Effects Of Nutrition Education And Counseling Intervention On Maternal Weight And Obstetric Outcomes Among Pregnant Women Of Gedeo Zone, SNNPR, Ethiopia, 2019, Cluster Randomized Control Trial

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Abstract

Background

A good approach to improve maternal diet during pregnancy is nutrition education and counseling. However, due to the scarcity of intervention trials, especially in Ethiopia, the effect of nutrition education and counseling intervention on pregnancy outcomes is not well studied.

Objective

To assess the effect of nutrition education and counseling on maternal weight and the outcomes of pregnancy among pregnant women in public health care institutions of Gedeo Zone, Southern, Ethiopia.

Methods

A cluster randomized control trial study design was undertaken. Simple random sampling followed by cluster sampling was used to reach eligible study participants. A total sample of 235 (115 intervention vs. 120 control group) pregnant women who followed antenatal care service in public health facilities of Gedeo Zone were included in the study. Independent t-test was used to analyze the group difference for continuous variable and chi-square test for categorical variables. The post intervention values between two groups were compared using ANCOVA by adjusting to the baseline variables.

Result

After nutrition education and counseling, pregnant women in the control group had less weight gain than in the intervention (65.03kg vs. 56.69kg, $p = 0.001$). The proportion of LBW neonate was 17.8% in the intervention group and 38.2% in the control group ($p < 0.001$). Multivariable logistic regression analysis showed that the risk of LBW in the control group was 2.43 more likely than in the intervention group (AOR = 2.43; 95% CI: (1.2, 4.92)).

Conclusion

Nutrition education and counseling delivered to pregnant women on the time of pregnancy could reduce maternal malnutrition and low birth weight. We can recommend that; the intervention is easy to implement in health facilities of Gedeo zone and would be implemented without delay to achieve sustainable development goals.

The trial was retrospectively registered in Pan African Clinical Trial Registry (www.pactr.org) database with unique identification number for the registry is PACTR202101757871954.

Background

Pregnancy is critical phase in a girl's life, and in this situation, women need aware of the healthy diet importance and information related to nutrition. Adequate nutritious food during pregnancy is important

for the woman's health as well as the healthy growing fetus and economic productivity later in life (1).

Appropriate nutrition during pregnancy plays a fabulous role both for the mother and fetus because of the high nutrient and energy requirements. An adequate nutrient intake by the women before and during pregnancy can reduce the risk of medical problems of women's health and her infant (2, 3).

Stillbirth, miscarriage, low birth weight, death, delayed cognitive development, and sub-optimal productivity are all possible outcomes of malnutrition in pregnant women (4, 5).

In low- and middle-income countries of the world; many pregnant women have inadequate dietary intake of vegetables, meat, dairy products, and fruit (6). One factor that affects nutrient intake during pregnancy is insufficient knowledge of the pregnant women on diet (7).

Nutrition education and counseling is a good approach to improve the nutritional status of women and gestational weight gain during pregnancy (7–10). Nutrition education and counseling focus on enhancing intake of nutritious food during the third and fourth trimester of pregnancy significantly reduced the prevalence of low birth weight and increased maternal weight (11).

In Ethiopia, the extent of maternal and child death is high because of under-nutrition and micronutrient deficiencies. The Ethiopian Demographic Health Survey reported that a maternal mortality rate of 412 per 100,000 live birth and 67 child deaths per 1000 live births in 2016, and the prevalence of low birth weight (infant's weight less than 2.5kg) was 13.5% (12).

There is a high occurrence of insufficient dietary diversity practice among pregnant women in various parts of Ethiopia. In rural areas pregnant women had limited understanding on dietary diversity practices and they have positive attitude towards nutritional education.

In Ethiopia, 62% of pregnant women received at least one ANC visit for their most recent birth, and 66% of these women claimed to have received nutritional education and counseling, although the quality and quantity of this counseling was unknown (12).

