

# Prevalence of undernutrition and its associated factors among pregnant women in north Shewa, Ethiopia: A multi-center cross-sectional study

Women's Health  
Volume 20: 1–8  
© The Author(s) 2024  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/17455057241290883  
journals.sagepub.com/home/whe



Meron Demisew<sup>1</sup>, Habtamu Fekadu Gemed<sup>2</sup> and Kassahun Ayele<sup>1</sup> 

## Abstract

**Background:** Maternal undernutrition remains a public health issue, particularly in low-income countries such as Ethiopia, which increases the possibility of a cycle of malnutrition in future generations.

**Objectives:** This study assessed the prevalence of undernutrition and its associated factors among pregnant women in Minjar Shenkora district north Shewa, Ethiopia.

**Design:** The study used a multicenter cross-sectional study design.

**Methods:** The study was conducted from June to August 2021 with 334 pregnant women selected using systematic random sampling techniques. A semi-structured questionnaire was used to collect the sociodemographic, obstetric, and dietary data. The nutritional status of the pregnant women was assessed using mid-upper arm circumference measurements. Multivariate logistic regression was used to identify independent variables associated with maternal undernutrition, with an adjusted odds ratio (AOR) of  $p < 0.05$  indicating statistical significance.

**Results:** The prevalence of undernutrition was 22.2%. Low monthly household average income (AOR = 3.69, 95% CI: 1.62–8.40), women's education limitation (AOR = 1.24, 95% CI: 0.28–5.46), poor nutritional attitude (AOR = 2.54, 95% CI: 1.21–5.32), and inadequate dietary diversity score (AOR = 4.42, 95% CI: 1.53–12.8) were significantly associated with undernutrition.

**Conclusion:** Maternal undernutrition prevalence was very high based on the WHO standards, and low monthly household average income, women's education level, poor nutritional attitude, and inadequate dietary diversity scores were associated with undernutrition. Therefore, policies and programs aimed at reducing maternal undernutrition are needed. Socioeconomic strengthening and nutritional counseling during pregnancy are also recommended for improved nutritional status.

## Keywords

undernutrition, associated factors, pregnant women, Ethiopia

Date received: 25 March 2024; revised: 24 July 2024; accepted: 26 September 2024

## Introduction

Pregnancy is an anabolic process in which nutritional demand exceeds the growth of uterine cells.<sup>1,2</sup> This is a critical time for human development, and anything that compromises the fetal environment may have important and lasting effects on a child's future health. Optimal nutrition during this period is important for the health and well-being of the mother as well as the child.<sup>3,4</sup> Pregnant women

<sup>1</sup>Department of Food and Nutritional Science, Wollega University Shambu Campus, Shambu, Ethiopia

<sup>2</sup>Department of Food Technology and Nutrition, Wollega University, Nekemte, Ethiopia

### Corresponding author:

Kassahun Ayele, Department of Food and Nutritional Science, Wollega University Shambu Campus, P.o. Box:38, Shambu, Ethiopia.  
Email: kassahunaye23@gmail.com



need more food, a varied diet, and additional macro- and micronutrients because of the physiological, anatomical, biochemical, and several other related changes that occur in the fetus and themselves.<sup>5-8</sup> Poor maternal nutrition contributes significantly to the risk of anemia and negative pregnancy outcomes.<sup>9,10</sup>

Undernutrition is the term used to describe when a person consumes insufficient amounts of nutrients and energy to meet their health needs.<sup>11,12</sup> Undernutrition raises the possibility of a cycle of malnutrition, intrauterine growth, infant stunting, subsequent lifetime of impaired productivity, increased maternal and fetal morbidity, tissue depletion in mothers, intrauterine growth retardation, stillbirth, and premature birth.<sup>13-15</sup> Maternal undernutrition in low- and middle-income countries is an underlying cause of 3.5 million deaths and disabilities.<sup>16,17</sup> Africa has a significantly higher rate of undernutrition during pregnancy, with sub-Saharan Africa being the most affected region.<sup>18,19</sup>

