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Original Article

Dietary Adequacy among Pregnant Women in Southern Ethiopia. A weighted Food Record Study

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Abstract

Background: *Nutrient deficiencies are a public health concern among pregnant women in developing countries, including Ethiopia. This study aimed to assess the adequacy of nutrients among pregnant women in Dilla, Southern Ethiopia.*

Methods: *A community-based cross-sectional study design was conducted in Dilla Town, Southern, Ethiopia. Data on socio-demographic and obstetric characteristics were collected using a standardized questionnaire. We employed a day-weighted food record method among 71 pregnant mothers. All the foods consumed by pregnant women were weighed using digital weight scales. Data collectors and supervisors were trained in data collection techniques and procedures. Calibration of equipment and standardized techniques were used to minimize random anthropometric measurement errors. Data entry was done using SPSS version 25 and NutriSurvey2007 and exported to Intake, Monitoring Assessment and Planning Program (IMAPP) software to estimate the usual nutrient intake and prevalence of nutrient inadequacy.*

Results: *The current study indicated that energy, protein, and micronutrient intakes (iron, folic acid, and calcium) among pregnant women in the study area were low as compared to the World Health Organization (WHO)/Food and Agricultural Organization (FAO) reference nutrient intake. The inadequacy of selected micronutrient intakes such as vitamin-A, vitamin-C, iron, calcium, and zinc for pregnant women by comparing usual nutrient intake with the estimated average requirement (EAR) cutoff point. Calcium, vitamin-C, and vitamin-A deficiency were prevalent in 98.47, 95.52, and 72.28 percent of the population, respectively.*

Conclusions: *The prevalence of risk of nutrient inadequacy (calcium, vitamin-A, and vitamin-C) among pregnant mothers was high. Therefore, multiple micronutrient supplementation and provision of nutrient-dense food-based interventions need to be considered. Furthermore, multisectoral collaboration on the nutrition-sensitive and specificity intervention is also needed*

Keywords*: Weighted food record, Pregnant women, Dietary adequacy, Nutrients.*
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Introduction

Pregnancy is a critical period in which extensive physiological, anatomical, and other activities take place (1). During pregnancy, the body goes through *lots* of physical and hormonal changes. These changes result in the modification of nutritional needs and lifestyle choices (2). To fuel the mother and the growing baby, the mother needs to get foods from variety of sources. These foods the mother consumes during pregnancy must provide sufficient energy, protein, and micronutrients (3). Nutritional requirements increase during pregnancy and what's more, these requirements change as the pregnancy progresses and the baby develops. The Daily recommended intakes for women also differ during pregnancy and lactation, and in comparison, to other family members. Pregnant women should be vigilant about their food intake to ensure the appropriate progress of a normal pregnancy and prevent pregnancy

complications (4).

Inadequate macro and micronutrient intake results in poor outcomes like anemia in pregnancy and neural tube defect in a fetus as well as risk of developing chronic disease risk in the future life of their offsprings (3). To prevent these problems, adequate dietary intake is essential to meet the body's nutrient demands for a good pregnancy outcome and the development of the fetus (2, 3, 5). Because the fetus completely relies on maternal stores and nutrient intake during pregnancy (6), the dietary requirements for both macro and micronutrients increase sharply during pregnancy to support both maternal physiological change and fetal development (7). Pregnant women are among the most vulnerable segments of the population for micro and macronutrient deficiencies (3, 8). These deficiencies are aggravated during pregnancy because of the increment in nutrient requirements for fetal development, placenta, and maternal tissues. Moreover, poor diet during pregnancy could affect gestational weight gain and fetal growth (9).

Micronutrient deficiencies are a public health concern among women of reproductive age, particularly pregnant women in low- and middle-income countries (10). Vitamin A, folate, iron, iodine and zinc deficiencies are the most common (11).

Ethiopia is one of the countries with a very high burden of these micronutrient deficiencies (12). In spite of high prevalence of micronutrient deficiencies, the government of Ethiopia has implemented different strategies to ensure adequate nutrient intake among pregnant mothers (13). However, there is no published evidence at national and subnational level that shows the adequacy of nutrients among pregnant women. Hence, this study aimed to assess the dietary adequacy among pregnant women.

