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Under Nutrition and Associated Factors among Lactating Mothers in Southern Ethiopia: Institution Based Cross-Sectional Study

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ABSTRACT

Background: Maternal Nutrition contributes significantly to the long term health of mothers and their children. Despite this importance, globally, about 795 million people are undernourished and women and their children are the most vulnerable groups.

Objective: The main aim of this study was to assess under nutrition and associated factors among lactating mothers in Arba Minch Zuria district, Southern Ethiopia.

Methods: Institution based cross-sectional study was used. Data was collected using interview administered questionnaire from a total of 441 lactating mothers. To get the required respondents, first health centers in Arba Minch Zuria district were selected by using lottery method and probability to population size was performed for each health center. Finally, eligible respondents were selected using systematic sampling method. The questionnaire was pretested and close supervision was undertaken during data collection to assure the quality of data. The collected data was entered using EpiData version 3.02 and exported to SPSS version 20.0 for analysis. Binary and multivariable logistic regression were conducted, and finally variables with p-value of <0.05 were considered as statistically significant predictors.

Results: Prevalence of under nutrition in this study was 26.1%. Under nutrition is higher among mothers who are unable to read and write ($AOR\ (95\% CI)=3.931\ (1.700,\ 9.091)$), mothers who experienced more than five numbers of pregnancies ($AOR\ (95\% CI)=2.453\ (1.051,\ 5.728)$), those with more than four members of family size ($AOR\ (95\% CI)=2.289\ (1.171,\ 4.4720)$), those who live in the household with no toilet ($AOR\ (95\% CI)=6.407\ (3.556,\ 11.545)$) and those who have less than 4 antenatal care visits ($AOR\ (95\% CI)=2.053\ ([1.185,\ 3.559])$).

Conclusion and recommendations: In this study, the magnitude of under nutrition among lactating women was high. So, nutrition based health information, education and communication is needed for mothers especially during pregnancy and lactation in the study area.

Keywords: Nutritional status, Arba Minch, Health center, Lactating mother

Abbreviations: ANC: Antenatal Care; AOR: Adjusted Odds Ratio; BMI: Body Mass Index; CI: Confidence Interval; COR: Crude Odds Ratio; EDHS: Ethiopian Demographic and Health Survey; FAO: Food and Agricultural Organization; MDG: Millennium Development Goal; MNCH: Maternal, Neonatal and Child Health; SNNPR: Southern Nation and Nationalities and Peoples Region; USAID: United States Agency for International Development

SUMMARY

Maternal nutrition during lactation plays a great role for the health of mother and newborn. Despite this importance, about 20% of lactating mothers in Ethiopia are under weight and different factors are associated with the nutritional status of lactating mothers. However, those factors were not well accessed in the country. So, the main aim of this study was to assess nutritional status of lactating mothers and its associated factors in Arba Minch Zuria district of Ethiopia. The data was collected from lactating mothers who visited

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health centers of the district for reasons like post natal care, immunization services, family planning services, child health care or any other reason.

Body mass index of the lactating mothers was measured and mothers were classified as under-weight if their body mass index is $\leq 18.5 \text{ kg/m}^2$, normal if their body mass index is from $18.5\text{-}24.9 \text{ kg/m}^2$, over weight if their body mass index is from $25\text{-}29.9 \text{ kg/m}^2$ and obese if their body mass index is $\geq 30 \text{ kg/m}^2$. Of the total 441 respondents in this study, 26.1% of lactating mothers were underweight. In this study, under nutrition is associated with educational level, numbers of pregnancies, family size, and presence of toilet and antenatal care visits. In conclusion, the magnitude of under nutrition among lactating women in this study was high. So, nutrition based health information, education and communication by health extension workers and other concerned bodies are needed for mothers especially during pregnancy and lactation in the study area to decrease the problem.

BACKGROUND

Nutrition is a fundamental pillar of human life, health and development [1]. Maternal nutrition during pregnancy and lactation influences the growth and development of the fetus. As a result, adequate nutrition for the mothers during lactation is important for the health of mothers and their children [2]. Lactating mothers from low-income countries are nutritionally vulnerable group. The maternal nutrition requirement varies with respect to age, income and physiological changes like pregnancy and lactation [1,3].

Inadequate quality and quantity diet is one of the major reasons for high levels of malnutrition in pregnant and lactating women [4]. Due to the nursing process, mothers are subjected to nutritional stresses and pregnancy followed by lactation increase the health risk of mothers resulting in a high maternal mortality [3]. Lack of sufficient calories, of macro- and micro-nutrients by the mothers during critical times like pregnancy and lactation can lead to deficiencies in building materials for the development and growth of the new born [5].

