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Effect of educational intervention on the knowledge and appropriate counselling skills of health professionals post training regarding nutrition during pregnancy in Asmara, Eritrea

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ABSTRACT

Background

Reinforcing desirable attitudes and behavior related to nutrition among pregnant women can only be achieved when they are provided with timely and comprehensive nutrition education and counseling. The knowledge and counseling skills of health professionals has an immense and recognized role in introducing positive dietary behavior and practice related to pregnancy among pregnant women.

Objective

To assess the effect of training given to health professionals regarding nutrition during pregnancy on their knowledge and counseling skills.

Methods

A single group pre-post quasi-experimental study design with pre-intervention, immediate post-intervention was employed in July of 2018 in five health facilities providing antenatal care service on 16 health care professionals in Asmara. A manual based training was given by a qualified trainer based on a prepared module and leaflet on important messages on appropriate nutrition during pregnancy for 2 days. A pre-designed pretested questionnaire was used to collect data via interview by trained data collectors for both the pretest and immediate posttest. Data was analyzed using SPSS Version 22.0 program. Statistical significance level was set at *p*-value of less than 0.05.

Result

The analysis showed that the median scores of knowledge increased significantly from 30.5/47 (IQR=8) at pre-intervention to 44/47 (IQR=3.5) at immediate post intervention. On the average, the level of knowledge increased significantly by 13.5 units out of 47 ($p<0.001$). Major gap in knowledge of health professionals was seen in the complication of maternal

under nutrition such as preeclampsia (6.3%) and gestational weight gain (6.3%). The mean nutrition counseling practice score of health professionals was 30.97 (SD=1.26)/34. Sources of main food groups (fats, iron) was discussed by all participants. More than eighty percent (93.8%) checked for adherence to iron supplement and none of the respondents failed to give information on how to take the supplement and three quarter of the respondents gave information on use of iodized salt. There was no significant difference in the mean score of counseling skills of health professional's between the categories of demographic characteristics.

Conclusion

This research has made it clear that it is possible to improve the knowledge and practices of health professionals through the proposed intervention aimed at primary health care teams providing antenatal care.

Keywords: Health professionals, education, knowledge, counseling skills

INTRODUCTION

Over the centuries as indicated by many researchers, it has been vivid that healthy children are the foundation of a healthy population. A prerequisite for children to be healthy is a healthy dietary practice and care that should be started by all women of child bearing age before or during pregnancy [1-6]. Healthy dietary practice is simply one that provides all the nutrients required by the body, in the right proportions. Poor nutrition is among the modifiable health risk factors and it's may be for this reason that researchers and other concerned authorities have been increasingly interested in studying the influence of diet during pregnancy [2, 7-10].

To reinforce desirable attitudes, dietary behavior and positive infant and maternal outcomes among pregnant women, nutrition education and counseling has to be instituted correctly and it has to be achievable [2, 11-13]. This can only be true if health professionals play their vital role of providing nutrition education and counseling to pregnant women. For the implementation of this to be successful, the Ante Natal Care (ANC) providers should have adequate nutrition knowledge, know the standard of practice with skilled counseling technique [2, 9]. An emphasis is put on health professionals as medium of transmission because they have been chosen as the best source of education and counseling in a number of studies [1, 14]. They were reported as the trusted source of information and advice because they were perceived to have the necessary skills to do so.

The effect of education is not a one-off impact that leads individuals into given contexts. The benefits of education are more dynamic. Nutrition education and counseling being one of the core preventive measures is basically concerned with improvement of social communication strategies that can bring long lasting behaviors affecting the knowledge and practice of pregnant women towards nutrition. An important point to be noted here is that the ultimate purpose of the education and counseling is behavioral change rather than just telling women what to consume and what not to consume [15].

The antenatal period is the period where pregnant women come into frequent contact with health professionals during their routine antenatal visits. Therefore, ANC providers be it the doctors or midwives hold the key in the promotion and introduction of positive dietary behaviors among pregnant women. As indicated in the research by Arrish et al., pregnant women have a good character of catching up to nutrition related information and this is a good quality where we all have to make good use of it. There is also an evidence from a study indicating that pregnant women who were educated and counseled introduced positive changes to their dietary behavior compared to those who were not [1].

