructs. It also covered the way of delivering nutrition counseling including role-playing and field practice. A one-day additional training was given to the counseling team after two months of intervention to maintain providers' knowledge and counseling skills.

Fidelity of the intervention was checked using criteria that were developed by the investigators. The criteria were adopted from the National Institutes of Health Behavioral Change Consortium developed best practice recommendations [32]. The criteria included a checklist to assess intervention design, training of counselors, counseling process, receipt of intervention, and enactment of skills gained from the intervention [33].
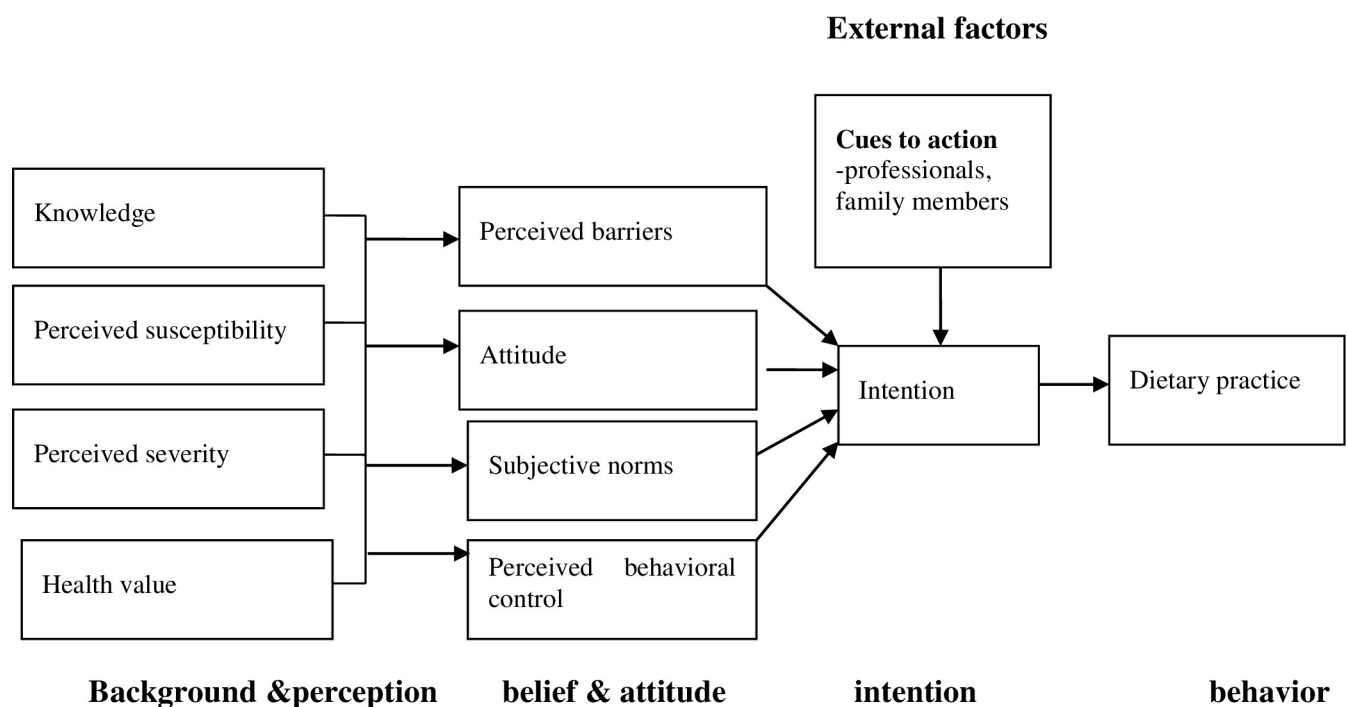
Fig 2. A new model: Combined health belief model and theory of planned behavior adopted from SUN X et al. [31].

Data collection tools and procedures

Full details of the data collection tools and procedures were published previously [12]. Six nurses collected data using structured questionnaires through one-to-one interviews made with the participants at their homes. Data on socio-demographic and obstetric characteristics were collected at the baseline. Whereas, data on dietary practice, food security, HBM, and TPB constructs were taken before and after implementation of the trial.