Household food insecurity, hunger and under-nutrition remain critical issues in different developing countries including Ethiopia [6]. In Ethiopia, although there are maternal nutrition interventions that are efficacious and effective in improving Maternal, Neonatal and Child Health (MNCH) outcomes, implementations have been limited [7,8].

Malnutrition has been identified as a key underlying cause for maternal deaths. It pre-disposes pregnant and lactating women to an increased risk of infection, anemia, visual impairment, goiter among others. Environmental and economic conditions have huge impacts on the nutritional status of women in Sub-Saharan Africa. In this population,

poverty limits food choices, thus affecting their quality of diet [9].

Ethiopia has reached Millennium Development Goal (MDG) 1, halving the number of undernourished people (from 75% to 35% over two decades). Despite these positive advances, Ethiopia remains one of the world's most food-insecure countries, where approximately one in three people live below the poverty line and about 27% of women age 15-49 were undernourished (BMI of less than 18.5 kg/m^2) [10].

To solve the problem of maternal malnutrition, micronutrient supplementation and food-based strategies such as diet diversity and food fortification have been reported in many studies in Sub-Saharan Africa [9,11]. Despite these efforts, the proportion of children and mothers affected by malnutrition is still high [2,3,12]. In addition, few studies in Ethiopia highlighted the issue of nutritional status among lactating mothers. So, the main aim of this study was to assess under nutrition and associated factors of lactating mothers in Arba Minch Zuria district, Southern Ethiopia. The findings of this study is vital for policy makers, health care providers and any concerned bodies to design appropriate intervention strategies to tackle the problem.

MATERIALS AND METHODS

Quantitative institution based cross-sectional study was conducted on lactating women who visited Arba Minch Zuria district health centers from June 5-20, 2018. All lactating mothers visited public health centers of the area were the source population and all lactating mothers visited selected public health centers of the area during data collection period were the study population. Lactating mothers who lived in the area for more than six month and visited the public health centers of the area were included into the study. Lactating mothers who were critically ill, have hearing impairment and physical deformity that can alter anthropometric measurements were excluded from the study.

Sample size determination and sampling procedures

Sample size was calculated using single population proportion formula by considering the following assumptions: P=20% (prevalence of underweight among lactating mothers from the study conducted in Nekemte town [2], significance level of 5% ($\alpha=0.05$) and Z $\alpha/2=1.96$, Margin of error of 4% ($d=0.04$) and 10% non-response rate, the final sample size becomes 441 lactating mothers.

To get the eligible respondents, first, out of the seven health centers in Arba Minch Zuria district, four of them were selected by using lottery method. Then, the calculated sample size was proportionally allocated to the health centers based on their population size according to the average number of clients registered prior to the study period in the respective health center. Finally the eligible

respondents were selected by using systematic sampling method.

Measurements

In this study, lactating mother is a mother who is feeding breast milk for her infant/child during the study period. Body mass index is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). Under-nutrition is defined as, lactating mothers with BMI of $\leq 18.5 \text{ kg}/\text{m}^2$. Individual Dietary Diversity Score is defined as, the sum of food groups eaten in a specified reference period.

Food secure households are those who were not experienced none of the food insecurity (access) conditions or just experienced worry, but rarely in the past 4 weeks. Food insecure households is inability of households to access sufficient food at all time to lead active and healthy life (includes all stages of food insecurity; mild, moderate and severe). Mildly food insecure households are households that worried about not having enough food sometimes or often, and/or are unable to eat preferred foods, and/or eat a more monotonous diet than desired and/or some foods considered undesirable, but only rarely. Moderately food insecure households are household's sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or have started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes. But it does not experience any of the three most severe conditions. Severely food insecure households are those household who has graduated to cutting back on meal size or number of meals often, and/or experienced any of the three most severe conditions (running out of food, going to bed hungry or going a whole day and night without eating), even as infrequently as rarely.

Data collection procedure

Data was collected using structured interview administered questionnaire adopted from similar studies and modified based on the study variables and local context. The questionnaire first prepared in English and translated to Amharic and then translated back to English by bilingual expert, to check its consistency. Twelve female diploma nurse data collectors and three MPH supervisors were recruited and trained for data collection.

Data quality assurance

To ensure the quality of data, training was given for data collectors and supervisors. Pre-test was conducted on 5% of the total sample to assess its clarity, length, completeness

and consistency. The questionnaire was also translated to Amharic and close supervision was undertaken.