Specifically health and nutrition education to improve and ensure regular consumption of foods rich in iron, folate and vitamin C and to reduce consumption of interfering substances has appeared to be a core strategy for the prevention and control of anemia [15]. Food-based strategies, which include fortification of foods with micronutrients and dietary diversification to increase production and consumption of foods rich in iron, vitamin C and folate as well as supplementation with specific micronutrient to the vulnerable groups and other public health measures have been in operation for over two decades. However the outcome has not been really apparent. One of the most important barriers reported was the absence of health and nutrition education provided by the health care professionals.

However, the reality is far from the ideal situation. Studies done in United States and other western countries indicate that health providers are suffering from barriers like low knowledge and confidence level, lack of time, lack of incentives and lack of training in nutrition counseling [1, 8, 16]. In Eritrea, the extent to which Ante

Natal Care providers have adequate knowledge and counseling skills required to provide sufficient information to pregnant women is still unknown. There has never been an attempt to explore if they are faced with some obstacles to fulfill their role in nutrition education and counseling. No measure have ever been taken that studied an effect of training provided to them in their knowledge and counseling skills.

In addition to the above statements, there are no available guidelines except for the focused antenatal care guideline which is general and does not specifically inform health professionals on how to approach pregnant women with regards to nutrition advice. The need for a guideline has also been addressed in study by Bareto Malta et al in 2012. In that study, the distribution of printed materials acted like a job aid in guiding the ANC providers in selecting and providing the most relevant information to pregnant women at each visit [7]. Thus this study aimed at assessing whether training provided to health professionals had an effect in their knowledge and counseling skills.

METHODS

Design and study place

Single group pre-post quasi-experimental study design with pre-intervention, immediate post-intervention was employed in July of 2018 in Asmara, the capital city and largest settlement in Eritrea. According to the Municipality of Asmara, there are a total 114,640 households in the city and it is home to a population of around 416,367 people.

Study population

There are 18 health facilities in Asmara out of which 17 provide ANC service. Of these 3 are health centers, 3 are community hospitals and 11 are health stations. The community hospitals have a catchment population of around 50,000 and they provide service for more than 3 subzones. There are approximately 59 health care providers with exclusive ANC service in the facilities. Health assistants, comprehensive nurse midwives and nurse midwives who were working as ANC providers during the study period were the study population for this study.

Sample size

Complete enumeration of the health professionals working in five randomly selected health facilities was undertaken for the study. There were 17 health professionals working in the selected health facilities and all were invited to participate in the study. Only one refused to do so. The health professionals were 5 from Godaif health station, 4 from Edaga Hamus community hospital, 3 from Semenawi Asmara health center, 2 from Bet Mekae community hospital and 2 from Geza Banda health station.

Inclusion and exclusion criteria

All health professionals providing ANC and willing to participate in the study were included in the study. Providers who were not working at the ANC during the study period (Due to rotation in the other units such as EPI, leave or training) were excluded from the study.

Intervention

The intervention of this study was a health education program concerning nutrition during pregnancy prepared based on a training manual by the research team. A hand out was synthesized that the health professionals can use as a reference. A job aid and leaflet containing the core messages for every topic was developed that the health professionals can use as a memory aid. The prepared materials were reviewed by expertise for their appropriateness and adequacy. The teaching materials contained; an introductory messages regarding nutrition during pregnancy, hazards of maternal malnutrition on mother and fetus, sources of the main food groups and micronutrients. It also focused on important supplements to be taken during pregnancy, harmful substances to be avoided, gestational weight gain and GATHER (Greet, Ask, Tell, Help, Explain, Return) counseling skill.