Malnutrition among pregnant women and their children will remain a major concern in Ethiopia and other low- and middle-income countries until an adequate nutritional education and counseling program can be included into existing programs such as ANC (6). The effect of nutrition education given by the usual health service should be examined, and possible remedial action should have to be taken. Therefore, this study aimed to investigate the effect of nutrition education and counseling on the obstetric outcomes of pregnancy among pregnant mothers in Gedeo zone, southern Ethiopia.

Methods

Study Design and Period

Institutional based cluster randomized control trial was conducted from January to July 2019.

Source and study population

All pregnant mothers attending anti natal care service at public health facilities of Gedeo Zone were the source population and randomly selected pregnant mothers that followed ANC service at randomly selected public health facilities of Gedeo Zone were the study population.

Inclusion and Exclusion Criteria

All Pregnant mothers in the second trimester (4th & 5th month) of pregnancy attending ANC service at selected health institutions were included in this study and pregnant mothers < 18 years and comorbidities with complications and special requirements were excluded from the study.

Sample Size Determination

The sample size for this study was calculated using online calculator for cluster randomized control trial with the following assumption. The standard normal deviate for $\alpha = Z\alpha = 1.96$, Power = 80%, number of clusters in each group 3 (advisable to limit the number of clusters), the average number of cluster size $m = 42$ (Obtained from health facilities Average ANC customer flow) and within-cluster correlation coefficient (ρ), ICC = 0.01. Design effect = $1 + (\rho (m-1)) = 1.41$ (13), Intervention group size = $N'1 = 101$, and Control group size = $N'0 = 101$; Size of combined group Total, $N = 202$. Adding 20% nonresponse rate, finally 242 (121 in control and 121 in the intervention group) were enrolled in this study. Because of problems as described in Fig. 1, the actual data were collected from 115 pregnant women in the intervention group and 120 pregnant women in the control group. The CONSORT diagram of this the trial was prepared based on the Consolidated Standards of Reporting Trials (CONSORT) statement (Fig. 1).

The ethical letter was obtained from the Ethical Review Committee of Dilla University with unique number 007/19-01) to conduct the trial.

Sampling Procedure

From the total of 38 public health institutions in Gedeo zone, six institutions namely (Dilla hospital, Wonago hospital, Bulle hospital, Yirga chefe hospital, Cheleleketu health center, and Gedeb Hospital) were selected by a simple random sampling method. These institutions were equally and randomly assigned as an intervention group and control group using the SRS (lottery) method. Information about patient flow to the health institutions indicated that an average of 42 women for two weeks. The computed sample size was proportionally distributed to the selected health care institution based on the average number of women who visited ANC service. Pregnant women from each health institution were selected by simple random sampling technique based on their medical registration number.

Data Collection Instruments and Procedures

Using pre-designed structured questionnaires, data were collected by interview, anthropometric measurements, and hemoglobin level measurement. The questionnaires were composed of socio-

demographic and economic factors, feeding practices, and adherence to iron-folic acid supplementation. The data collectors were six trained female Diploma Nurses and three BSc Nurses meant supervision should be accomplished by recruited supervisors. The training was given by a nutritionist.

Anthropometric Measurements: Measurements were taken by standardized and calibrated equipment. Height was measured barefoot on a cleaned surface, in light clothing and avoid any pins and braids from the hair that could affect the measurement and recorded to the nearest 0.1cm and positioning the subject at the Frankfurt plane using a stadiometer Seca (Germany). Weight was measured with light clothing in a closed room by a female data collectors and recorded to the nearest 0.1 kg using UNICEF Seca digital weighing scale (Germany) (Gibson, 2005) (14). Mid-upper arm circumference (MUAC) was taken from the left-arm using non-stretchable flexible tape.

Dietary Diversity Score (DDS): was computed for each pregnant woman during the previous 24 hours. The dietary questionnaires contained ten different food groups based on their nutrients: those include grains (white roots, tubers, and plantains), pulses (beans, peas, and lentils), nuts and seeds, dairy, meat (poultry and fish), eggs, dark green leafy vegetables, vitamin A-rich fruits and vegetables, vegetables, and fruits. To categorize women's dietary diversity, as women who eat five or above and less than five different food items have a high and low dietary diversity score respectively (15).