Methods and materials

Study area and period: The study was conducted in Dilla town, which is situated at 360 km from Addis Ababa towards Southern Ethiopia. The area had an estimated total population of 93,245 of which 47,555 were males and 45,690 were females. Among females, 21,726 of them were women of reproductive age. The town has 9 kebeles, and it also has one referral hospital and two government health centers. Based on the data from the health bureau, there were 567 pregnant mothers in the study area (14). Kocho is the staple food consumed in the study area(15).

Study design: Community based cross-sectional study design was conducted.

Source of population: All pregnant mothers who were living in Dilla town, Southern, Ethiopia

Study population: All pregnant women who were living in selected kebeles Dilla town, Southern, Ethiopia

Inclusion and exclusion criteria

All pregnant women who resided for at least for 6 months in selected kebeles were included. However, those women who were critically ill during data collection and having hearing problem were excluded because the data collection need clear communication with enumerators.

Sample size determination: Since there are no standard formulae to compute sample size for study using weighted food record method, we computed the sample size by reviewing previously published literature and estimation. The sample size was determined to be 71 mothers. Those participants selected conveniently from four randomly kebeles, including Hasdela, Boyity. Bareda and oday'a kebeles, out of nine.

Data collectors and data collection procedures

The data collector team had 8 health extension workers as a data collector who were fluent in Amharic and local (Gedeofa) language and 2 BSc nurses as a supervisor. Pre-tested and structured questionnaire was prepared in English and translated into Amharic and local language Gedeofa and then face to face interview was conducted.

Data quality control

A three-day of training workshop was given by the principal investigator about research details and data collection procedures for data collectors and supervisors. Calibration of digital weight scales and standardize technique were used to minimize random anthropometric measurement errors.

Weighed food record method

Weighed food record method data was collected from a selected group of (n = 71) study participants. The assessment period was from the morning before the participants ate their breakfast to the time of dinner. The participants were strongly advised not to change their normal dietary pattern and were asked to eat separately during the day of data collection. The weighted portion size of the consumed food by the participant and the leftovers were measured and recorded. All the foods consumed by pregnant women were weighed using digital weight scales (2 kg maximum weight, model CS 2000) and records were taken to the nearest 0.1g. In addition, the weighed foods were recorded with a detailed description of the types of food and preparation methods. To decrease the effects of fasting days on the quality of the study, weekend days and non-fasting days were the times of data collection.

Methods of data process and analysis

To assess the socio-demographic characteristics, mean

and median were used. SPSS version 25 was used to enter and analyze data. After dietary assessment was conducted using the one-day weighted food record method, the data was entered into NutriSurvey2007 and exported to Intake, Monitoring Assessment and Planning Program (IMAPP) software (Iowa State University, 1995–2015) to estimate the usual nutrient intake and prevalence of inadequacy. The Ethiopian food composition table (FCT) was used to calculate the nutrient values of food. Kenya food composition was used to calculate the nutrient value of food that was not found on the Ethiopian FCT.

Results

Socio-demographic characteristics

A total of 65 pregnant mothers participated in the study, with a response rate of 91.54%. The mean age of study participants was 26.52 (±4.39SD) and 66.2% were in the age ranges between 25-34 years which are illustrated in table 1.

Table 1: Socio- demographic characteristics of study participants in Dilla Town, Southern Ethiopia, 2021

Variable	Category	Frequency	Percentage
Age of the pregnant mothers	15-24 years	20	30.8
	25-34 years	43	66.2
	35 and above years	2	3.1
Marital status	Married	63	96.6
	Others*	2	3
Religion status	Christian	53	81.5
	Muslim	12	18.5
Educational status	Unable to write and read	4	6.2
	Write and read	3	4.6
	Primary education	10	15.4
	Secondary education	28	43.1
	Higher education	20	30.8
Occupational status	Housewife	30	46.2
	Government employee	16	24.6
	Privet work	19	29.2

Others*: include participants who are either separated, widowed or single.