The training program was carried out in the form of lecture using power point presentations, group discussion, case presentations, self-reading of hand outs and leaflets. The intervention was implemented in two sessions. The sessions were of 2 hours each accompanied by refreshment programs. The training was given by a qualified trainer (a midwife with a deep knowledge regarding nutrition during pregnancy) based on the prepared teaching materials. The education was given in the premises of Edaga Hamus Community Hospital.

Data collection tools, techniques and procedure

The knowledge level of health professionals regarding nutrition was assessed at two times, prior to receiving the manual based training and immediately after the end of the training session. A questionnaire sheet for health professionals was adapted from an Ethiopian study done on the effect of nutrition education by health professionals on pregnancy specific nutrition knowledge and practice of pregnant women [2]. The questionnaire for health professionals had three sections. The socio-demographic section addressed the background information of the health professionals including whether they have ever received in-service training

regarding nutrition and their level of confidence in providing nutrition related information to ANC clients. The knowledge questionnaire consisted of 20 close ended multiple answer questions which included knowledge on maternal and fetal complications of under nutrition, amount and frequency of meal during pregnancy, energy requirement during pregnancy, Gestational Weight Gain, iron and folate supplementation, duration of iron supplementation, sources of main food groups, iodized salt to use and things to avoid during pregnancy.

Phase I of the data collection from the health professionals (baseline assessment) using a questionnaire immediately before receiving training took place from July 23rd to July 25th. Phase II or post intervention data collection was done after the completion of the training. The quantitative data which is the knowledge questionnaire was administered via a face-to face interview method after the participants were informed briefly about the study and their written consents were obtained. Two professionals who have bachelor of science in nursing for data collection and one clinical nurse for the purpose of supervising the data collection period were trained for one day on the overall research objective and methodology, data collection tools, interviewing and recording skills in addition to strict instructions on consistency and completeness of the tool. To assess if the provider will give pregnancy specific messages related to nutrition and if he/she is counseling the participants with the appropriate skill, non-participatory observation method using an observational checklist that consisted of 17 questions was used. Non participatory observation took place from July 31st to August 9th. A total of 226 pregnant women were counseled as part of the study. During the non-participatory observation, the ANC providers' practice of nutrition counseling was cross checked against the checklist components and recorded as "not done", "partially done", and "completely done" while providing nutrition education and counseling for two different ANC clients. The specific variables of the checklist were considered to be "completely done" if the ANC provider does it right in at least one client. Items were scored on a scale of three in which score 2 stood for 'completely done', 1 for 'partially done', and 0 stood for 'not done'. Consequently, the possible range of the total score of the checklist was 0-34. Recruitment of participants, intervention and data collection was all done in the ANC settings of the health facilities.

Validity

The face and content validity of the data collection instruments was ensured as the tool was reviewed by nutrition experts from the MOH, clinical nurses and advisors from the college. Considering their suggestions and recommendations, the tool was modified and finalized to fit the local context.

Study outcomes and measures

The two outcome variables in this study were the knowledge level of health professionals at two different times on nutrition and their counseling skills after intervention. Composite scores of knowledge and counseling skills of each health professional was computed. The pregnancy specific nutrition education was the independent variable in this study. Co-variables on health professionals were age, sex, work experience, qualification, recent training on nutrition, self-reported level of confidence and monthly salary.

Data Analysis Procedures

The goal of the statistical analysis for this study was to test the hypothesis. The cleaned data was coded and entered in to SPSS version 22.0 and was analyzed. Normality of the entered data was checked with Kolmogorov-Smirnov test and Fisher's measures of skewness and kurtosis. Descriptive analysis of the socio-demographic and other covariates was done using frequencies (percentages), mean (SD) and median (IQR) as appropriate. Scores of the knowledge of health professionals at pre and immediate post were computed. A non-parametric test, Wilcoxon signed rank test was used to compare the differences in mean scores of knowledge of health professional's pre and post intervention. Comparison of the counseling skills of health professionals with their socio-demographic characteristics was done using non-parametric statistic, namely, Mann-Whitney U test. Finally the results were presented using tables. A statistical significance was considered at *p*-value of less than 0.05.

