

Effect of Nutrition Education on Pregnancy Specific Nutrition Knowledge and Healthy Dietary Practice among Pregnant Women in Addis Ababa

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Abstract

Background: Evidence showed that nutrition education during pregnancy has significant impact on dietary habit of pregnant women and on maternal and birth outcome of pregnancy. The World Health Organization (WHO) recommends that health care providers need to give adequate, specific and acceptable nutrition related advice to pregnant women during every visit of antenatal care (ANC).

Objective: To assess the effect of nutrition education on the knowledge and practice of pregnant women during pregnancy in Akaki Kality Sub-city, Addis Ababa.

Methodology: A before-after cross sectional study was conducted among 406 pregnant women in Akaki Kality Sub-city, Addis Ababa. Knowledge and practice of pregnant women on pregnancy specific nutrition was assessed before and after receiving education from trained ANC providers. Data was managed using SPSS 20. Change in nutrition knowledge and dietary practice of pregnant women during pregnancy was analysed by using paired t-test and 95% confidence interval.

Results: The response rate of this study was 96.3%. The common source of information for pregnant women on nutrition during pregnancy was health professionals (59%). The mean knowledge and practice score of pregnant women was 5.5 (SD ± 2) out of 9 and 6.2 (SD ± 2) out of 11 respectively. After nutrition education program intervention the proportion of pregnant women with knowledge on proper nutrition during pregnancy increased from 53.9 (95% CI: 48.9, 58.8) to 97% (95% CI: 94.8, 98.5) while the pregnancy specific dietary practice of the pregnant women increased from 46.8% (95% CI: 41.8, 51.7) to 83.7% (95% CI: 79.8, 87.2).

Conclusions and recommendations: Nutrition education during pregnancy by health care providers could improve knowledge and practice of women during pregnancy. Thus, attention should be given to promote nutrition education at the ANC for pregnant women to get reliable and accurate information from health professionals.

Keywords: Pregnancy; Nutrition education; Knowledge; Practice; Akaki kality sub-city

Introduction

Healthy and balanced nutrition is fundamental for all human beings for the proper functioning of the body system [1]. Pregnancy is a period that the body goes through numerous physical and hormonal changes. Balanced nutrition during pregnancy helps for the expected weight gain of the mother and the growth and development of the fetus [2,3]. It also helps to improve birth outcomes and prevent the child from developing diseases such as heart disease and obesity later in life [4].

Evidences suggested that an inadequate or excessive amount of some nutrients may cause malformations or medical problems in the fetus, and neurological disorders and handicaps are a risk that is run by mothers who are malnourished [4]. Besides, poor nutrition practice

during pregnancy is linked with gestational weight gain, increased maternal infections, preeclampsia, anemia, preterm birth or miscarriage [5,6].

Furthermore optimal levels of micronutrients are highly essential for women's health during child bearing years. Since the demands for specific nutrients during pregnancy and lactation are directly depend on a mother's intake. Suboptimal level of these crucial nutrients during pregnancy may increase the risk of adverse pregnancy outcomes such as neural tube defects, early fetal loss, preeclampsia, low birth weight and maternal mortality [7,8]. Although poor dietary intake is a common cause of micronutrient deficiencies, the root cause is linked with low socioeconomic status and lack of knowledge about healthy eating patterns [9].

Ethiopia is among the nations with the highest infant and maternal mortality rates in the world and the Intergenerational effect of Protein energy under nutrition and micronutrient deficiencies has been

attributed as a major cause of maternal and infant mortality. The prevalence of anemia among women in reproductive age group is 17%. In addition, the prevalence of underweight among women in reproductive age is 28%, and subclinical iodine deficiency during pregnancy is 82.8%. Nutrition education at ANC visit is undeniably crucial to overcome such a kind health outcome or curb intergenerational cycle of malnutrition [10,11]. Several studies documented that nutrition education helps the mother to adhere healthy behavioral practices and controlling medical and other associated health risk factors to improve both mother's health and pregnancy outcomes [7,12,13]. World Health Organization (WHO) also recommends that ANC providers should provide adequate, specific and acceptable nutrition related advice to their ANC clients during every visit of antepartum [10].