In Ethiopia, undernutrition continues to remain a common public concern owing to various factors, such as sociodemographic status, political instability, and economic decline.<sup>20,21</sup> Nearly one in five pregnant women is malnourished, and approximately 68% are more likely to be malnourished.<sup>22</sup> The burden of undernutrition can be associated with sociodemographic and economic characteristics, obstetric and health-related characteristics, dietary characteristics, and environmental factors.<sup>23-25</sup> Although studies have assessed the nutritional status of pregnant women in other parts of Ethiopia,<sup>22,25,26</sup> they indicated inconsistencies in the prevalence and associated factors within communities. Similarly, the studies focused on urban communities rather than rural settings. This study consisted of rural kebeles in the district which may be influenced by local norms, sociodemographic and economic problems, and limited access to health and nutrition services. The problem of undernutrition needs to be assessed within communities with different lifestyles to implement evidence-based maternal nutrition programs for healthy pregnancy outcomes in the country. Hence, this study aimed to assess the prevalence of undernutrition and its associated factors in pregnant women in north Shewa, Ethiopia.

## Methods

### Study design and setting

A multicenter cross-sectional study was conducted in public health centers in the Minjar Shenkora district, north of the Shewa Zone, Ethiopia, between June and August 2021. The findings in the study were written and reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. The district is located at the southern end of the North Shewa Zone and is bordered to the east, south, and west by the Oromia

region, to the northwest by the Hegere Mariam Woreda, and to the northeast by the Berehet Woreda. It is an administrative district of the northern Shewa Zone, the Amhara National Regional State. Arerti is an administrative center located 135 km from Addis Abeba, the capital city of Ethiopia. According to the 2007 census report of the Statistical Agency of Ethiopia, the district's total population is 128,879, with 66,918 men and 61,961 women. Six public health centers in the district provide antenatal services to the community namely, Bolo Health Center, Balchi Health Center, Dire Health Center, Kristos Semra Health Center, Arerti Health Center, and Arerti Hospital.

### Study population

The study population consisted of pregnant women who resided in the Minjar Shenkora district, and who attended antenatal clinics at health centers in the district during the study period.

### Eligibility criteria

All pregnant women who visited public health centers in the district for follow-up were eligible for inclusion in the study. Exclusion criteria included pregnant women with infectious diseases (HIV/AIDS and tuberculosis), chronic diseases (hypertension and diabetes mellitus), hematologic diseases, and emergency cases. Similarly, pregnant women who were unable to hear and/or speak were excluded.

### Sample size determination and sampling techniques

The required sample size for this study was calculated using a single population proportion formula, considering a previous finding of 28% with 95% confidence and 5% margin error.<sup>27</sup> Considering a nonresponse rate of 10%, the final study sample size was calculated to be 334 participants. The calculated sample size was proportionally allocated to all public health centers in the district based on the average number of pregnant women in the respective antenatal care visits before the study period. The average number of pregnant women who visited the antenatal care service daily through data collection was predicted primarily based on the previous 2 months' daily client flow of the clinic, which was obtained by referring to client registration books or records before data collection. The sampling interval was calculated by dividing the monthly average attendance at the follow-up of the antenatal care by the required sample size ( $k=N/n$ ). Systematic simple random sampling technique was used. From the sampling procedure, after calculating the sampling fraction "k," the first participant was randomly selected between 1 and "k" value. We consider every  $k$ th value as a sample from each health center.

## Study variables

**Outcome variables.** The outcome variable of this study was the nutritional status of pregnant women.

### Independent variables

- Sociodemographic and economic factors
- Obstetric and health-related characteristics
- Dietary diversity of pregnant women
- Nutritional knowledge and attitude perspectives

## Operational definitions

**Maternal undernutrition.** Pregnant women's nutrition status assessed using the mid-upper arm circumference (MUAC) measurement.<sup>28</sup>

**Maternal dietary diversity score.** Number of food groups consumed by pregnant women out of the 10 food groups; Food groups included cereals, pulses, nuts, dairy, meat products (including poultry and fish), eggs, dark green leafy vegetables, vitamin A-rich vegetables and fruits, other vegetables, and other fruits.<sup>29</sup>

**Maternal nutritional knowledge.** Pregnant women's knowledge of nutrition, including the ability to remember and recall food and nutrition-related terminologies.<sup>30,31</sup>

**Maternal nutritional attitude.** Pregnant woman's feeding or eating behavior is influenced by her emotions, motivations, perceptions, and thoughts.<sup>30</sup>