The primary outcome of this trial was the dietary practice, which was assessed using a food frequency questionnaire (FFQ). Post-intervention data were collected between 36 to 37 weeks of gestation. Women who didn't attend all counseling sessions were considered non-adherent to the guideline. But, women who withdraw from participating in the study were labeled as lost to follow up. The data collection team was trained for three days using a training manual. The data collection supervisors and the principal investigator closely followed the data collection process.

Measurements

A food frequency questionnaire was taken from the literature and customized based on locally available foodstuffs [34]. The questionnaire contained 54 food items. When the women consumed a food item at least once a day, they categorized under the consumers' category, otherwise not [35]. Food items of the FFQ were categorized into nine food groups [36]. Dietary diversity score (DDS) was analyzed by counting the number of food groups the women consumed within a week. The sum of food groups was divided into terciles (three parts) and women who took the highest tercile were considered having high DDS, or else not. Individual food items the women took within a week were counted and the mean food variety score (FVS) was analyzed. Women who scored above the mean FVS were labeled as having good FVS, otherwise not.

The frequencies of each animal source foods the women ate within the days of a week were counted to assess animal source food (ASF) consumption. Then, the frequency of ASF consumption was divided into three parts (tercile). Women who had the highest tercile were classified under high consumption of ASF. Women who took four or more meals a day were considered having adequate meal frequency, otherwise having inadequate meal frequency.

When women had high DDS, ASF consumption, FVS above the mean and adequate meal frequency, they were labeled as having appropriate dietary practice. Household food security was determined using 27 questions adapted from previously validated tools [37]. Food secure households did not report any food insecurity indicators except rarely worry due to fear of shortage of food in the household [37].

Principal Component Analysis (PCA) was done to assess the wealth index of the household. Quintiles of the wealth score were calculated based on the first principal component. Eight questions were used to determine women's decision making power. Code one was given for each question when a decision was made by the woman alone or jointly with her husband otherwise zero [2]. Subjective norms, knowledge, attitude, intention, perceived susceptibility, perceived severity, perceived benefit, and perceived barriers were assessed using the sum of their respective composite questions.

Data management and analysis

Data were entered into Epi info version 7.2. Software and exported to SPSS version 23 Software for analysis. The baseline difference in socio-demographic characteristics between the two groups was examined using a chi-square test. Pre- and post-intervention differences in dietary

practice, DDS, FVS, ASF consumption, and meal frequency between the intervention and control groups were analyzed using a McNemar test.

Generalized Estimating Equation (GEE) with a binary logit function was used to examine the change difference of outcome between the intervention and control groups. GEE was run to accommodate clustered data and correlation of observations within subjects. The unstructured covariance matrix was considered during fitting the model while accounting for the effects of potential confounding factors. Crop production, socio-demographic variables, obstetric characteristics, food security, time, treatment, time and treatment interaction were analyzed. The effect of the intervention was assessed using time and treatment interaction. Odds ratios and respective 95% confidence intervals were calculated. *P* values < 0.05 were considered statistically significant.

Results

Socio-demographic characteristics of pregnant women

Seven hundred twelve pregnant women were recruited in this study. Among them, 694 respondents gave complete baseline data and were randomized into the intervention (346 women) and control (348 women) groups. At the end of this trial, 645 **(IG = 313, CG = 332)** respondents strictly adhered to the protocol. Baseline data on wealth index, occupation, age, ethnicity, family size, education, and religion of the respondents were similar between the two groups (P > 0.05). The socio-demographic characteristics of the pregnant women is available everywhere [27].

Health belief model and theory of planned behavior constructs and their correlation with knowledge and dietary practice of pregnant women

Women in the intervention group demonstrated better scores of the HBM and the TPB constructs (P< 0.001) compared with women in the control group and their baseline scores. Comparison of the HBM and the TPB constructs score within and between intervention and control groups were published previously [27].

Except for the perceived barrier, the intervention had a strong positive correlation with all other HBM and TPB constructs (*P<0.001)*. All HBM and TPB constructs also showed a significant positive correlation with knowledge and the dietary practice of pregnant women (*P<0.001)*. Correlation of the HBM and the TPB constructs with knowledge and dietary practices of pregnant women were published previously [27].