Nutrition education during pregnancy about healthy diet and healthy lifestyle during pregnancy can be the right time to encourage adequate daily iron, folic acid intake, and other pregnancy specific foods [7]. Nutrition education programs endeavor to improve participants' dietary intakes during pregnancy by promoting balanced diet. Overwhelming evidence suggests that nutrition education during pregnancy has significant impact on knowledge and dietary habit of pregnant women, which enables to improve maternal and birth outcome of pregnancy [14-16]. However to what extent the knowledge and practice of pregnant women improved by nutrition education interventions in Ethiopia remain largely unknown. Therefore this study aimed to evaluate the effect of nutrition education on knowledge and practice among pregnant women during pregnancy in Addis Ababa, Ethiopia. The findings of this study may contribute to the national effort in improving nutritional status of women and children to identify strategies that improve nutritional status during the first 1000 days of life.

Methods

Study design and period

Facility based before-after cross sectional study was employed from March to May of 2016.

Study area

Akaki Kality sub city is one of the largest sub city among the 10 sub cities of Addis Ababa city administration which is located in the southern part of the city, 20 Km far from the center [17]. The Sub-city is characterized by typical flow of illiterate population especially women to work in one of the many factories located in the Sub-city. Due to its closeness to neighboring Oromia towns and new settlements, the Sub-city has an estimate of 200,000 extra catchment populations in addition to the population projection. According to 2014/2015 report estimate, there were 5,030 pregnant women in the Sub city, with coverage for the first and fourth ANC visits at 147% and 93% respectively.

Study population

All pregnant women who stayed at least 6 months in the region and attended antenatal care follow-up during the study period at any of the health facilities of Akaki Kality Sub-city. In addition, only pregnant women who were on second and third trimester pregnancy were eligible to take part in this study.

Sample size determination

A total sample of 422 pregnant women were selected. Sample size was determined using single population proportion formula by taking all the necessary assumptions for cross sectional study: 95% confidence level with an assumption of 50% proportion of knowledge on nutrition among pregnant women due to the lack of similar study in the study area. Based on these assumptions the total estimated sample size of the study was found to be 384. By considering 10% drop-out from follow-up, the final sample size was 422 pregnant women.

Sampling technique and procedure

The calculated sample size was proportionally allocated to the selected health facilities based on the average number of clients who visited ANC follow up prior to the study period in the respective health facilities. Simple random sampling was used to select the pregnant women from each health facility based on their medical registration number.

Study variables

Outcome variable and measures: The two outcome variables in this study were:

Knowledge of pregnant Women: A pregnant woman was classified as knowledgeable if her knowledge score was 6 and above out of 9 and not knowledgeable if her score was <6 out of 9. The knowledge components were knowledge of the pregnant women on eating variety of food, increasing amount to eat during pregnancy, use of iodized salt, iron supplement duration and food source of Iron, need for supplements in addition to regular foods, diet related restrictions during pregnancy.

Healthy dietary practice among pregnant women: A woman was considered as having appropriate pregnancy specific nutrition practice if she is practicing at least 7 of the following 11 practices listed below [18-22]:

1. Adding at least one additional meal from what used to be in her non pregnant state,
2. Eating 2 to 3 servings of meat, fish, nuts or legumes,
3. Eating 2 to 3 servings of dairy (milk, eggs, yogurt, cheese),
4. Eating 2 servings of green vegetables; 1 serving of a yellow vegetable,
5. Eating 3 servings of fruit,
6. Eating 3 servings of whole grain breads, cereals, or other high-complex carbohydrates,
7. Using Iodized salt,
8. Adheres to her Iron supplements every day
9. Avoids alcohol use and smoking,
10. Decreases caffeine intake from what was in her pre-pregnancy days,
11. Not avoiding food types totally during the pregnancy period.

Covariates: The exposure of interest in this study include age categorized into four groups (15-19, 20-24, 25-29 and 30+); marital status was classified as single, married, separated, divorced and widowed, gravidity, parity, number of ANC visits, marital status, educational status of pregnant women and partners, average monthly income, occupation and source of information.