## Data collection procedures

Data were collected using a semi-structured questionnaire adapted and modified from previous literature,<sup>25,26</sup> which consisted of questions on sociodemographic characteristics, obstetric and health-related characteristics, nutritional knowledge, nutritional attitude, and dietary diversity. The data were collected by trained data collectors. The dietary diversity score (DDS) questionnaire included 10 different food groups based on their nutrients: (1) cereals, white roots, tubers, and plantains; (2) pulses and legumes (beans, peas, and lentils); (3) nuts and seeds; (4) dairy and dairy products; (5) meat, fish, and poultry; (6) eggs; (7) dark green leafy vegetables; (8) vitamin A-rich fruits and vegetables; (9) other vegetables; and (10) other fruits. The 24-h dietary recall method was used to assess the DDS, and the 2 days nonconsecutive multiple-pass 24-h recall method was used to reduce individual bias. Pregnant women who consumed 5 or more of the 10 food groups on the day or within 24 h before data collection were considered to have an adequate DDS, while pregnant women who consumed less than 5 food groups of the 10 food groups on the day or within 24 h were considered to have inadequate DDS.<sup>29</sup>

The nutritional knowledge questionnaire was a dichotomous type scale adapted from previous similar studies. Pregnant women who scored  $\geq 70\%$  out of 100% from prepared questions showed good nutritional knowledge, whereas those who scored  $< 70\%$  had poor nutritional knowledge. Similarly, a questionnaire that was used in previous studies was used to assess nutritional attitude; pregnant women who scored  $\geq$  mean from the prepared questions had a favorable attitude, while pregnant women who scored  $<$  mean score were considered to have an unfavorable attitude toward nutrition.<sup>30,31</sup>

## Anthropometric measurement

The nutritional status of pregnant women was assessed by MUAC measurements.<sup>32</sup> The upper left arm was measured for a right-handed pregnant woman and the upper right arm was measured for a left-handed woman, with no clothing. The MUAC of a pregnant woman was measured at the mid-point between the acromion of the scapula and olecranon of the ulna on the arm. Measurements were taken using an adult MUAC tape that was non-elastic and non-stretchable. Finally, the average of two measurements was taken on the same day and recorded to the nearest 0.1 cm, per standard procedures. A pregnant woman with a MUAC  $< 23$  cm was considered undernourished, while a pregnant woman with a MUAC  $\geq 23$  cm was considered to have a normal nutritional status.<sup>32,33</sup>

## Data quality control

The questionnaire was prepared in English, translated into Amharic, and back-translated to English to ensure consistency. To preserve data quality, the questionnaires were pre-tested on 5% of the pregnant women, and corrections and modifications were made based on the gaps identified during the interview. Data collectors and supervisors were trained on the study's background, objectives, tools, and ethical procedures. Training for data collectors emphasized the importance of keeping the study participant's information confidential. Furthermore, supervisors were required to check how the data collectors performed their tasks, including ethical procedures, and verify the completion of questionnaires during the data collection process.

## Statistical analysis

After data collection, data were edited, coded, checked, and cleaned for consistency and completeness. The data were entered into Epidata 3.1 version software and then exported to IBM SPSS version 21 for analysis. Descriptive statistics were used to describe the participants in the study. Bivariate and multivariable logistic regression analyses were performed to measure the association between dependent and independent variables. Variables with a  $p$ -value  $< 0.2$  in bivariate regression were included in the

multivariable logistic regression analysis, whereby a  $p$ -value  $<0.05$  was considered to be statistically significant. Assumptions of logistic regression included evaluation of multicollinearity and confounders before the final logistic regression model analysis. The fitness of the final model was checked using the Hosmer–Lemeshow goodness-of-fit test.

## Results

### *Sociodemographic and economic characteristics of pregnant women*

A total of 334 pregnant women were interviewed and included in the study, resulting in a response rate of 100%. More than half (56.9%,  $n=190$ ) were aged 26–34 years and 79.9% ( $n=267$ ) were married. The majority (74%,  $n=247$ ) of the pregnant women were members of the Orthodox Church and most (84.1%,  $n=281$ ) were of Amhara ethnicity; 213 (63.8%) lived in rural areas (Table 1).

### *Obstetric and health characteristics of pregnant women*

In this study, 215 (64.4%) and 186 (55.7%) patients had multigravidas and multiparas, respectively. More than half of the pregnant women 186 (55.4%) were in their third trimester of pregnancy and 120 (34.9%) had 4 or more antenatal care visits during their current pregnancy, but only 137 (41%) women had access to nutritional information (Table 2).