Table 2: Obstetric characteristics of study participants in Dilla Town, Southern Ethiopia, 2021

Variable	**Category**	**Frequency**	**Percentage**
Stage of Pregnancy	Second trimester	33	50.8
	Third trimester	32	49.2
ANC follow-up	Yes	61	93.8
	No	4	6.2
Antenatal care(ANC) frequency	0 visit	4	6.2
	1 visit	11	16.9
	2 visits	16	24.6
	3 visits	12	18.5
	4and above visits	22	33.8
History of infection on the last six months	Yes	18	27.
	No	47	72.2
Took iron with folic acid	Yes	63	96.9
	No	2	3.1

Nutrient inadequacy

The adequacy of nutrients like energy, iron, and protein were below WHO/FAO recommendations as illustrated in the table blow (Table 3)

Table 3: Estimated daily median intakes (1st, 3rd quartiles) of selected nutrients among study participants Dilla town Southern Ethiopia 2021

Nutrients	Median intake	IQ (1st, 3rd quartiles)	WHO/FAO (RNI)
Energy (Kcal)	884.63	516.38, 1181.6950	500
Protein(gm)	54.38	38.30, 73.3950	30
Fat(gm)	36.00	19.4650, 59.25	-
Carbohydrate(gm)	277.14	212.05, 365.50	-
Dietary fiber(gm)	3.73	2.08, 9.53	-
PUFA(gm)	3.31	1.2750, 7.44	-
Cholesterol (mg)	55.50	7.12, 144.3050	-
Vitamin A (mg)	218.44	81.14, 464.9250	600
Carotene (mg)	0.48	0.17, 1.7150	-
Vitamin E(Eq.mg)	2.43	1.11, 5.4250	15mg
Vitamin B1(mg)	0.47	0.38, 0.6950	0.9
Vitamin B2(mg)	0.64	0.3650,0.9150	1.5mg
Vitamin B6(mg)	0.41	0.18,0.79	1.9mg
Folic acid(mg)	53.28	30.76, 93.4850	370-470
Vitamin C(mg)	20.56	9.01, 32.65	50
Calcium (mg)	374.78	272.21, 492.18	1000-1200mg
Iron (mg)	177.57	125.04, 242.1150	179-299
Zinc(mg)	9.48	7.14, 13.6350	10mg

Note: IQR; Inter Quartile Range, RNI; Recommended Nutrient Intake

The current study identified the inadequacy of selected micronutrient intakes such as Vitamin A, C, iron, calcium, and zinc for pregnant women by comparing usual nutrient intake with the estimated average requirement (EAR) cutoff point. Calcium and vitamin A inadequacy were prevalent in 98.47 and 72.28 percent of the population, respectively. Almost all sampled pregnant mothers have an adequate intake of iron as illustrated in the table below (Table 4).

Table 4: Prevalence of inadequacy of selected nutrient intake of pregnant mothers in Dilla, Southern, Ethiopia

Nutrients	Usual mean intake	Prevalence of inadequacy
Calcium	409.90	98.47
Iron	191.73	1.20
Vitamin A	420.30	72.28
Zinc	11.65	5.41
Vitamin C	26.42	94.52

Discussion

Identifying the specific nutrient gaps among pregnant mothers is essential to provide evidence-based intervention to improve maternal nutritional status. Thus, this community-based cross-sectional study aimed to assess adequacy of nutrient intake of pregnant mothers. The current study indicated that the median energy, protein, and fat intakes were 884.63 Kcal/day, 54.38 Kcal/day and 36.00 Kcal/day respectively. The median intakes of iron, folic acid and calcium were 177.57 Kcal/day, 53.28 Kcal/day and 374.78 Kcal/day respectively. Energy, protein, and micronutrient intakes (iron, folic acid, and calcium) in pregnant women in the study area were low as compared to WHO/FAO reference nutrient intake.