Data collection procedure

Data was collected in two phases using data collection tool of 9 point knowledge and 11 point practice questions. The tool was modified from FAO/WHO KAP assessment of nutrition and a book for Nutrition and Lifestyle for pregnancy and Breastfeeding [18-20].

The first phase of the data collections was conducted right before pregnant women receiving nutrition education from their ANC providers while phase two was collected after the intervention of nutritional education. The client was appointed to comeback after 4 weeks for follow up and phase two data was obtained. To those that did not show up on the appointment on date, the data collectors used phone interview to obtain the post-counselling data.

Data processing and statistical analysis

Data was entered to cleaned and analyzed using IBM, SPSS version 20 statistical software. Descriptive data analyses were performed to generate frequencies and proportions from each variable in relation to the outcome variable. Pre-test Knowledge component was compared with their respective post-test questions to see the significance of change in each question. For each component Confidence Interval of proportions in the pre and post counselling phase was calculated and observed for overlap. The change in each component from pre to post counselling was said to be significant if the Confidence interval of the two proportions does not overlap. This similar technique was applied in practice score for each dietary practice components. The overall knowledge and practice scores of pregnant women before and after nutrition education were tested using paired t-test.

Ethical considerations

Ethical clearance was obtained from Addis Ababa University School of Public Health ethical review board. Permission was secured from Akaki-Kality Sub-city Health Office and Tirunesh Beijing Hospital. An informed verbal consent was obtained from all the study participants by explaining the purpose of the study. Besides, all the information collected from the study participants was kept confidential.

Result

Out of 422 pregnant women Interviewed in the pre-nutrition education, 406 were successfully followed to the post-nutrition education interview. Coupled data obtained from 406 participants for the analysis with 96.3% retention rate. The mean age of pregnant women was 26.6 (SD ± 3.9) and the majority 78.1% of the participants lies in between the age 20 to 29 years. Regarding the level of education 76.1% of the study participants were attended primary education and above. Among the study participants 38.7% of the participants were housewives and 44.5% were employed. The majority of the study participants 91.6% were currently married. The study participants had an average 2.7 (SD ± 1) family size and average monthly household income of the study participants were 3,141 ETB (SD ± 1,588 ETB)

Regarding obstetric history 51.2% of the study participants were Primigravida, 54.2% were Nuli-para, and 28.6% of the participants came for their first ANC follow up for the index pregnancy. The mean gestational age of ANC attendants was 27.1 (SD ± 6.8) (Table 1).

Variable	Categories	Frequenc y	Percent (%)
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Age	15-19	21	5.2
	20-24	136	33.5
	25-29	181	44.6
	≥ 30	68	16.7
Gravidity	Prim gravida	208	51.2
	Multigravida	198	48.8
Parity	Nuli-para	220	54.2
	Primi-para	118	29.1
	Multi-para	66	16.3
	Grand multi-para	2	0.5
Religion	Orthodox	309	76.1
	Muslim	64	15.8
	Protestant	29	7.1
	others	4	1
Gestational Age	Second TMP	169	41.6
	Third TMP	237	58.4
Number of ANC visits	1	116	28.6
	2	126	31
	3	122	30
	4+	42	10.3
Marital status	Single	23	5.7
	Married	372	91.6
	Separated	5	1.2
	Divorced	4	1
	Widowed	2	0.5
Level of Education	Illiterate	44	10.8
	Read and write	53	13.1
	Primary Education	118	29.1
	Secondary Education	94	23.2
	Collage and above	97	23.9
Partner's Level of Education	Illiterate	20	4.9
	Read and write	51	12.6
	Primary Education	102	25.1
	Secondary Education	117	28.8
	Collage and above	96	23.6
Occupational status	Unemployed	43	10.6
	Student	10	2.5
	Housewife	157	38.7

	House servant	6	1.5
	Daily laborer	4	1
	Merchant	5	1.2
	Government employee	72	17.7
	Private employee	109	26.8
Family size	1	14	3.4
	2	198	48.8
	3	118	29.1
	4+	76	18.6
Monthly Family Income (ETB)	<1500	65	16
	1500-1999	4	1
	2000-2499	69	17
	2500-2999	21	5.2
	3000-3499	96	23.6
	3500-3999	19	4.7
	4000-4499	43	10.6
	4500-4999	4	1
	≥ 5000	85	20.9

Receiving Information	Nutrition	Yes	356	87.7
		No	50	12.3

Table 1: Socio demographic status of pregnant women attending ANC at respective health facility, Addis Ababa April 2016.