RESULTS

This study sought to answer the question of whether training given to health professionals had an effect in bringing a positive change in their knowledge and counseling skills. A total of 17 health professionals were approached to participate in the study and 16 agreed to do so making the response rate at 94.2%.

Socio-demographic profile of health professionals

Table 1 indicates the socio-demographic profile of health professionals. Of the participants, 13 (81.3%) were females, the mean age of the participants was 42.19 (SD=15.57) while the age range was 22-65. Three fourth

(75%) of the respondents were married. Only 1 respondent was a degree holder while the majority (62.5%) were at diploma level. Less than half (43.8%) of the respondents had worked for 15 years or more.

Table 1: Socio-Demographic profile of health professionals (N=16).

Variable	Frequency	Percent
Sex		
Male	3	18.8
Female	13	81.2
Profession		
BSM	1	6.3
Nurse midwife	6	37.5
Comprehensive nurse	4	25.0
Associate nurse	5	31.2
Marital status		
Single	3	18.8
Married	12	75.0
Divorced	1	6.2
In-service training regarding nutrition		
Yes	6	37.5
No	10	62.5
Confidence on nutrition education provision		
Not confident	1	6.3
Moderately confident	4	25.0
Fully confident	11	68.7
	M (SD)/Md (IQR)	**Min., Max.**
Age	42.19 (15.57)[a]	22, 65
Monthly Salary	2600 (541)[a]	1600,3500
Years of service/Experience	17.60 (13.75)[a]	1,43

M=Mean, SD=Standard Deviation, Md=Median, IQR=Interquartile range, Min=Minimum, Max=Maximum,
[a]Mean (SD) is reported

Only 6 (37.5%) claimed to have received in-service training regarding nutrition and only 1 (6.3%) believed to have lacked confidence on nutrition education provision. The mean years of service was 17.60 (SD=13.75) with an average monthly salary of 2600 (SD=541).

Knowledge on nutrition during pregnancy among health professionals

The majority (87.5%) of the respondents had a correct knowledge on how frequently and what amount a pregnant woman should eat, after intervention the proportion increased to 100%. As indicated as in Table 2, need of folate and iron supplementation early during pregnancy was correctly addressed by 16 (100%) and 15 (93.8%) proportion of the respondents respectively. The first knowledge parameter's value remained the same but the latter increased to 16 (100%) in the post education assessment. All of the respondents had the right knowledge regarding dose of folic acid in a woman who had a prior child with a neural-tube defect and dosage of daily elemental iron in a woman with anemia after intervention. All of the studied health professionals knew that pregnant women should use iodized salt at both assessments. All of the respondents stayed true to the fact that alcohol and cigarette are completely restricted during pregnancy while coffee consumption should only be reduced after the intervention. Results of questions raised regarding maternal complications of under nutrition during pregnancy showed that all of the respondents knew anemia as a complication while preeclampsia was known to only 1 participant but after intervention 10 (62.5%) came to know about it. Miscarriage as a complication of under nutrition was mentioned by only 6 (37.5%) participants, but after intervention those who mentioned it were more than half (68.8%). There was a huge increase in the number of respondents who correctly knew GWG (from 6.3% to 93.8%) in comparison to a no change in those who answered the importance of folic acid, i.e. to prevent birth abnormalities of the nervous system of the unborn baby (100% to 100%). Meaning of intermittent iron and folic acid supplementation was known to 15 (93.8%) after the intervention. Similar proportion of the

respondents were familiar with duration of iron supplementation before intervention but after intervention every single respondent was familiar with the correct duration.

Table 2: Percentage distribution of correct knowledge of nutrition during pregnancy among health professionals, pre and immediate post intervention (N=16).