### *Nutritional knowledge, attitude, and dietary diversity of the respondents*

In this study, only 103 (30.8%) respondents were knowledgeable about nutrition, while the remaining 231 (69.2%) were not knowledgeable regarding their nutrition. One hundred eighty-seven (56%) respondents had a favorable attitude, and the remaining 147 (44%) had an unfavorable attitude toward nutrition. In this study, 31.1% of the pregnant women achieved an adequate DDS, whereas 68.9% had an inadequate DDS (Table 3).

### *The prevalence and determinants of undernutrition among pregnant women*

Of the pregnant women, 74 (22.2%) were undernourished (MUAC  $<23$  cm) and 260 (77.8%) had a normal MUAC ( $\geq 23$  cm). In the bivariate analysis, the average monthly household income, education level of the pregnant woman, education level of the husband, occupation of the pregnant woman, occupation of the husband, nutritional knowledge and attitude, and dietary diversity were associated with undernutrition. However, in multivariate

**Table 1.** Sociodemographic and economic characteristics of the pregnant women in north Shewa, Ethiopia, 2021.

Variable	Category	Frequency	Percent
Age (years)	15–25	107	32.0
	26–34	190	56.9
	$\geq 35$	37	11.1
Marital status	Single	29	8.7
	Married	267	79.9
	Divorced	24	7.2
	Widowed	14	4.2
Religion	Orthodox Church	247	74.0
	Muslim	65	19.5
	Others <sup>a</sup>	22	6.6
Ethnicity	Amhara	281	84.1
	Other <sup>b</sup>	53	15.9
Place of residence	Rural	213	63.8
	Urban	121	36.2
Family size	One	12	3.6
	Two	90	26.9
	Three	111	33.2
	Four	85	25.4
	Five and above	36	10.8
Educational level of women	No formal education	185	55.4
	Primary and secondary school	90	26.6
	College and above	59	17.7
Educational level of husband	No formal education	116	43.4
	Primary and secondary school	77	28.8
	College and above	74	27.7
Occupation of women	Housewife	169	50.6
	Private sector	96	28.7
	Government sector	45	13.5
	Other <sup>c</sup>	24	7.2
Occupation of husband	Farmer	98	36.7
	Private sector	78	29.2
	Government sector	68	25.5
	Other <sup>c</sup>	23	8.6
Household monthly average income	$<2,000$	183	54.8
	$\geq 2,000$	151	45.2

<sup>a</sup>Protestants, and Catholics.

<sup>b</sup>Oromo, Argoba, and Tigre.

<sup>c</sup>Merchants and daily labor.

regression analysis, only average monthly household income, education level, nutritional attitude, and DDS remained significantly associated with undernutrition during pregnancy. Pregnant women who earned below an average of 2,000 ETB household monthly income were more likely to be undernourished than those who earned  $\geq 2,000$  ETB. Pregnant women with no formal education were more likely to be undernourished than those with an education level of college and above. Additionally, pregnant women who did not have a favorable attitude toward nutrition were more likely to be undernourished than

**Table 2.** The obstetric and health characteristics of the pregnant women in north Shewa, Ethiopia, 2021.

Variable	Category	Frequency	Percent
Gravida	Primigravida	119	35.6
	Multigravida	215	64.4
Parity	Primiparous	148	44.3
	Multiparous	186	55.7
Trimester	First trimester	40	12.0
	Second trimester	109	32.6
	Third trimester	185	55.4
Intake of iron and folate supplements	Yes	190	56.9
	No	144	43.1
Antenatal care follow-up visits in current pregnancy	One	64	19.2
	Two	68	20.4
	Three	82	24.6
	Four and above	120	35.9
Access to nutritional information	Yes	137	41.0
	No	197	59.0

**Table 3.** Nutritional knowledge, attitude and dietary diversity of the pregnant women in north Shewa, Ethiopia, 2021.

Variable	Category	Frequency	Percent
Nutritional knowledge	Knowledgeable	103	30.8
	Not knowledgeable	231	69.2
Nutritional attitude	Favorable attitude	187	56.0
	Unfavorable attitude	147	44.0
Dietary diversity score	Adequate	104	31.1
	Inadequate	230	68.9

those who had a favorable attitude, and pregnant women with an inadequate DDS were more likely to be undernourished than those with an adequate diet (Table 4).