Knowledge of pregnant women on nutrition during pregnancy

The mean overall knowledge score of appropriate nutrition among pregnant women was found to be 5.5 (SD ± 2). Among study participants, 53.9% of them have adequate knowledge regarding appropriate nutrition during pregnancy.

Less than half of the pregnant women (43.8%) believe to eat variety of food during pregnancy and 270 (66.5%) have knowledge on the need to eat more during pregnancy than their non-pregnant state. Meat, liver and fish were known by 129 (31.8%) participants as a good food source of Iron, while 145 (34.7%) of the participants thought vegetables as good food source for Iron and 132 (32.5%) reported don't know.

Use of Iodized salt during pregnancy was known by 323 (79.6%) of the participants. Only 144 (35.5%) of the study participants reported that the duration of Iron supplementation was for 6 months, while 113 (27.8%) for 3 months and the rest did not know the duration of Iron tablet supplementation.

One third of the pregnant women in the study (275) knew the need for supplementation of important minerals and vitamins during pregnancy. Of the study participants, 335 (82.5%) and 263 (64.8%) knew maternal under nutrition would bring fetal and maternal complications respectively (Table 2).

Knowledge Type	Categories	No	%
Knowledge on eating variety food	Variety of food	178	43.8
	Only what she craves	165	40.6
	Don't know	63	15.5
Knowledge on increasing amount of food during pregnancy	More food	270	66.5
	Less food	25	6.2
	The same as	111	27.3
Knowledge on food source for iron	Red meat, liver and fish	129	31.8
	Fruits and vegetables	145	35.7
	Don't know	132	32.5
Knowledge on using iodized salt during pregnancy	No	83	20.4
	Yes	323	79.6
Knowledge on fetal complication of maternal under nutrition	No	71	17.5
	Yes	335	82.5
Knowledge on maternal complications of under nutrition	No	143	35.2
	Yes	263	64.8

Knowledge on duration of Iron supplementation	6 months	144	35.5
	3 months	113	27.8
	don't know	149	36.7
Knowledge on necessity of supplementation because of inadequacy of nutrients in foods	No	131	32.3
	Yes	275	67.7
Knowledge on effect of maternal under nutrition on fetal weight	Low birth weight and still birth	336	82.8
	No effect on fetal Weight	5	1.2
	Don't know	65	16

Table 2: Knowledge of nutrition during pregnancy among pregnant women attending ANC at respective health facility, Addis Ababa April 2016.

In this study the main source of information reported by the study participants were health professionals 59%, families and friends 20%, mass media (television and radio) 9%, and the rest 12% did not received any previous information on nutrition during pregnancy (Figure 1).

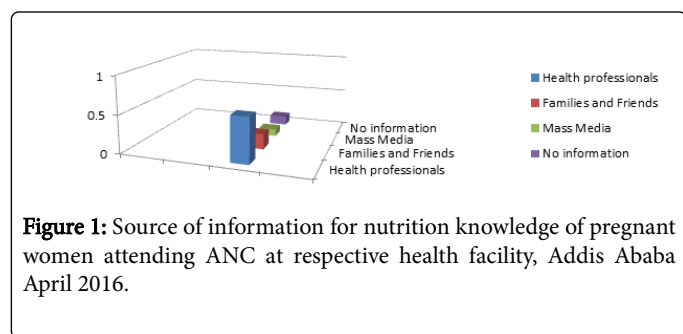


Figure 1: Source of information for nutrition knowledge of pregnant women attending ANC at respective health facility, Addis Ababa April 2016.

The practice of pregnant women on appropriate nutrition during pregnancy

All of the pregnant women were assessed during the great lent when most Orthodox Christian fast or abstain from eating any animal products but due to the limited number of pregnant women who reported fasting (5.4%) the analysis was not adjusted in anyway.