Nutrition Education and Counseling: It was given by an experienced health education and nutrition experts and delivered to the intervention group four times based on the time frame for consecutive four months. The content of NEC is modified from the new Blended Training Module on Nutritional Counseling for Pregnant Women in Ethiopia (10, 16). Each education sessions were for one hour, and the first section was before an initial interview to obtain baseline data. The nutrition educations were delivered in a counseling format and emphasis on promoting behavioral change. The content of the section included the nutritional value of food, the essence of balanced diet, cooking practices for optimum retention of nutrients, and creating awareness about food taboos relating to pregnancy and infant feeding, health, and hygiene practices, disease control, food frequency demonstration provided on cooking vegetables, highly nutritious local dish that can be made with affordable, readily available ingredients. The method of education delivered consists of lectures, questions, and answers, role play, drama, brochures, leaflets photographs were used to deliver key information; finally, specific counseling was given to the intervention groups individually during their ANC follow-up.

Women in the control group received nutrition counseling (routine health service) given by health extension workers based on the general usual service.

Operational Definitions

Gestational Weight Gain: Is defined as any additional weight the woman gains during pregnancy from the point of conception to the end of the pregnancy.

Low Birth Weight: weight of less than 2500g at birth.

Intervention Group: Those who receive intensive NEC by nutritionist expert, According to the new blended Training Module on Nutritional Counseling for Pregnant Women in Ethiopia (10).

Control Group: Those who receive routine services only.

Data Quality Control

The questionnaire was organized in English and translated into the local language Gedeofa and translated back to English to increase respondents understanding on the question. A pretest of the questionnaire was done on 5% of the sample size at Chuchu health center before the actual data collection. Height and weight measurements were taken twice for each mother. All anthropometric measurements were measured by trained diploma nurses and relative technical error of measurement was calculated to check intra-observer variability. The weight scale would be calibrated to zero levels with no object on it and placed on the level surface before the measurement was performed. The scale of measurements was checked continuously for their reliability. Supervision by the principal investigator was accomplished to check the completeness of the collected data and logical consistency. Therefore, everything would be corrected on the spot.

Data Processing and Analysis

Data was coded and entered by use of EPI-DATA 3.2 and analyzed in Stata-software. Descriptive summaries like frequency, proportions, cross tabs, and graphical presentation. Kolmogorov Smirnov and Leven tests were used to assess the normality and homogeneity of the data. Independent t-test was used to analyze the group difference for continuous variable and chi-square test for categorical variables. The post intervention values between two groups were compared using ANCOVA by adjusting to baseline data. Logistic regression analysis was used to examine the effects of the intervention on low birth weight by adjusting other confounding factors. Here the non-statistical significance result of Hosmer Lemeshow test showed that the multivariable logistic regression model fits the data well, and the association was checked by P-value < 0.05, AOR, and 95% CI were considered as associated factors.

Results

Socio-Demographic Characteristics of Pregnant Women

Among 242 pregnant women who enrolled in this study, 135 (intervention group = 115, control group = 120) were included in the analysis. The mean age of pregnant women in the intervention group was 25.9 (SD $\pm$ 4.9) and 26.01 (SD $\pm$ 5.2); and the most of the pregnant women lies between in the age of 20 to 29 years in both groups. Regarding the status of education 76.1% in the intervention group and 78.2% in the control group of the study, participants were attended primary education and above. At the baseline of this study, the mean body weight of the women was 56.69 kg (SD $\pm$ 6.9) in the intervention group and 55.95 kg (SD $\pm$ 7.6) in the control group.

Generally, at baseline, the two groups were no statistically significant difference in all socio-demographic characteristics of the participants ($P > 0.05$) (Table 1).

Table 1
Baseline characteristics of women in control and intervention group, Gedeo Zone.