This study showed that both macro and micronutrient intake of pregnant mothers is below the recommendation. Pregnancy is a critical and vulnerable stage of life which is characterized by tissue synthesis, rapid growth and development and enormous maternal physiologic changes from the time of conception to birth, adequate dietary protein and energy is crucial to ensure a healthy outcome (WHO 2007). Most pregnant women do not take the recommended amount of essential nutrients including protein and energy as was the case in this study. This finding is consistent with study conducted in Niger and Ghana which indicated that energy and protein intakes of pregnant mother was low respectively (16, 17). This might be because they consume less protein rich animal foods, probably due largely to their high cost. The other reason might be lack of awareness that not knowing the good sources of these nutrients.

Our study showed the median intake of selected micronutrients (Iron, folic acid, and calcium) is lower when compared to the recommended level. Similarly a study done on adequacy of nutrient intakes among pregnant mothers of Ghana reported the intake of iron, calcium, and folic acid to be below the recommended level (16). This may be due to consumption of one type of diets (monotones) which are not rich in different micronutrient contents and mostly plant origin and can be explained by diet of the pregnant women in many developing countries is predominantly cereal-based and characterized by inadequate micronutrient intakes (18, 19).

Overall, more than 98.49% of the pregnant mothers included in our study are at risk of inadequate calcium intake. Highest prevalence of nutrient inadequacy was also seen in Vitamin A (72.28%) and Vitamin C (94.52%) intake. Previously studied researches also have consistent findings on the highest prevalence of calcium, vitamin A and vitamin C inadequate intake (16, 20). A study reported that the most limiting nutrients in the diet of over 50% pregnant women were riboflavin, calcium, folic acid and vitamin C (16). The finding is consistent with these countries might be due to their socio-economic status similarity. In contrary the prevalence for these nutrients inadequacy is lower than the study conducted in Canada (21). This might be because of different nutritional strategies that enable the mothers to get supplements and high socio-economic status.

The strength of this study is its utilization of the weighted food record method, which is the gold standard method, IMMAP software, and assessed the prevalence of risk of inadequacy of nutrient intakes among pregnant mothers, based on usual nutrient intake distribution. However, the limitations of this study were that the cross-sectional nature of this study does not allow evaluation of the seasonal variation effect on energy and nutrient intake of pregnant mothers. Samples were from connivances sample and seasonal variation was not considered, which affected the dietary consumption pattern. Not considering the intake of micronutrient supplementation is also another limitation of the study. Even though we couldn't completely avoid the observational bias and the bias secondary to using health extension workers as data collectors the objective of the study was clearly explained and participants and were strongly advised not to change their normal dietary habit. Using Kenya FCT is the other limitation.

In conclusion, the median energy and most nutrient intake were low for pregnant mothers (iron, vitamin-C, folic acid, and calcium) as compared with the WHO/FAO RNI. The prevalence of risk of nutrient inadequacy for selected nutrients (calcium, vitamin-A, and vitamin-C) among pregnant mothers was also high. Pregnant mothers were consuming diets that lacks several important micronutrients, increasing their risk of deficiency. Therefore, multiple micronutrient supplementation, and the provision of nutrient-dense food-based interventions should be considered. The town health office, nutrition focal person and regional health office should give attention to increase the nutrient adequacy of pregnant mothers by promoting good dietary practice. The health extension service needs to be further enhanced and strengthened to create awareness and promote optimal feeding practices such as consumption of a diverse diet that includes good sources of energy, protein and micronutrients. Further research is also needed to identify the effect of seasonal variation on nutrient intake in Ethiopia.

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Conflict of Interest: All the authors declare no competing interest.

Author's contribution: Conceptualization, methodology, and investigation were done by Temesgen Muche. Temesgen Muche Ewunie, Eden Ashenafi, Abirham Shiferaw, Daniel Sisay, Sewitemariam Desalegn, Getachew Assefa and Robel Hussen Kabthymer participated in data extraction and analysis, as well as in writing the original draft, revision, and edition of the final paper. All authors have read and agreed on this final version of the manuscript.

Ethical disclosure: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Ethical Review Board of Dilla University. Verbal informed consent was obtained from all study subjects. Verbal consent was witnessed and formally recorded**.**

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