Before nutritional education, two hundred eighty three (69.7%) of the participants have added at least one additional meal during their current pregnancy. When study participants interviewed on the type of food recommended at servings of a day's meal, 204 (50.2%) were in line with meat and legume servings (protein foods), 172 (42.4%) in line with dairy products, and 187 (46.1%) in line with green vegetable servings. Less than half (44.1%) of the pregnant women reported eating at least two fruits per day.

The adherence of pregnant women for Iron supplement tablet in one week before the survey was 69%. Three hundred thirty six (82.8%) reported using iodized salt for cooking in their current pregnancy. Only 55 (13.5%) pregnant women reported alcohol use and 250 (61.6%) decreased their coffee consumption during their current pregnancy.

One hundred eleven (27.3%) participants have avoided one or more food types in their current pregnancy. The most frequently avoided foods were meat, grains, dairy products and spicy foods. The reason for avoiding food groups were having nausea and vomiting when

consumed the food (39.6%), not like the food (49.5%) and being told by other people it will harm pregnancy (9.9%). The overall mean score practice of pregnant women was found to be 6.2 (SD ± 2) out of 11. The proportion of women with good practice on nutrition during pregnancy was 46.8% (190/406) (Table 3).

Nutrition Practice specific to Pregnancy	Categories	No	%
Addition of at least one additional meal from non-pregnant diet	No	123	30.3
	Yes	283	69.7
Eating 2 to 3 servings of meat, fish, nuts or legumes per day	No	202	49.8
	Yes	204	50.2
Eat 2 to 3 servings of dairy (milk, eggs, yogurt, and cheese) per day	No	234	57.6
	Yes	172	42.4
Eat 2 servings of green vegetables; 1 serving of a yellow vegetable per day	No	219	53.9
	Yes	187	46.1
Eat 2 to 3 servings of fruit per day	No	227	55.9
	Yes	179	44.1
Eat 3 servings of whole grain breads, cereals, or other high-complex carbohydrates	No	128	31.5
	Yes	278	68.5
Use Iodized salt	No	70	17.2
	Yes	336	82.8
Taking 7 Iron supplement tablets in the past week	No	126	31
	Yes	280	69
alcohol use and smoking in the current pregnancy	No	351	86.5
	Yes	55	13.5
Decreasing coffee use	No	156	38.4
	Yes	250	61.6
Avoiding one or more food type during pregnancy	No	295	72.7

	Yes	111	27.3
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Table 3: Pregnancy specific Nutrition practice among pregnant women attending ANC at respective health facility, Addis Ababa April 2016.

The effect of nutrition education on pregnant women knowledge

The present study showed that significant improvement in awareness level of pregnant women who received nutrition education. The nutritional knowledge of pregnant women after taking nutrition education significantly increased from 53.9 (95% CI: 48.9, 58.8) to 97% (95% CI: 94.8, 98.5).

The knowledge of pregnant women significantly increase in all knowledge components except the effect of maternal under nutrition leads to fatal complication (82.5%, 95% CI: 78.4, 86.1 to 89.4%, 95% CI: 85.9, 92.2). The proportion of pregnant women with knowledge on eating variety of food increased from 43.8% to 85.7%. Similarly knowledge on using iodized salt, Knowledge on maternal complication as a result of under nutrition during pregnancy, knowledge on duration of Iron supplementation, and knowledge on food source for iron increased from 79.6% to 95.6%, 64.8% to 91.4%, 35.5% to 92.1%, and 31.8% to 86.9 respectively (Table 4).