Effect of the intervention on the dietary practices of pregnant women

Before the implementation of the trial, there was no statistically significant difference in the dietary practice, DDS, ASF consumption, and frequency of meal between the two groups. Pregnant women in the control group had better FVS than women in the intervention group at the baseline (Table 1).

After the trial, women in the intervention group showed a significant improvement in the dietary practices, DDS, ASF consumption, FVS and frequency of meals compared with their dietary practices before the intervention. In the control group, the proportions of women who had appropriate dietary practices, high DDS, high ASF consumption, FVS above the mean and more than three meals showed a significant reduction at the end of the study.

At the end of this trial, the proportion of women who had appropriate dietary practices increased by 18.3% in the intervention group. However, the number of women who had

Table 1. Baseline dietary practices of pregnant women in West Gojjam Zone.

Variables	Intervention group(n₁ = 313)	Control group (n₂ = 332)	P
	Frequency (%)	Frequency (%)	
Dietary practice			
Appropriate	59(18.8)	74(22.3)	
Inappropriate	254(81.2)	258(77.7)	0.281
DDS			
High	98(31.3)	119(35.8)	
Low	215(68.7)	213(64.2)	0.223
ASF consumption			
High	109(34.8)	133(40.1)	
Low	204(65.2)	199(59.9)	0.098
FVS			
Above the mean	127(40.6)	176(53.0)	
Mean and less	186(59.4)	156(47.0)	0.002
Frequency of meal			
More than three	111(35.5)	123(37.0)	
Three or less	202(64.5)	209(63.0)	0.676

appropriate dietary practices decreased by 12.4% in the control group. The average difference of appropriate dietary practice between the two groups was 30.7% (P<0.001).

Additionally, in the intervention group, DDS improved by 24.6%, whereas in the control group, it showed a 15.9% reduction, with an overall difference of 40.5% between the two groups (P<0.001). Similarly, FVS increased by 22.7% among women in the intervention group while it decreased by 13.2% in the control group, with an average difference of 35.9% between the two groups (P<0.001).

In the same way, the proportion of women who took ASF increased by 10.9% in the intervention group while it decreased by 9.7% in the control group. The overall difference in ASF consumption was 20.6% between the two groups (P<0.001). The proportion of women who took four or more meals increased by 38.0% in the intervention group, whereas it decreased by 9% in the control group. The overall difference in meal frequency was 47.0% between the two groups (P<0.001) (Table 2).

On the multivariable Generalized Estimating Equations model, after controlling for possible confounders, pregnant women in the intervention group were 7.2 times more likely to have appropriate dietary practices compared to the control group [AOR = 7.187, 95% CI:

Table 2. Differences between baseline and end line dietary practices and difference of the differences between intervention and control groups.

	Intervention group(n = 313)			Control group(n = 332)			
Variable	Baseline	End line	Difference (EL-BL)	Baseline	End line	Difference (EL-BL)	Difference of difference
Dietary practice	0.188	0.371	0.183***	0.223	0.099	-0.124***	0.307***
DDS	0.313	0.559	0.246***	0.358	0.199	-0.159***	0.405***
FVS	0.406	0.633	0.227***	0.530	0.398	-0.132***	0.359***
ASF	0.348	0.457	0.109***	0.401	0.304	-0.097***	0.206***
Meal frequency	0.351	0.731	0.380***	0.370	0.280	-0.090***	0.470***

*** P<0.001.

Table 3. GEE result of the intervention effect.