Knowledge Components	Pre-intervention n (%)	Immediate Post n (%)
Maternal complications of under nutrition during pregnancy		
Increased infections	8 (50)	13 (81.3)
Preeclampsia	1 (6.3)	10 (62.5)
Anemia	16 (100)	16 (100)
Preterm birth	10 (62.5)	16 (100)
Miscarriage	6 (37.5)	11 (68.8)
How frequently and what amount a pregnant woman should eat	14 (87.5)	16 (100)
Energy requirement during pregnancy	8 (50)	16 (100)
Gestational weight gain	1 (6.3)	15 (93.8)
Need of folate supplement early during pregnancy	16 (100)	16 (100)
Need of iron supplement early during pregnancy	15 (93.8)	16 (100)
Timing of folic acid initiation	4 (25)	16 (100)
Importance of folic acid supplementation		
To prevent preterm labor and delivery	6 (37.5)	16 (100)
To prevent birth abnormalities of the nervous system of the unborn baby	16 (100)	16 (100)
Dose of folic acid	9 (56.3)	16 (100)
Dose of folic acid in a woman with a prior child with a neural-tube defect	12 (75)	16 (100)
Duration of iron supplementation	15 (93.8)	16 (100)
Dosage of daily elemental iron in a woman with anemia	16 (100)	16 (100)
Meaning of intermittent iron and folic acid supplementation	1 (6.3)	15 (93.8)
Usage of iodized salt during pregnancy	16 (100)	16 (100)
Alcohol and cigarette restriction in pregnancy	15 (93.8)	16 (100)

Concerning sources of main food groups as indicated in *Table 3,* the analysis showed that the nutrition education provided made all of the respondents favor injera, rice, maize, wheat and millet as good sources of carbohydrate. The education had the same effect on legumes, eggs, cheese, milk, yogurt, nuts and seeds as source of proteins. Besides the same effect was seen with eggs being as source of fats. Minimal change was seen in the number of respondents who vouched for fatty meat, milk and cheese as being sources of fat from pre-intervention (n=14, 87.5%) to post intervention (n=15, 93.8%). The number of respondents who thought egg yolk was a rich source of iron increased from half to 93.8% in the post education assessment. Only 43.8% believed legumes could be a rich source of iron but after intervention, the majority (87.5%) were in consensus with the idea.

Table 3: Percentage distribution of correct knowledge of sources of main food groups

Sources of main food groups	Pre-intervention n (%)	Immediate post n (%)
Carbohydrate		
Injera	10 (62.5)	16 (100)
Rice	14 (87.5)	16 (100)
Maize	14 (87.5)	16 (100)
Wheat	13 (81.3)	16 (100)
Millet	9 (56.3)	16 (100)
Fruits	5 (31.3)	10 (62.5)
Proteins		
Legumes	11 (68.8)	16 (100)
Eggs	11 (68.8)	16 (100)
Cheese, Milk, Yogurt	11 (68.8)	16 (100)
Nuts and seeds	8 (50)	16 (100)
Cereal, Wheat, corn and rice	16 (100)	13 (81.3)

Meat, poultry and fish	14 (87.5)	14 (87.5)
Peanut	9 (56.3)	13 (81.3)
Fats		
Sunflower	4 (25.5)	13 (81.3)
Avocado, vegetable oils, margarine butter	10 (62.5)	15 (93.8)
Fatty meat, milk and cheese	14 (87.5)	15 (93.8)
Eggs	6 (37.5)	16 (100)
Fish	7 (43.8)	14 (87.5)
Vitamins		
Fruits	16 (100)	16 (100)
Vegetables	14 (87.5)	16 (100)
Iron		
Meat and fish	10 (62.5)	13 (81.3)
Green leafy vegetables	10 (62.5)	16 (100)
Legumes	7 (43.8)	14 (87.5)
Egg yolk	8 (50)	15 (93.8)
Fruits	5 (31.3)	8 (50)

Effect of Educational intervention on appropriate knowledge of nutrition during pregnancy

In order to assess the effect through time on knowledge before and after educational intervention, a non-parametric test, Wilcoxon signed rank test was used as shown in *Table 4*. The median scores at pre-intervention, immediate after intervention were 30.5/47 (IQR=8) and 44/47 (IQR=3.5) respectively. On the average, the level of knowledge increased significantly by 13.5 units out of 47 (p<0.001).