Knowledge Questions	Categories	Pre-Counseling		Post-Counseling	
		No	Proportion (95% CI)	No	Proportion (95% CI)
Overall knowledge	Knowledgeable	219	53.9 (48.9, 58.8)	394	97.0 (94.8, 98.5)*
	Not Knowledgeable	187	46.1	12	
Knowledge on eating variety food without avoiding food	No	228	56.2	58	85.7 (81.9, 88.9)*
	Yes	178	43.8 (38.9, 48.8)	348	
Knowledge on increasing amount of food during pregnancy	No	136	33.5	45	88.9 (85.4, 91.7)*
	Yes	270	66.5 (61.6, 71.0)	361	
Knowledge on food source for iron	No	277	68.2	53	86.9 (83.3, 90.1)*
	Yes	129	31.8 (27.3, 36.5)	353	
Knowledge on using iodized salt during pregnancy	No	83	20.4	18	95.5 (93.1, 97.1)*
	Yes	323	79.6 (75.3, 83.4)	388	
Knowledge on fetal complication of maternal under nutrition	No	71	17.5	43	89.4 (85.9, 92.2)
	Yes	335	82.5 (78.4, 86.1)	363	
Knowledge on maternal complications of under nutrition	No	143	35.2	35	91.4 (88.2, 93.9)*
	Yes	263	64.8 (59.9, 69.4)	371	
Knowledge on duration of Iron supplementation	No	262	64.5	32	92.1 (89.1, 94.5)*
	Yes	144	35.5 (30.8, 40.3)	374	
Knowledge on necessity of supplementation because of inadequacy of nutrients in foods	No	131	32.3	36	91.1 (87.9, 93.7)*
	Yes	275	67.7 (62.9, 72.2)	370	
Knowledge on effect of maternal under nutrition on fetal weight	No	70	17.2	9	93.3 (90.4, 95.5)*
	Yes	336	82.8 (78.7, 86.3)	397	

*Confidence interval of all the proportions does not overlap suggesting Significant in change from pre-counseling

Table 4: Pre and post counseling knowledge of pregnant women attending ANC at respective health facility, Addis Ababa April 2016.

The finding of this study showed that nutrition education has a positive effect on the change of pregnancy specific dietary practice. The overall pregnancy specific dietary practice of pregnant women increased from 46.8% (95% CI: 41.8, 51.7) to 83.7% (95% CI: 79.8, 87.2).

Higher proportion of pregnant women changed their practice of pregnancy related diet by taking additional extra meal from non-pregnant state from (69.7% to 100%), eating 2 servings of green leafy vegetables from (46.1% to 88.2%), use of Iodized salt (82.8% to 96.1%), and adherence to Iron supplement (69% to 100%).

There was no significant change in practice of pregnant women with regard to consuming recommended daily servings of grains and cereals and servings of dairy products among the study participants (Table 5).

Nutrition Practice specific to Pregnancy		Pre-Counseling		Post-Counseling	
		No	Proportion (95%CI)	No	Proportion (95%CI)
Overall practice	Good practice	190	46.8 (41.8, 51.7)	340	83.7 (79.8, 87.2)*
	No practice	216	53.2	66	16.3
Added at least one additional meal from non-pregnant diet	No	123		0	0
	Yes	283	69.7 (64.9, 74.1)	406	100**
Ate 2 to 3 servings of meat, fish, nuts or legumes per day	No	202	49.8	157	38.7
	Yes	204	50.2 (45.3, 55.2)	249	61.3 (56.4, 66.1)*
Ate 2 to 3 servings of dairy (milk, eggs, yogurt, and cheese) per day	No	234	57.6	204	50.2
	Yes	172	42.4 (37.5, 47.3)	202	49.8 (44.8, 54.7)
Ate 2 servings of green vegetables; 1 serving of a yellow vegetable per day	No	219	53.9	48	11.8
	Yes	187	46.1 (41.1, 51.0)	358	88.2 (84.6, 91.2)*
Ate 2 to 3 servings of fruit per day	No	227	55.9	161	39.7
	Yes	179	44.1 (39.2, 49.1)	245	60.3 (55.4, 65.1)*
Ate 3 servings of whole grain breads, cereals, or other high-complex carbohydrates	No	128	31.5	127	31.3
	Yes	278	68.5 (63.7, 72.9)	279	68.7 (63.9, 73.2)
Used Iodized salt	No	70	17.2	16	3.9
	Yes	336	82.8 (78.7, 86.3)	390	96.1 (93.7, 97.7)*
Took 7 Iron supplement tablets in the past week	No	126	31	0	0
	Yes	280	69.0 (64.2, 73.4)	406	100**
Used Alcohol	No	351	86.5 (82.7, 89.6)	406	100**
	Yes	55	13.5	0	0
Decreased coffee use	No	156	38.4	95	23.4
	Yes	250	61.6 (56.6, 66.3)	311	76.6 (72.2, 80.6)*
Avoided one or more food type during pregnancy	No	295	72.7 (68.0, 76.9)	339	83.5 (79.5, 86.9)*
	Yes	111	27.3	67	16.5

**One-sided, 97.5% confidence interval.
*Confidence interval of the proportions does not overlap suggesting Significant in change from pre-counseling.