Variable		Beta coefficient	Standard error	95% CI	P	AOR	95% CI
Dietary practice	Intercept	-2.094	.6043	-3.278, -.909	.001	.123	.038, .403
	Time	-1.002	.1729	-1.341, -.663	< .001	.367	.262, .515
	Group	-.188	.1977	-.575, .200	.342	.829	.562, 1.221
	Time*group	1.974	.2414	1.501, 2.447	< .001	**7.200**	4.486, 11.556
DDS	Intercept	-.989	.5469	-2.061, .083	.071	.372	.127, 1.086
	Time	-.877	.1430	-1.157, -.596	< .001	.416	.314, .551
	Group	-.142	.1735	-.482, .198	.414	.868	.618, 1.219
	Time*group	1.975	.2174	1.549, 2.401	< .001	**7.209**	4.707, 11.039
FVS	Intercept	-.707	.4898	-1.667, .253	.149	.493	.189, -.707
	Time	-.589	.1250	-.834, -.344	< .001	.555	.434, -.589
	Group	-.454	.1647	-.777, -.131	.006	.635	.460, -.454
	Time*group	1.615	.2067	1.210, 2.020	< .001	**5.026**	3.352, 1.615
ASF	Intercept	-1.401	.5112	-2.403, -.399	.006	.246	.090, .671
	Time	-.452	.1252	-.698, -.207	< .001	.636	.498, .813
	Group	-.202	.1673	-.530, .126	.226	.817	.588, 1.134
	Time*group	.927	.1867	.561, 1.293	< .001	**2.527**	1.753, 3.643
Meal frequency	Intercept	-1.037	.5065	-2.030, -.044	.041	.355	.131, .957
	Time	-.448	.1358	-.714, -.182	.001	.639	.490, .834
	Group	.022	.1686	-.308, .353	.894	1.023	.735, 1.423
	Time*group	2.156	.2165	1.731, 2.580	< .001	**8.634**	5.648, 13.198

The model was adjusted for wealth index, food security, decision making power, education, age, parity, gravidity and family size

AOR = adjusted odds ratio, CI = confidence interval, P = P-value.

(4.49, 11.49)]. Likewise, women in the intervention group were 7 times at higher odds of taking diversified meals than those in the control group [AOR = 6.994, 95% CI: (4.59, 10.66)].

Similarly, women who got counseling were 5 times [AOR = 4.928, 95% CI: (3.31, 7.33)] and 2.5 times [AOR = 2.531, 95% CI: (1.76, 3.63)] more likely to had better FVS and ASF consumption than women in the control group, respectively. Women in the intervention group were 8 times more likely to take four or more meals a day compared with women in the control group [AOR = 8.146, 95% CI: (5.377, 12.341)] (Table 3).

Discussion

In this study, nutrition counseling using the HBM and the TPB constructs was effective on improving the dietary practices of pregnant women. The proportion of women who had appropriate dietary practices was significantly higher in the intervention group compared with women in the control group. This finding persists after controlling the potential confounders.

This result is in agreement with the report of a study from Dessie Town which reported significant improvement in the dietary practices of pregnant women who attended nutrition education using the HBM [10]. A similar positive finding was also reported from the Alaje district of northern Ethiopia, Addis Ababa, Burkina Faso, and Iran that showed the positive effects of nutrition counseling on improving the dietary practices of pregnant women [38–41].

The possible explanation for the success of this intervention might be the method of counseling. In this study, counseling was given using a counseling guide and simple messages with culturally appropriate pictures. Counseling was delivered using a client-centered two-way communication approach. The counselors used trimester based education. Besides, before

each counseling session, counselors assessed existing knowledge, dietary practice and socio-economic situation of each woman. Then, counseling was given based on the need of specific women. All these encourage behavior change towards having appropriate dietary habit. Moreover, this study used leaflets with core messages and appropriate pictures, which might help women in the intervention group to remember key messages.

Furthermore, in this study counseling was given using the HBM and the TPB constructs. Scholars who used the HBM and the TPB for counseling pregnant women have also reported a positive result on improving the dietary practices of pregnant women [10]. This might be due to the fact that counseled women perceived that poor diet during pregnancy had severe adverse effects on them and their fetus. They considered themselves to be at risk to the negative consequences of an unhealthy diet. They perceived taking a healthy diet is crucial to maternal and fetal health. All this motivated them to take action towards improving their nutrient intakes.

Additionally, counseling increased perceived behavioral control, self-efficacy, knowledge, and attitudes regarding having a healthy diet, which in turn improved the intention of having appropriate dietary practice. The intention is the direct determinant of having healthy dietary practice.

Nutrient requirements increase during pregnancy and with increasing gestational age. However, most Ethiopian women perceived that increasing nutrient intake while they are pregnant leads to having a big baby that further predispose to difficulty during delivery. As a result, they practice eating less while they are pregnant compared with their practices before pregnancy [5, 11, 42].