Table 4: Effect of educational intervention on appropriate knowledge of nutrition during pregnancy.

	Md (IQR)	Min., Max.	Z-value	*p*-value
Pre intervention	30.5 (8)	22,37		
Post intervention	44 (3.5)	37,46	-3.52	<0.001

Nutrition counseling skill of health professionals

In order to accurately measure the counseling skills of health professionals, two different evaluations using the same tool at different time periods by the same evaluator were performed. The scores for practice of nutrition counseling as revealed in *Table 5* were then obtained by averaging the two repeated evaluations of the same person.

Table 5: Descriptive of nutrition counseling among health professionals providing ANC (N=16).

Practice	M (SD)	Completely done n (%)	Partially done n (%)	Not done n (%)
Measures weight	1.88 (0.34)	14 (87.5)	2 (12.5)	0 (0.0)
Informs the measured weight to the client	1.4 (0.8)	10 (62.5)	3 (18.8)	3 (18.8)
Informs GWG to the client	1.53 (0.49)	9 (56.3)	7 (43.8)	0 (0.0)
Informs maternal complications of under nutrition to the client	1.84 (0.35)	14 (87.5)	2 (12.5)	0 (0.0)
Informs fetal complications of under nutrition to the client	1.87 (0.34)	14 (87.5)	2 (12.5)	0 (0.0)
Asks diet related symptoms	1.7 (0.44)	12 (75.1)	4 (25.0)	0 (0.0)
Gives information on what things to avoid during pregnancy	1.87 (0.34)	14 (87.5)	2 (12.5)	0 (0.0)
Mentions food sources of carbohydrates	1.87 (0.34)	14 (87.5)	2 (12.5)	0 (0.0)
Mentions food sources of proteins	1.87 (0.34)	14 (87.5)	2 (12.5)	0 (0.0)

Mentions food sources of fats	2 (0)	16(100.0)	0 (0.0)	0 (0.0)
Mentions food sources of vitamins	1.96 (0.12)	15 (93.8)	1 (6.3)	0 (0.0)
Mentions food sources of iron	2 (0)	16 (100)	0 (0.0)	0 (0.0)
Gives information to the client on addition of one meal, small portions and frequent feeding	1.87 (0.28)	15 (93.8)	1 (6.3)	0 (0.0)
Checks for adherence to iron supplement	1.96 (0.12)	15 (93.8)	1 (6.3)	0 (0.0)
Gives information on how to take iron supplement	2 (0)	16 (100)	0 (0)	0 (0.0)
Gives information on use of iodized salt	1.75 (0.44)	12 (75.0)	4 (25)	0 (0.0)
Motivates client to ask questions and answers them clearly	1.53 (0.61)	10 (62.6)	5 (31.3)	1 (6.3)

More than three quarter (87.5%) of the respondents weighed the pregnant mother up on first encounter with her, but only 62.5% of them clearly informed the client on her weight. More than half (56.3%) of health professionals accurately mentioned the weight one mother is supposed to gain based on her current weight throughout her pregnancy. Fetal and maternal complications of under nutrition during pregnancy was discussed by similar proportion (87.5%) of ANC providers. Three quarter (75.1%) of the ANC providers asked their clients about pica, nausea and vomiting. Avoiding alcohol, smoking, caffeine and other items was discussed with clients by 87.5% of the ANC providers. Counseling on eating of variety of food and addition of extra meal during pregnancy was done by almost all providers (n=15, 93.8%). Sources of main food groups (fats, iron) was discussed by all participants. More than eighty percent (93.8%) checked for adherence to iron supplement and none of the respondents failed to give information on how to take the supplement and three quarter of the respondents gave information on use of iodized salt. More than half (62.6%) of the study participants motivated their clients to ask questions at the end of counseling session.