Variable	Intervention Group (= 115) n (%)	Control Group (= 120) n (%)	p-value
Age group 15–19	9(7.83)	8(6.6)	0.09
20–24	52(45.2)	37(30.6)	
25–29	31(26.9)	34(28.1)	
30–34	17(7.8)	28(23.1)	
35+	6(5.2)	13(10.7)	
Religion Orthodox	54(45.2)	56(46.2)	0.48
Muslim	40(33.9)	32(26.7)	
Protestant	12(10.6)	21(17.2)	
Other	9(6.8)	11(9.5)	
Women Educational status	24(20.67)	24(20.67)	0.16
No education	41(35.7)	41(35.7)	
Primary	32(27.8)	32(27.8)	
Secondary	18(15.7)	18(15.7)	
Higher and above			
Occupation Of Women	43(37.4)	48(40.2)	0.30
Housewife	26(22.6)	21(17.5)	
Employee	39(33.7)	49(40.8)	
Merchant	7(6.3)	2(1.7)	
Other			
Marital status, Married	99(90.8)	101(84.2)	0.33
Unmarried/Divorced	16(9.2)	19(15.8)	

Continuous values are expressed as mean $\pm$ standard deviation

Variable	Intervention Group (= 115) n (%)	Control Group (= 120) n (%)	p-value
Husband education	16(13.9)	20 (16.5)	0.10
No education	30(26.1)	39(32.5)	
Primary education	47(40.9)	51(42.47)	
Secondary	22(19.3)	10(8.4)	
Higher and above			
Monthly income in ETB	28(23.3)	28(23.33)	0.16
< 999ETB	44(36.7)	27(22.5)	
1000–1999	43(35.8)	65(54.17)	
>= 2000			
Family size <5	97(80.8)	101(84.17)	0.88
>=5	18(19.2)	19(15.83)	
Gravidity Prima	37(32.2)	24(19.7)	0.04
multi-gravidity	78(67.8)	96(79.3)	
Weight	(56.69 ± 6.98)	(55.95 ± 7.6)	0.83
DD score	(11.93 ± 1.6)	(11.58 ± 1.4)	0.09
MUAC	(23.67 ± 2.5)	(23.08 ± 1.76)	0.06
Continuous values are expressed as mean ± standard deviation			

Nutritional Status of Pregnant Women

At the end line of the study the mean scores of weight, MUAC, and dietary diversity scores ($P < 0.01$) were significantly higher in the intervention group compared to the control group. The nutrition education and counseling intervention had a significant effect on maternal weight gain, MUAC, and dietary diversity practice of pregnant women. Weight gain is the difference in weight before labor and weight as on the first ANC visit; gestational weight gain in the intervention arm was significant higher than those in the control group (65.03kg vs. 56.69kg, $p = 0.001$). Women enrolled in the intervention had a mean weight gain of 10.08 kg; however, those in the control group had a mean weight gain of 2.22kg (Table 2).

Table 2

Differences between baseline and end-line measurements of weight, MUAC, and DDS and adjusted group differences (95 % CI) of the posttest.

Variable	Baseline	End line	Adjusted mean difference to controls	p-value
Women's Weight	(54.58 ± 5.1)	(56.8 ± 7.6)	10.08(9.55, 10.60)	0.001
Control	(56.69 ± 6.3)	(65.03 ± 7.2)		
Intervention				
DDS Control	(11.47 ± 1.8)	(11.8 ± 1.6)	0.15(0.16, 0.45)	0.029
Intervention	(11.9 ± 1.5)	(12.5 ± 1.4)		
MUAC Control	(23.04 ± 1.8)	(23.8 ± 1.6)	1.27(1.12, 1.42)	0.00
Intervention	(23.59 ± 2.5)	(24.35 ± 1.4)		
CI; confidence interval, ANCOVA; mean group differences adjusted for baseline variables, economic status, educational level, gravidity...				

Based on this finding the result persists after adjusting the potential confounder variables; and it was concluded that nutrition education and counseling intervention in the study was efficient in terms of improving the dietary practice and better body weight gain of pregnant women.

Comparison of Birth Weight between Intervention and Control Groups

At the end line of this study the mean birth weight in the intervention group was 0.19kg greater than that in the control group (3.07 vs. 2.88 kg, $p = 0.001$). The control group had a larger proportion of newborns with low birth weight than the intervention group. The proportion of LBW babies was 17.5% in the intervention group and 35.2% in the control group ($p < 0.001$) (Table 3).