Data processing and analysis

Data was coded, entered into Epidata version 3.02 and exported to SPSS version 20.0 for analysis. Descriptive statistics was computed to determine the frequency and percentages. Binary logistic regression was conducted and COR with 95% CI was estimated to select the candidate variables for the final model. Then, variables with p-value of <0.25 at binary logistic regression were taken into multivariable logistic regression to control confounding. Hosmer-Lemeshow goodness-of-fit with stepwise (backward elimination) logistic regression was used to test for model fitness. AOR with 95% CI was estimated to assess the presence of association at multivariable logistic regression. Finally, variables with p-value of <0.05 were considered as statistically significant predictors of the outcome variable.

RESULTS

Socio-demographic characteristics of the study respondents

Out of the total 445 sample size calculated for the study, 441 respondents responded making a response rate of 99.1%. The age of the respondents ranges from 15 to 46 with mean and standard deviation of 26.98 ± 5.67 . About 211 (47.8%) respondents were in the age group of 17-25 years, 291 (66%) were protestant and 438 (99.3%) were married. About 124 (28.1%) of mothers and 159 (36.1%) of husbands were unable to read and write. Regarding their family size, 224 (50.8 %) of the respondents have 4-6 family members (Table 1).

Maternal health care and feeding practices

Among the total respondents, 228 (51.7%) were experienced one to two pregnancies. Majority of the respondents, 198 (44.9%) spaced their children from 1-2 years and 274 (62.1%) had ≥ 4 ANC visits during their last pregnancy. Majority of lactating mothers, 276 (62.6%) were using family planning methods and out of these, 146 (33.1%) uses injectable, whereas only 4 (0.9%) uses pills. About 95 (21.5%) of respondents had experienced diarrhea in the last two weeks preceding the study period. Majority of the respondents, 310 (70.3%) has their own latrine. The mean \pm SD of lactating mothers dietary diversity score was 5.0 ± 1.89 and majority of them, 296 (67.1%) had mean DDS of ≥ 5 (Table 2).

Table 1. Socio-demographic and economic characteristics of lactating mothers (n=441) in Arba Minch Zuria district, Southern Ethiopia, 2018.

Variables	Category	Frequency	Percentage
Age of mothers (in year)	17-25	211	47.8
	26-35	183	41.5
	36-49	47	10.7
Religion	Orthodox Protestant	150 291	34.0 66.0
Ethnicity	Gamo Gofa Wolayita Amhara Others*	302 13 24 13 89	68.5 2.9 5.4 2.9 20.2
Maternal educational level	Unable to read and write Able to read and write primary secondary and above	124 92 136 89	28.1 20.9 30.8 20.2
Husband's educational level	Unable to read and write read and write primary secondary and above	159 89 102 91	36.1 20.2 23.1 20.6
Mother's Occupation	Farmer Merchant Government employer	305 72 64	69.2 16.3 14.5
Family size	1-3 members 4-6 members >6 members	121 224 96	27.4 50.8 21.8

*= Oyda, Basketo, Oromo

Table 2. Maternal health care and feeding practice of the study participants (n=441) in Arba Minch Zuria district, Southern Ethiopia, 2018.

Variables	Category	Frequency	Percentage
Number of pregnancy	1-2	228	51.7
	3-4	107	24.2
	5-6	62	14.1
	>6	44	10
Age of breast feeding child	Less than 6 months	99	22.4
	6 to 11 months	158	35.9
	12 to 24 months	184	41.7

Space b/n index child and the previous birth	It is the first child	101	22.9
	1-2 years	198	44.9
	> 2 years	142	32.2
Antenatal care for the last pregnancy	Yes	413	93.7
	No	28	6.3
Number of antenatal care (n=413)	First ANC	12	2.7
	Second ANC	38	8.6
	Third ANC	89	20.2
	Fourth ANC and above	274	62.1
Current use of family planning	Yes	276	62.6
	No	165	37.4
Which method is used (n=276)	Pills	4	0.9
	Dipo	146	33.1
	Implant	109	24.7
	IUCD	17	3.9
The last time menstruation is seen	In this month	118	26.8
	Before one month	131	29.7
	Don't know	192	43.5
Time to breast feed	<6 months	21	4.8
	6-11 months	75	17.0
	12-24 months	260	59.0
	>24 months	62	14.0
	Do not know	23	5.2
Start of complementary feeding	Yes	345	78.2
	No	96	21.8
Age at start of complementary feeding	<6 months	80	18.1
	At 6 months	215	48.8
	>6 months	50	11.3
Mothers diarrhea in the last two weeks	Yes	95	21.5
	No	346	78.5
Presence of toilet	Yes	310	70.3
	No	131	29.7
Source of drinking water	Tap	279	63.3
	Protected	80	18.1
	River/not protected	66	15
	Hole	16	3.6