Counselling skills of health professionals and comparisons across categories of demographic characteristics

According to this research the mean nutrition counseling practice score of health professionals was 30.97 (SD=1.26)/34. Shown in *Table 6* is a comparison of counseling skills of health professionals across categories of demographic characteristics which was done using non-parametric statistic, namely, Mann-Whitney U test. The analysis showed that there was no significant difference in the mean score of counseling skills of health professional's across the categories of demographic characteristics.

Table 6: Comparison of counselling skills of health professionals across categories of demographic characteristics.

Variable	Md (IQR)	Mann-Whitney U	*p*-value
Gender			
Male	31.0 (*)		
Female	32.0 (2.25)	16.5	0.704
Qualification			
Associate Nurses	32.0 (1.75)		
Comprehensive Nurses/Midwives	32.25 (5.88)	21.0	0.679
Years of service			
<15 Years	32.0 (2.25)		
>=15 Years	31.0 (7.5)	18.0	0.174
Training			
Yes	31.5 (3.38)		
No	32.0 (3.50)	28.5	0.875

IQR cannot be computed because Q3 was not found.

DISCUSSION

The present study assessed an educational intervention undertaken with ANC providers in the hope of answering the question whether training given to them had an effect in bringing an increment in their knowledge and appropriate counseling skills. The results were positive in terms of improving the heath professionals' knowledge regarding appropriate nutrition during pregnancy.

In this study the median knowledge score of health professionals was 44/47 after intervention. This result,

upon changing the scores to percentage, was higher than a similar Ethiopian study which was 7.5/11 [2] and also higher than a Brazilian study which was 3.9/5 [7]. The higher result in this study might be a vivid effect of a more qualified nutrition education provided to the health professionals or the discrepancy could be due to difference in the background characteristics of the study participants. The higher change in this study could also be due to the short interval between the pre and post assessment and the fact that there was only one post education assessment. In addition to that some of the items were well known among the studied health professionals such as need of supplements and their duration as well as avoidance of alcohol and smoking. This is perhaps as a result of long standing public health campaigns that have helped to raise awareness regarding the issues.

An Australian study found that 79.3% of the interviews had received nutrition information during their midwifery education and/or during practice [1] and in another primary survey of health care professionals, 58% stated that they previously received nutrition training [16] but in this study only 37.5% received in-service training regarding nutrition. In addition to that, another Australian study showed that most healthcare providers (74%) expressed interest in receiving ongoing professional education about iodine in pregnancy [17]. The discrepancy in the results clearly indicate the need to introduce programs focusing on practical counseling skills that could further enrich health professional's knowledge and their counseling skills especially in this setting as they are the leading maternity care givers who provide continuity of care for the vast majority of women during pregnancy. One thing to be addressed here is the common challenge identified in many literatures. The available nutrition curricula focuses on the role of nutrients in metabolic pathways rather than on practical food based knowledge; lack of involving nutrition experts; and lack of resources [1]. A solution forwarded for this is the introduction of a competency based nutrition education addressing clinical and public health nutrition and inter professional collaboration. To conclude this point, this research has made it vivid that health care professionals would benefit from being offered affordable and easily accessible nutrition education from trusted institutions and their workplaces. Involving dietitians as the experts in the field as mentioned above in providing access to information could tremendously influence the ANC providers.

In the pre intervention of this study major knowledge gap among health professionals was evidenced on maternal complications of under nutrition during pregnancy, especially on complications like preeclampsia (6.3%), GWG (6.3%), meaning of intermittent iron and folic acid supplementation (6.3%). This concept was also seen in similar Ethiopian study where the overall knowledge on maternal complications of under nutrition was 29.2% and knowledge on GWG was 37.5% [2]. Two key factors emerged for this phenomenon, firstly the presence of other obvious causes for the above listed complication and secondly the intermittent iron and folic acid supplementation is a new concept that just got introduced. Above all the lack of basic nutrition knowledge on some aspects among some ANC providers may also be linked to inadequate education regarding that matter provided in undergraduate programs.