Table 5: Pre and post counseling practice of pregnant women attending ANC at respective health facility, Addis Ababa April 2016.

Discussion

The present study revealed that the knowledge of pregnant women on nutrition during pregnancy significantly increased from 53.9% to 97% after the provision of nutrition education while the pregnancy specific dietary practice of the pregnant women increased from 46.8% to 83.7%.

Midwives and nurses in this study were the source of information for 59% of the pregnant women. The result of this study was higher

than the study conducted in Gambia that showed the source of information for the study participants were 35% being informed on nutrition and diet by their ANC providers [23]. Although the result of this study was higher than the study conducted in Gambia much effort was needed to improve nutrition education to adequately provide the necessary information which is crucial to prevent the Intergenerational effect of malnutrition.

The result of this study also showed that the proportion of mothers who have appropriate knowledge on maternal nutrition during

pregnancy was found to be 53.9%. The result of this study is similar with the study conducted in America in which more than half of the women in the study had the basic and essential knowledge regarding importance of nutrition during pregnancy [24]. This result is lower than the study conducted in Malaysia: 65.7 % and Swaziland 67% of mothers had appropriate knowledge towards maternal nutrition [25,26]. Whereas the result of this study is higher than the study conducted in Egypt: 46% of mothers had appropriate knowledge regarding maternal nutrition [23]. However it was the same level with the result of a study done in East Wollega, elsewhere Ethiopia 52.5% of the respondents had the knowledge that food during pregnancy is important for bodies' energy and heat [27]. This discrepancy might be related to socioeconomic and cultural difference of the study participants.

In this study 64.8% pregnant women understood that maternal under nutrition would bring fetal complications. The result of this study was higher than the result obtained from East Wollega, Ethiopia: 34.8% of pregnant women had knowledge that inadequate nutrition during pregnancy can cause maternal complications like miscarriage or preterm birth [27]. Another cross sectional study conducted in India reported that the proportion of mothers who had knowledge towards maternal nutrition during pregnancy leads to maternal complication was 27.4% [28]. This discrepancy might be due to the difference in disease causation beliefs of the areas which in turn affected by difference in knowledge, cultural and spiritual influences.

The result of this study revealed that 66.5% of the study participants have knowledge on need of eating more during pregnancy than their non-pregnant state. This is lower than the study conducted in Pakistan which reported that 84% of mothers had knowledge on increasing or adding extra food items in the diet during pregnancy than non-pregnant state [29]. The discrepancy of the two studies may be due to the fact that the differences between the study participants; pregnant women in Pakistan may have a better educational level, economic status and more access to nutrition information during pregnancy than Ethiopian pregnant women.

In this study 31.8% pregnant women have knowledge on food source of Iron; the result was lower than the study conducted in India 61.3% [30]. This study also showed that only 35.5% of the study participants reported that duration of Iron supplementation being for 6 months, while 27.8% reported as it was given for 3 months and the rest did not know the duration of Iron supplementation during pregnancy. Although Iron supplementation during pregnancy was promoted *via* Television and Radio in Ethiopia the finding of this study showed that more than half of the study participants lacked the essential knowledge regarding iron supplementation. This can be attributed to the fact that women lack access to information so that audience-specific education and promotion of the use of iron supplementation during pregnancy should be emphasized *via* different information dissemination channels in the study area to reach to the target group.

The result of this study also revealed that the proportion of pregnant women with good pregnancy specific nutrition practice was found to be 46.8%. Similarly the study conducted in Swaziland reported that 51% pregnant women had good practice regarding nutrition during pregnancy [25]. On the other hand a higher proportion of pregnant women with good nutrition practice were reported from another study conducted in Malaysia 74% and Pakistan 65.5% [24,29]. The possible reasons for these differences might be related to the difference in

socioeconomic status, cultural believes, access to nutrition and health services among the study participants.