## Discussion

Undernutrition is still a major health concern in many low- and middle-income countries, including Ethiopia, especially during crises such as political instability and economic decline.<sup>19</sup> It is therefore critical to assess the prevalence of undernutrition and its associated factors in pregnant women. This study assessed the prevalence of undernutrition and the factors contributing to undernutrition in pregnant women in north Shewa, Ethiopia. The study found that the overall prevalence of undernutrition among pregnant women was 22.2%, and relevant factors, such as low monthly household average income, low educational level of women, unfavorable nutritional attitude, and inadequate dietary diversity, were significantly associated with undernutrition among pregnant women in the study area. The results of this study are comparable with a study conducted in Alamata, where 23.2% of pregnant

women were undernourished, but it was higher than other studies in Gondar (14.4%), Mettu (17.5%), and Dessie (19.5%).<sup>17,33–35</sup> However, the prevalence of undernutrition in this study was lower than that in studies conducted in Kacha Birra District, Southern Ethiopia (52.6%) and Konso District, Ethiopia (32%).<sup>26,36</sup> These variations might be due to differences in the MUAC cutoff value, study season, socioeconomic differences, dietary diversity practices during pregnancy, or environmental factors that affect the nutritional status of women. The findings of this study are also supported by a systematic review and meta-analysis on the burden of malnutrition in African countries which found the overall maternal undernutrition among pregnant women to be 23.5% and similar results were observed in Kenya (19%) and Nigeria (21.7%).<sup>18</sup> These similarities may be due to the fact that African countries are still facing problems of malnutrition.<sup>18</sup>

This study found that lower household monthly average income increased the risk of undernutrition. This is supported by previous studies conducted at the Gedo and Meso Health Centers.<sup>37,38</sup> Women from low-income households were consistently affected by undernutrition since income level is a key determinant of maternal nutritional status, as it affects access to food, use of healthcare, and availability of water supplies and sanitation services. The results of this study also indicated that the educational status of pregnant women was a significant indicator of their nutritional status, pregnant women with no formal education were more likely to be undernourished than pregnant women with an education level of college and above. This is consistent with a comparative report on maternal nutrition in the Metu and Gedo zones as well as in central Ethiopia,<sup>21,35,37</sup> which showed that pregnant women who had college-level education and above were less likely to be undernourished than those with no formal education. This implies that education is a valuable indicator that enables women to provide adequate care regarding their dietary patterns, which is a critical factor for health and well-being. Another finding of this study was that pregnant women with an unfavorable nutritional attitude were more likely to be undernourished than those with a favorable nutritional attitude. This finding is similar to previous studies conducted in Dessie Town, Kafa Zone, and Western Ethiopia.<sup>33,39,40</sup> Maternal nutritional attitude is an essential element in ensuring healthy dietary behaviors and food choices, which improves the quality of the diet to meet the increased nutritional demand in pregnancy.

Another finding of this study was that pregnant women with inadequate DDS were more likely to be undernourished than those with adequate DDS. This finding is supported by studies in Southern Ethiopia, Gindeberet district, Ethiopia, and Gurage Zone, Southern Ethiopia.<sup>26,41,42</sup> Dietary diversity is an indicator of the adequacy of nutrition, which improves nutritional status and meets macro- and micronutrient requirements.<sup>43</sup> Overall, the major strength of this study is