The mean nutritional counseling practice score of health professionals was 30.97/34, this upon changing the scores to percentage was much higher than an Ethiopian's study result which was only 2.87/12 [2]. The corresponding high level of knowledge could have consequently led to high counseling skill score in this study. The fact that the participants underwent two time assessment may also have contributed to a very high proportion of health professionals with the correct practice.

The ability of ANC providers to manage weight is essential given the high rates of inappropriate weight gain among childbearing women [1]. In this study more than half (62.5%) clearly informed the client on the measured weight which was much higher than the 12.5% in an Ethiopian's study who did so. Similar percentage of respondents (43.8%) in this study and Ethiopian study (50%) incorrectly informed client on GWG [2]. A survey of primary care practioners in US also indicated that only 40% or less of patients received nutrition counseling on the issue [16]. A minority (28.5%) of women in a Canadian study reported being counseled either at all or correctly about how much weight to gain during pregnancy [18]. This enlightens whoever is to make an intervention in which area to put more emphasis on as highlighting this piece of information to pregnant women might contribute to the prevention of under or excessive weight gain during pregnancy.

An Australian survey reported that 27% of the respondents advised about iron-rich food sources and 23% gave advice on general healthy eating. As cited in the same study, a study by Wulf and Ekstrom reinforced that recommendations provided in clinical guidelines were not always applied in practice, with only 15% recommending iron supplementation to all pregnant women [17]. In a similar Ethiopian study none of the respondents counseled clients on food source of iron or usage of iodized salt [2]. In this study, 93.8% checked for adherence to iron supplement and all mentioned food sources of iron, at the same time all gave information on how to take iron supplement.

The following limitations need to be considered while interpreting the findings of the study. The possible effect of other sources like TV, books, magazines and radio broadcasting within the training period on the change in the knowledge could not be controlled. Baseline assessment of counseling skills of health professionals was not taken. The presence of supervisors during nutrition counseling may have had an effect on the performance of ANC providers. Retention test was not done so it couldn't be identified for how long the improvement in knowledge could be maintained.

CONCLUSION

Training provided to health professionals resulted in a significant increase in their knowledge of appropriate nutrition during pregnancy and their counseling abilities to pregnant women. Major gap in knowledge of health professionals was seen in the complication of maternal under nutrition and gestational weight gain. The proportion of health professionals who had received in-service training regarding nutrition was low implying the need for creation of programs that enhance the knowledge and counseling skills of health professionals. The analysis showed that there was no significant difference in the mean score of counseling skills of health professional's across the categories of demographic characteristics. Dietary counseling requires the coordinated effort of dietitian and ANC providers.

Abbreviations

ANC: Antenatal care; ANOVA: Analysis of Variance; GWG: Gestational Weight Gain; MOH: Ministry of Health; SPSS: Statistical Package for Social Sciences

Ethical approval and consent to participate

Ethical clearance and support letter for the study was obtained from the ethical and scientific committee of ACHS then the researcher visited the head of the branch of MOH of Zoba Maekel for further permission. Moreover the head nurses and medical directors of each study site were approached with full explanation of the general purpose and nature of the study. Informed written and signed consent was taken from the participants after the purpose of the study was thoroughly explained to them beforehand. Above all, the participants' information was handled with great confidentiality. Health professionals were also informed that their participation was voluntary and that they could withdraw from the study at any time during the research.

Consent for publication

All authors read and approved the final manuscript

Availability of data

The complete dataset used and/or analyzed during the current study are available from the corresponding author and can be accessed upon reasonable request.

Authors' contribution

LG: Designed the study, coordinated recruitment of participants, education of participants, preparing of teaching materials and in writing of all drafts and final manuscript. SA: Designed the study, coordinated recruitment of participants, education of participants and participated in writing manuscript. HG: Coordinated recruitment of participants, education of participants, writing of all drafts and the final manuscript. EHT: Assured quality of data collection, led data analysis, writing manuscript, and in writing of all drafts and the final manuscript. All authors read and approved the final manuscript.

Competing interest

The authors declare that there is no conflict interest regarding the publication of this paper.

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