In this study 69.7% of the pregnant women have added at least one additional meal from non-pregnant state. Another study conducted in Wondo Genet, Ethiopia also reported that 75.2% of the pregnant women did not take any additional meal during pregnancy. The economic disparities and knowledge difference may have an effect on this discrepancy [31].

The result of this study revealed that the practice of pregnant women on recommended food servings of meal per day during pregnancy: 42.4%, 46% were in line with dairy products and green vegetable servings respectively. The result of this study was consistent with the study conducted in USA where 42.7% of the participants had habit of drinking milk daily. Whereas regarding green vegetables unlike to this study the study conducted in America reported that 58.9% of respondents had a habit of daily eating fresh vegetables [32]. Difference in diet of the two communities and the knowledge difference may create these disparities.

The adherence for Iron supplements in one week before the survey of this study was 69% which is close to results from America 63.7% and India 62% on antenatal mothers consuming Iron folate tablets [30,32]. The similarity of these results may be due to similar intervention strategies used, supplementation and one to one education and Iron supplementation.

Among the study participants 27.3% avoided one or more food types in their current pregnancy. In the study conducted in Wondo Genet, Ethiopia 21% of pregnant women were restricting their food intake by avoiding some food groups [31]. The common reasons for avoiding food groups in this study were having nausea and vomiting with consuming the food 39.6%, not liking the food 49.5% and being told by other people it will harm pregnancy and food taboo 9.9%. In accordance with the result of this study the previous study conducted in Shashaman, elsewhere Ethiopia reported that food taboo is one of the reason identified [33]. The possible explanations for the difference of the two studies may be due to the fact that the differences between the study participants, the present study was conducted on urban communities (pregnant women) which can be better than rural mothers in terms of education, better access to nutrition information during pregnancy, and cultural believes: whether right or wrong, tend to shape behaviors. However, this finding also shades hope that such misconceptions and taboos may gradually be circumvented with increased access to education and health services [34].

In this study the most frequently avoided foods by pregnant women were meat, grains, dairy products, vegetables and spicy foods. This is almost similar with what pregnant women also avoided in Shashamane, Ethiopia [33].

After the implementation of Nutrition education in this study the proportion of pregnant women with good knowledge of nutrition during pregnancy increased from 53.9% to 97% which support the previous study conducted in Iran: the positive effect of nutrition education observed in knowledge change was from 3% to 31%. [35]. This is in agreement with study done in India which found an overall nutritional knowledge improvement from mean score of 22 to 32.7 at pre and post assessment respectively [30]. These results can implicate the effectiveness of nutrition education in improving knowledge of pregnant women on nutrition during pregnancy. Higher change in nutrition knowledge among pregnant women 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 this study pregnancy specific dietary practice of the pregnant women increased from 46.8% to 83.7%. Increase in consumption of most foods observed after nutrition education of this study was in agreement with a Dutch study where there was a significant increase in the amount of almost all the food groups consumed in the post-Nutrition Education as compared to non-Nutrition Education and pre-Nutrition Education group [23].

Several limitations need to be considered when interpreting our findings. First, although maximum effort was made to restrict the knowledge and practice change to the effect of nutrition education at the ANC, limiting the effect of other sources like TV and radio broadcastings was beyond the scope of this research. Any random or systematic measurement error in self-reported data might affect the observed result in this study.

Conclusions and Recommendations

Nutrition education to pregnant women during their ANC visit improved the nutrition knowledge of pregnant women. It also helps to improve dietary intake during pregnancy and enhance adherence to supplements. Thus the ministry of health (MOH) and other concerning organizations should broaden the current focus of Iron supplementation during pregnancy to audience specific practical nutrition education to improve nutrition knowledge of pregnant women.

Authors' contributions

AZ has contributed in the design, data collection and write up of the study protocol, ME has contributed in the design, manuscript development and revisions, MA has contributed in the revision and write up of the manuscript, SF, and RY has also contributed in revising the manuscript.

Competing interests

The authors declared that they have no competing interests.

Availability of data and materials

The data used for analysis could be made available up on request.

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