Table: 3 Comparison of birth weight between intervention and control groups.

	Intervention group n=103	Control group n=108	p-value
Birth weight (kg)	(3.01±0.46)	(2.88±0.4)	0.001
LBW- no. (%)	18(17.5)	38(35.2)	
NBW no.(%)	85(82.5)	70(64.8)	0.001

a. Independent T-test.

b. LBW, low birth weight (< 2.5 Kg); NBW, Normal Birth Weight(≥2.5kg)

c. Chi-square test; Missing from intervention group, n = 12, and from control group, n =

Effect of Nutrition Education Intervention on Birth Weight

After controlling other possible confounder variables (gestational age, maternal weight, family size, source of drinking water and latrine utilization), the multivariable logistic regression analysis showed that the risk of LBW in the control group was 2.43 more likely than in the intervention group [(AOR=2.43; 95% CI: (1.2, 4.92)]. In this analysis, variables that have a statistically significant association with low birth weight were women in the intervention group, no educational level and secondary educational level, and household monthly income <2000ETB. The risk of LBW babies was 2.14 times higher in babies who were born in family monthly income < 2000ETB than with family income $\geq$ 2000ETB [(AOR=2.14; 95% CI: (1.1-4.26)]. The mothers who had no formal educational level had 2.55 times higher chance of having LBW babies than mothers who had secondary and above educational level [AOR=2.55; 95% CI: (1.06, 6.14)] (Table 4).

Table 4 Bi-variable and multivariable logistic regression analyses of low birth weight in public health facilities of Gedeo zone, 2019.

Risk Factors	LBW no. (%)	NBW no. (%)	COR(95%CI)	AOR(95%CI)
Group				
Control	38(35.2)	70(64.5)	2.56(1.35-4.87)*	2.43(1.19-4.93)*
Intervention	18(17.5)	85(82.5)	Ref	Ref
Women's Education				
No education	36(19.1)	38(80.9)	2.24(0.97-5.13)	2.55(1.06-6.14)*
Primary	17(19.4)	49(80.6)	3.36(1.09-5.08)*	2.04(1.02-4.56)*
Secondary & above	12(34.6)	68(65.4)	Ref	Ref
Family Monthly Income				
< 2000	33(22.8)	111(77.2)	0.57(0.3-0.97)*	2.14(1.1-4.26) *
≥2000	23(34.3)	44(65.7)	Ref	Ref
Mother's Occupation				
Housewife	27(32.1)	57(69.9)	1.4(0.27-6.4)	1.4(0.3-3.4)
Employee	10(25.0)	30(75.0)	0.98(0.2-5.3)	0.78(0.2-2.6)
Other	19(21.5)	68(78.5)	Ref	Ref
Mother's End line MUAC				
<23	33(27.7)	87(72.5)	1.17(0.93-3.21)	0.7(0.59-0.96)
≥23	22(24.3)	68(75.7)	Ref	Ref
Women's End line DDS				
Poor Practice	49(29.7)	116(70.3)	0.43(0.18-1.02)	0.46(0.19-1.09)
Good Practice	7(15.2)	39(84.8)	Ref	Ref

*p-value <0.05

Discussion

This study verified the effect of nutrition education and counseling intervention to improve dietary behavior and the effect on weight gain during pregnancy and subsequent birth weight.

To enhance the nutritional status of pregnant women, the World Health Organization (WHO) promotes nutrition education and counseling (17). Therefore, this study tried to assess the effects of nutrition counseling on dietary practices and nutritional status of pregnant women. The result shows that significant improvements in good dietary practice. The result of this finding is similar to those studies done in Pakistan and Iran (7, 11).

In this study the intervention group increased on an average weight gain from the baseline to the ninth month of pregnancy was 10.08kg and 2.22kg for the control group, which was higher than the weight gain reported by studies done in India and Bangladesh (9, 18). The findings of this study confirmed the effectiveness of nutrition education and counseling in improving gestational weight gain and birth weight. The success of this intervention may be due to the study setting; i.e. institutional based intervention method used and others were community based intervention.