**Table 4.** Determinants of undernutrition among pregnant women north Shewa, Ethiopia, 2021.

Variables	Nutritional status		95% CI	
	Undernourished	Normal	COR	AOR
<b>Women's education</b>				
No formal education	51 (27.6%)	134 (72.4%)	3.36 (1.36–8.30)	1.24 (0.28–5.46)*
Primary and secondary school	17 (18.9%)	73 (81.1%)	1.63 (0.88–3.03)	0.62 (0.14–2.75)
College and above	6 (10.2%)	53 (89.8%)		
<b>Husband education</b>				
No formal and primary school	31 (26.7%)	85 (73.3%)	2.33 (1.06–5.10)	1.51 (0.57–4.04)
9–12 class	18 (23.4%)	59 (76.6%)	1.19 (0.61–2.33)	1.04 (0.40–2.70)
College and above	10 (13.5%)	64 (86.5%)		
<b>Women occupation</b>				
Housewife	45 (26.6%)	124 (73.4%)	3.72 (1.26–10.97)	2.58 (0.28–23.49)
Private sector	19 (19.8%)	77 (80.2%)	1.47 (0.80–2.69)	1.05 (0.23–4.87)
Other	6 (25%)	18 (75%)	1.08 (0.40–2.91)	0.72 (0.13–3.80)
Governmental	4 (8.9%)	41 (91.1%)		
<b>Household monthly average income</b>				
<2,000	58 (31.7%)	125 (68.3%)	3.91 (2.13–7.11)	3.69 (1.62–8.40)*
≥2,000	16 (10.6%)	135 (89.4%)		
<b>Gravidity</b>				
Primigravida	20 (16.8%)	99 (83.2%)	0.60 (0.34–1.06)	0.33 (0.10–1.12)
Multigravida	54 (25.1%)	161 (74.9%)		
<b>Parity</b>				
Primipara	28 (18.9%)	120 (81.1%)	0.71 (0.41–1.20)	2.36 (0.79–7.05)
Multipara	46 (24.7%)	140 (75.3%)		
<b>Nutritional information</b>				
No	51 (25.6%)	148 (74.4%)	1.67 (0.96–2.90)	1.39 (0.66–2.91)
Yes	23 (17%)	112 (83%)		
<b>Nutritional knowledge</b>				
Not knowledgeable	63 (27.3%)	168 (72.7%)	3.136 (1.575–6.247)	1.58 (0.56–4.38)
Knowledgeable	11 (10.7%)	92 (89.3%)		
<b>Nutritional attitude</b>				
Unfavorable	50 (34%)	97 (66%)	3.501 (2.024–6.054)	2.54 (1.21–5.32)***
Favorable	24 (12.9%)	163 (87.1%)		
<b>Dietary diversity score</b>				
Inadequate	66 (29.9%)	155 (70.1%)	5.589 (2.576–12.124)	4.42 (1.53–12.80)**
Adequate	8 (7.1%)	105 (92.9%)		

I: Reference; COR: crude odds ratio, AOR: adjusted odds ratio; CI: confidence interval.

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ .

that it identified the prevalence and associated factors of undernutrition, which is important for strategies to improve maternal nutritional status and health. In addition, this research covered all health centers in the study district, which ensured population representation. Despite these strengths, the study exhibited limitations: the cross-sectional design was not able to show temporal and causal effect relationships of variables with dependent variables and the study design limited the pregnant women included in the study to those attending antenatal care services in health facilities. In addition, the women's response may be subject to social desirability bias. Further studies should be conducted in other rural areas to confirm the generalizability of the study results.

## Conclusion

The prevalence of undernutrition was relatively high in this study area, and determinant factors such as low monthly household average income, low women's educational status, unfavorable nutritional attitude, and inadequate DDS were associated with the prevalence of undernutrition in pregnant mothers. Therefore, policies and programs aimed at reducing maternal undernutrition are needed. Socioeconomic strengthening and nutritional counseling during pregnancy are recommended to improve maternal nutritional status. Furthermore, community-based research that covers a larger population size should

be conducted to investigate other determinant variables of maternal undernutrition in the study area.

## Declarations

### Ethical approval and consent to participate

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human participants were approved by the Wollega University Ethical Review Committee (WU RD/453/2021). Written informed consent was obtained from participants, and verbal informed consent was obtained from participants who were unable to read or write. For the participants (below 18 years of age), their guardians or parents signed the written informed consent on their behalf.

### Consent for publication

Not applicable.

### Author contribution(s)

**Meron Demisew:** Conceptualization; Methodology; Software; Data curation; Supervision; Formal analysis; Validation; Writing – review & editing; Writing – original draft.

**Habtamu Fekadu Gemed:** Methodology; Writing – review & editing; Data curation; Supervision; Validation.

**Kassahun Ayele:** Conceptualization; Methodology; Software; Data curation; Supervision; Formal analysis; Validation; Writing – original draft; Writing – review & editing.

### Acknowledgements

We would like to express our heartfelt gratitude and appreciation to all the pregnant women who voluntarily participated in this study.

### Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was funded by Wollega University/WU SGS 486/2021.

### Competing interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Data availability

The data are available upon request.