Moreover, the dietary practices of pregnant women decrease with increasing gestational age. According to Kuche D *et al*, nutrient intakes of the third trimester pregnant women were less than nutrient intakes of women before the third trimester [43]. In line with the report of previous researchers, in this study, dietary practices of pregnant women in the control group decreased from their baseline dietary practices.

The possible justification for the inappropriate dietary practices of pregnant women in the control group was poor counseling practice of the health workers. During nutrition education, professionals don't use counseling guide and behavioral models. They advise pregnant women to take one additional meal from foods available at home compared to their meals before pregnancy [12]. Thus, women may not understand the type and amount of food needed for them. This type of simple advice never brings behavior change towards healthy eating habits.

The second possible justification may be the study setting. This study was done among women in rural settings. Women in rural areas were more likely to practice eating down due to the high prevalence of food taboo in the rural areas than in urban settings [6]. Seasonal variation might be the other explanation for reducing the dietary intake of women in the control group. In both groups, baseline quantitative data from the majority of the study participants were collected from May to June, whereas end line data were collected from September to October.

The study area is extremely dependent on rain-fed harvesting or the "Meher" harvest. Harvest season starts in November and continuous until February. Therefore, the availability of crops in the household deteriorates during the lean season, particularly between July and October. This may be the reason for the lower proportion of the appropriate dietary practices of pregnant women.

Women in the intervention group had higher dietary diversity and food variety scores compared with the control group. The reason for this might be due to the use of a counseling manual with a detail description of each foodstuff with its benefits for the women and the growing fetus. The positive effect of counseling on diet during pregnancy on improving dietary

diversity was reported by previous studies. Studies done in Burkina Faso and Iran showed that the dietary diversity of pregnant women in the intervention group showed a significant improvement compared with the control group [40, 44]. A study done among under two years old children also reported a significant improvement in the dietary diversity of children in the intervention group after nutrition education intervention [45].

Women who attended guided counseling reported improvement in animal source food consumption than women who attended nutrition education given by the health system. This finding is in agreement with the previous study done among under two years old children that reported significant improvement of ASF consumption in the intervention group compared to children in the control group [45]. One of the core contents of the counseling guide was taking animal products three times a day and its importance during pregnancy. This might increase women's knowledge and commitment to take ASFs.

The likelihood of taking four or more meals a day was higher among women in the intervention group compared with women in the control group. The previous study that assessed the effect of nutrition education on infant feeding practice showed a significant improvement in the frequency of meal in the intervention group [45]. This might also be due to the counseling method as increasing frequency of meals and portion sizes with increased gestational age were the two core contents of the counseling guide. Accordingly, counselors gave emphasis during counseling for the frequency of meals and portion size during each counseling session. The observed positive effects on dietary practices confirm that dietary practices of pregnant women can be modified through community-based guided counseling.

Implication: The findings of this study have significant practical implications for improving nutrition counseling methods, which in turn will improve maternal and child health. The fact that significantly higher numbers of pregnant women have appropriate dietary practices implies the need for enacting the community level education through health extension workers using theory enhanced approaches.

Being a randomized controlled trial using a client-centered approach and trimester based counseling were the strengths of this study. However, this study has some limitations. All responses were self-reported which were dependent on the women's memory and honesty in answering questions. The post-intervention result may not have lasted longer since it was a relatively short term intervention.

Conclusion

Counseling using the health belief model and the theory of planned behavior is an effective approach in increasing the proportion of women who had appropriate dietary practices. Women in the intervention group had high DDS, FVS above the mean, high ASF consumption, and adequate food frequency than women in the control group. Therefore, the findings of this study suggest the need for employing trimester based counseling using the HBM and the TPB to improve dietary practices of pregnant women. Moreover, this study recommends developing nutrition counseling guidelines with a detail description of diet during pregnancy, the HBM, and the TPB constructs.

Supporting information

S1 Checklist.
(DOCX)

S1 Data.
(DOCX)

Author Contributions

Conceptualization: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Data curation: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Formal analysis: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Funding acquisition: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Investigation: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Methodology: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Project administration: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Resources: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Software: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Supervision: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Validation: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Visualization: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Writing – original draft: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

Writing – review & editing: Yeshalem Mulugeta Demilew, Getu Degu Alene, Tefera Belachew.

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