The findings of this study also agreed with other studies done in Pakistan, Kenya and West Gojjam zone, Ethiopia (11, 19, 20), where they showed that due to the helpful effect of nutrition education and counseling intervention; women could improve dietary practice and gestational weight gain. Women in the intervention group were more likely to have proper dietary practices than the control groups. The poor counseling practice of the health workers could be a possible explanation for the inappropriate dietary practices of pregnant women in the control group.

In Ethiopia, low birth weight is associated with maternal malnutrition, lack of antenatal care visits, lack of nutrition counseling, birth interval less than two years, inadequate food intake during pregnancy, and a lack of education (21, 22). In this study, the mean birth weight in the intervention group was 0.19kg larger than the mean birth weight of the control group. The finding of this study agreed with other studies done in Bangladesh and west Gojjam Ethiopia (9, 19), where they suggested that low birth weight in the control group was higher than in the intervention group. This difference might be due to the effect of nutrition educations given for the intervention group. The 2016 EDHS also revealed a 13% prevalence of LBW which is lower than this study result (12). In this study the control group had a higher rate of low birth weight than the intervention group.

After fitting the multivariable logistic regression model, the results also revealed that low birth weight infants were lower in the intervention group compared with the control group. This study found that the risk of LBW babies was 39.6% higher in babies who were born from household monthly income $\leq$ 2000ETB than household monthly income $>$ 2000ETB. Our research finding is consistent with previous studies done by different scholars (9, 21). However, this study result is not consistent with the study done in India (18), and found that normal birth weight is weakly associated with maternal weight gain and which was not found to be statistically different between the two groups at the end line of the study.

Having enough amount of balanced diet plays a vigorous role in refining the pregnant women's weight and birth weight. In this study area, foods items found at home may not be diversified to fulfill the balanced diet of all pregnant women. While nutrition expert and health extension workers advise for pregnant women to take foods present at home by adding more nutritious food compared with women's usual diet.

The strength of this study was being an effective intervention trial by applying a client-based approach during mothers ANC follow-up time, and its applicability to in all maternity health care institution, and to community-based programs. The rate of loss to follow up is also a limitation of this study and supplementary qualitative information was not taken were the limitation for this study.

Conclusion

According to these findings, it was concluded that nutrition education and counseling is a possible approach to improve gestation weight gain and a strong reduction in the rate of low birth weight. The intervention is simple to implement in all maternal health care institutions and could be accomplished during ANC follow-up through health education and nutrition expert using a client-centered approach.

We can recommend that the intervention is easy to implement in health care institutions of Gedeo zone and would be implemented without delay to achieve sustainable development goals.

Abbreviations

ANC, Anti Natal Care; DDS, Dietary diversity score; GWG, Gestational weight gain; LBW, low birth weight; BBW, normal birth weight; MUAC, Mid-upper arm circumference; NEC, Nutrition education and counseling; SDG, Sustainable development goal

Declarations

Ethics approval and consent to participate

The study was reviewed and approved by the Institutional Review Board (IRB) of Dilla University College of Medicine and Health Science. The study purpose, procedures, possible risks, and benefits were explained to participants in local languages. Informed written consent was obtained and signed. Confidentiality of information collected from each study participant didn't disclose. They were informed that they have full rights to withdraw from the study at any time if they face any difficulties. The trial was retrospectively registered in Pan African Clinical Trial Registry (www.pactr.org) database with unique identification number for the registry is PACTR202101757871954.

Consent to Publication: Not applicable

Availability of Data Materials: Datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: The authors declare that they have no competing interests.

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Authors' Contributions

GS: conceived and designed the study, conducted statistical analysis and result interpretation, prepared manuscript. AT: conceived and designed the study, conducted the statistical analysis and result interpretation. The author read and approved the manuscript.

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Figures

Figure 1

CONSORT flow chart shows the flow of participants through the trial based on the criteria recommended by the CONSORT guideline.