### ORCID iD

Kassahun Ayele  <https://orcid.org/0009-0009-3950-3303>

## References

1. Redmer DA, Wallace JM and Reynolds LP. Effect of nutrient intake during pregnancy on fetal and placental growth and vascular development. *Domest Anim Endocrinol* 2004; 27(3): 199–217.
2. Hussain T, Tan B, Murtaza G, et al. Role of dietary amino acids and nutrient sensing system in pregnancy associated disorders. *Front Pharmacol* 2020; 11: 586979.
3. Ickes SB, Wu M, Mandel MP, et al. Associations between social support, psychological well-being, decision making, empowerment, infant and young child feeding, and nutritional status in Ugandan children ages 0 to 24 months. *Matern Child Nutr* 2018; 14(1): e12483.
4. Qin Y and Xie L. Nutrition and supplements during pregnancy: a vital component in building the health and well-being of both the mother and the developing baby. *Nutrients* 2023; 15(15): 3395.
5. Mousa A, Naqash A and Lim S. Macronutrient and micronutrient intake during pregnancy: an overview of recent evidence. *Nutrients* 2019; 11(2): 443.
6. Danielewicz H, Myszczyzyn G, Dębińska A, et al. Diet in pregnancy more than food. *Eur J Pediatr* 2017; 176: 1573–1579.
7. Kazma JM, van den Anker J, Allegaert K, et al. Anatomical and physiological alterations of pregnancy. *J Pharmacokinet Pharmacodyn* 2020; 47(4): 271–285.
8. Tan EK and Tan EL. Alterations in physiology and anatomy during pregnancy. *Best Pract Res Clin Obstet Gynaecol* 2013; 27(6): 791–802.
9. Nnam NM. Improving maternal nutrition for better pregnancy outcomes. *Proc Nutr Soc* 2015; 74(4): 454–459.
10. Lindsay KL, Gibney ER and McAuliffe FM. Maternal nutrition among women from Sub-Saharan Africa, with a focus on Nigeria, and potential implications for pregnancy outcomes among immigrant populations in developed countries. *J Hum Nutr Diet* 2012; 25(6): 534–546.
11. Peterson KE and Chen LC. Defining undernutrition for public health purposes in the United States. *J Nutr* 1990; 120(8): 933–942.
12. Mengstie MA, Worke MD, Belay Y, et al. Undernutrition and associated factors among internally displaced lactating mothers in Sekota camps, northern Ethiopia: a cross-sectional study. *Front Nutr* 2023; 10: 1108233.
13. Wells JC, Sawaya AL, Wibaek R, et al. The double burden of malnutrition: aetiological pathways and consequences for health. *Lancet* 2020; 395(10217): 75–88.
14. Vir SC and Suri S. Young child undernutrition: crucial to prioritize nutrition interventions in the first 1000 days of life. *Indian J Pediatr* 2023; 90(Suppl 1): 85–94.
15. Wells JC, Marphatia AA, Amable G, et al. The future of human malnutrition: rebalancing agency for better nutritional health. *Global Health* 2021; 17(1): 119.
16. Arero G. Undernutrition and associated factors among pregnant women in East Borena Zone, Liban District, Oromia regional state, Ethiopia. *Front Nutr* 2022; 9: 1008701.
17. Dadi AF and Desyibelew HD. Undernutrition and its associated factors among pregnant mothers in Gondar town, Northwest Ethiopia. *PLoS One* 2019; 14(4): e0215305.
18. Desyibelew HD and Dadi AF. Burden and determinants of malnutrition among pregnant women in Africa: a systematic review and meta-analysis. *PLoS One* 2019; 14(9): e0221712.
19. Christian AK and Dake FA. Profiling household double and triple burden of malnutrition in sub-Saharan Africa: prevalence and influencing household factors. *Public Health Nutr* 2022; 25(6): 1563–1576.