Nutrition education	Yes	296	67.1
	No	145	32.9
Sources of nutrition education (n=296)	Health professionals	251	56.9
	Mass media	45	10.2
Women Dietary Diversity Score (WDDS)	<5	145	32.9
	≥ 5	296	67.1

Household food security level of the study participants

Household food security of the study respondents was assessed and classified as; food secured, mildly food in

secured, moderately food in secured and severely food in secured. Accordingly, majority, 377 (85.5%) of households were food secured and only 11 (2.5%) of the respondents household were severely food in secured (**Figure 1**).

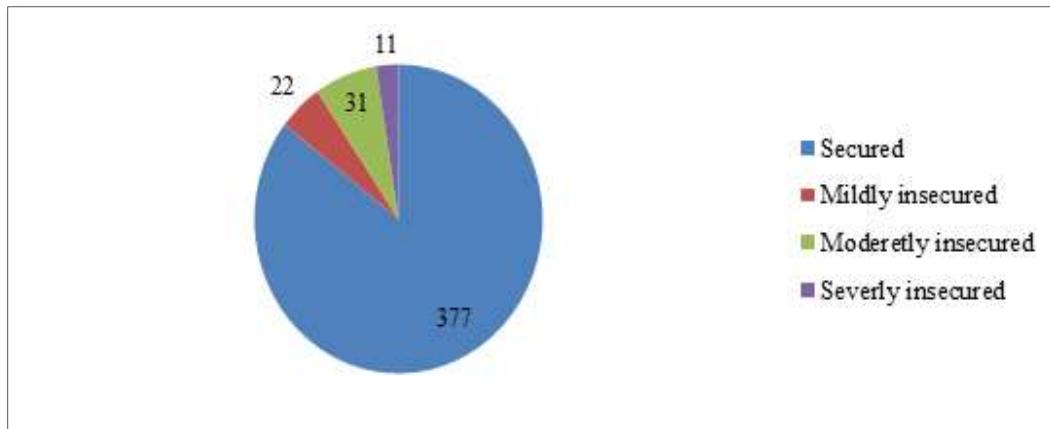


Figure 1. Household food security levels among lactating mothers (n=441) in Arba Minch Zuria district, Southern Ethiopia, 2018.

Under nutrition among lactating mothers

The overall prevalence of under nutrition ($BMI < 18.5 \text{ kg/m}^2$) among lactating mothers in this study was 26.1% (**Figure 2**).

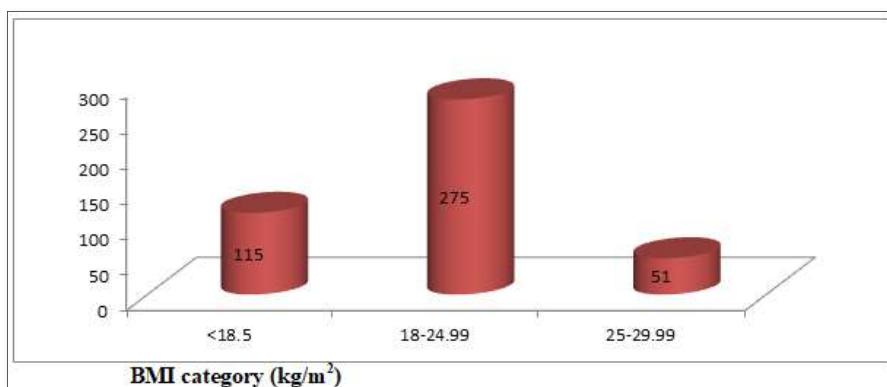


Figure 2. Bar chart showing nutritional status of lactating mothers (n=441) in Arba Minch Zuria district, Southern Ethiopia, 2018.