20. Abdu AO, Yimamu ID and Kahsay AA. Predictors of malnutrition among older adults aged above 65 years in eastern Ethiopia: neglected public health concern. *BMC Geriatr* 2020; 20(1): 497.
21. Workicho A, Belachew T, Ghosh S, et al. Burden and determinants of undernutrition among young pregnant women in Ethiopia. *Matern Child Nutr* 2019; 15(3): e12751.
22. Zewdie S, Fage SG, Tura AK, et al. Undernutrition among pregnant women in rural communities in southern Ethiopia. *Int J Womens Health* 2021; 13: 73–79.
23. Das S, Fahim SM, Islam MS, et al. Prevalence and sociodemographic determinants of household-level double burden of malnutrition in Bangladesh. *Public Health Nutr* 2019; 22(8): 1425–1432.
24. Alem AZ, Yeshaw Y, Liyew AM, et al. Double burden of malnutrition and its associated factors among women in low and middle income countries: findings from 52 nationally representative data. *BMC Public Health* 2023; 23(1): 1479.
25. Shiferaw A and Husein G. Acute under nutrition and associated factors among pregnant women in Gumay District, Jimma Zone, South West Ethiopia. *J Womens Health Care* 2019; 8(459): 2167.
26. Gelebo DG, Gebremichael MA, Asale GA, et al. Prevalence of undernutrition and its associated factors among pregnant women in Konso district, southern Ethiopia: a community-based cross-sectional study. *BMC Nutr* 2021; 7: 32.
27. Nigatu MGT and Gemedda DH. Household food insecurity, low dietary diversity, and early marriage were predictors for Undernutrition among pregnant women residing in Gambella, Ethiopia. *Adv Public Health* 2018; 1: 2018.
28. Tafara L, Bikila H, Feyisa I, et al. The prevalence of under nutrition and associated factors among pregnant women attending antenatal care service in public hospitals of western Ethiopia. *PLoS One* 2023; 18(1): e0278180.
29. Kuma MN, Tamiru D and Belachew T. Level and predictors of dietary diversity among pregnant women in rural South-West Ethiopia: a community-based cross-sectional study. *BMJ Open* 2021; 11(10): e055125.
30. Gezimu W, Bekele F and Habte G. Pregnant mothers' knowledge, attitude, practice and its predictors towards nutrition in public hospitals of Southern Ethiopia: a multicenter cross-sectional study. *SAGE Open Med*. Epub ahead of print 10 March 2022. DOI: 10.1177/20503121221085843.
31. Tesfa S, Aderaw Z, Tesfaye A, et al. Maternal nutritional knowledge, practice and their associated factors during pregnancy in Addis Sub city health centers, Addis Ababa, Ethiopia. *Int J Afr Nurs Sci* 2022; 17: 100482.
32. Hassan B, Rayis DA, Ahmed AB, et al. Prevalence and associated factors of undernutrition among pregnant Sudanese women. *Trans R Soc Trop Med Hyg* 2022; 116(4): 352–358.
33. Diddana TZ. Factors associated with dietary practice and nutritional status of pregnant women in Dessie town, north-eastern Ethiopia: a community-based cross-sectional study. *BMC Pregnancy Childbirth* 2019; 19(1): 517.
34. Endalifer M, Tewabe M and Adar A. Undernutrition and associated factors among pregnant women attending ANC follow up in Alamata general hospital, Northern Region, Ethiopia, 2017. *J Nutr Health Food Eng* 2019; 9(3): 70–78.
35. Shemsu S, Argaw A and Zinab B. Dietary practice and nutritional status among pregnant women attending antenatal care at Mettu Karl referral hospital, southwest Ethiopia. *Open Public Health J* 2020; 13(1): 538–546.
36. Teshome SM, Meskel D, Worsa TK, et al. Undernutrition and associated factors among pregnant women in Kacha Birra district, southern Ethiopia. *Austin J Nutr Metab* 2021; 8(1): 1098.
37. Tesfaye A, Sisay G, Kabthiymer RH, et al. Under-nutrition and associated factors among pregnant women in public health care hospitals of Gedeo Zone, southern Ethiopia: a cross-sectional study. *Heliyon* 2022; 8(5): e09511.
38. Serbesa ML, Iffä MT and Geleto M. Factors associated with malnutrition among pregnant women and lactating mothers in Mieso Health Center, Ethiopia. *Eur J Midwifery* 2019; 3: 13.
39. Tilahun AG, Fufa DA and Tadesse RD. Undernutrition and its associated factors among pregnant women at the public hospitals of Bench-Sheko and Kaffa zone, southwest Ethiopia. *Heliyon* 2022; 8(5): e09380.
40. Gebremichael MA and Belachew Lema T. Dietary diversity, nutritional status, and associated factors among pregnant women in their first trimester of pregnancy in Ambo District, Western Ethiopia. *Nutr Metab Insights* 2023; 16: 11786388231190515.
41. Tafasa SM, Darega J, Dida N, et al. Dietary diversity, undernutrition and associated factors among pregnant women in Gindeberet district, Oromia, Ethiopia: a cross-sectional study. *BMC Nutr* 2023; 9(1): 115.
42. Gudeta TG, Terefe AB, Mengistu GT, et al. Determinants of dietary diversity practice among pregnant women in the Gurage Zone, Southern Ethiopia, 2021: community-based cross-sectional study. *Obstet Gynecol Int* 2022; 2022: 8086793.
43. Saaka M, Mutaru S and Osman SM. Determinants of dietary diversity and its relationship with the nutritional status of pregnant women. *J Nutr Sci* 2021; 10: e14.