Factors associated with under nutrition among lactating mothers

Binary logistic regression analysis: In binary logistic regression analysis, maternal education (COR (95% CI)=4.478 (2.164, 9.269)), husband education (COR (95%

$CI)=4.65$ (2.237, 9.672)), having experienced >3 pregnancies ($COR (95\% CI)=2.704$ (1.582, 4.623)), having >4 family size ($COR (95\% CI)=2.473$ (1.461, 4.186)), absence of toilet ($COR (95\% CI)=5.121$ (3.242, 8.089)), <4 ANC visits for the last pregnancy ($COR (95\% CI)=2.99$

(1.965, 4.692)), presence of maternal diarrhea ($COR (95\% CI)=1.824$ (1.120, 2.970)), absence of nutritional education ($COR (95\% CI)=1.870$ (1.205, 2.902)) and being severely food insecure ($COR (95\% CI)=5.176$ (1.483, 18.073)) shows significant association with under nutrition (**Table 3**).

Table 3. Factors associated with under nutrition among lactating mothers in Arba Minch zuria district, Southern Ethiopia, 2018.

Variables	Category	Under-nutrition		COR (95% CI)	P-Value
		Yes	No		
Maternal age (in years)	17-25	52	159	1	1
	26-35	48	135	1.087 (0.690, 1.713)	0.718
	36-49	15	32	1.433 (0.720, 2.854)	0.306
Maternal educational level	Unable to read and write	48	76	4.478 (2.164, 9.269)	0.001
	Able to read and write	39	53	5.218 (2.453, 11.097)	0.001
	Primary	17	119	1.103 (0.450, 2.278)	0.975
	Secondary and above	11	78	1	1
Husband's educational level	Unable to read and write	58	101	4.651 (2.237, 9.672)	0.001
	Able to read and write	25	64	3.164 (1.417, 7.065)	0.005
	Primary	22	80	2.227 (0.992, 5.001)	0.052
	Secondary and above	10	81	1	1
Mother's occupation	Farmer	77	217	1.236 (0.658, 2.322)	0.511
	Merchant	23	58	1.375 (0.649, 2.912)	0.406
	G/ employee	15	51	1	1
Number of pregnancy	1-2 pregnancies	36	192	1	1
	3-4 pregnancies	36	71	2.704 (1.582, 4.623)	0.001
	5-6 pregnancies	26	36	3.852 (2.077, 7.142)	0.001
	>6 pregnancies	17	27	3.358 (1.662, 6.786)	0.001
Family size	1-3 members	25	117	1	1
	4-6 members	65	123	2.473 (1.461, 4.186)	0.001
	>6 members	23	73	1.360 (0.732, 2.530)	0.331
Age of breast feeding child	<6 months	25	74	1	1
	6-11 months	41	117	1.037 (0.583, 1.846)	0.901
	12-24 months	49	135	1.074 (0.614, 1.879)	0.801
Source of drinking water	Tap water	68	211	1	1
	Protected	24	56	1.33 (0.767, 2.307)	0.310
	River/not protected	18	48	1.164 (0.634, 2.135)	0.625
	Hole	5	11	1.410 (0.473, 4.203)	0.537
Presence of toilet	Yes	50	260	1	1

	No	65	66	5.121 (3.242, 8.089)	0.001
Presence of PNC for the last pregnancy	Yes	80	241	1	1
	No	35	85	1.240 (0.777, 1.980)	0.367
Number of ANC visit	<4 visits	64	98	2.99 (1.965, 4.692)	0.001
	≥ 4 visits	45	206	1	1
Current use of family planning	Yes	70	206	1	1
	No	45	120	1.104 (0.713, 1.708)	0.658
The last time menstruation have seen	In this month	24	94	1	1
	Before one month	31	100	1.214 (0.665, 2.218)	0.528
	Don't know	60	132	1.780 (1.035, 3.062)	0.037
Space between index child and the previous birth	It is 1 st child	26	75	1.060 (0.589, 1.906)	0.846
	1-2 years	54	144	1.146 (0.70, 1.878)	0.587
	>2 years	35	107	1	1
Time of breast feeding	<6 months	5	16	1	1
	6-11 months	20	55	1.164 (0.377, 3.592)	0.792
	12-24 months	63	197	1.023 (0.360, 2.905)	0.965
	>24 months	22	40	1.760 (0.568, 5.453)	0.327
	Do not know	5	18	0.889 (0.217, 3.643)	0.870
Start of CF	Yes	91	254	1.075 (0.639, 1.808)	0.786
	No	24	72	1	1
Age at start of CF	<6 months	20	60	1	1
	At 6 months	54	161	1.006 (0.556, 1.820)	0.984
	>6 months	17	33	1.545 (0.713, 3.350)	0.270
Maternal diarrheal disease	Yes	34	61	1.824 (1.120, 2.970)	0.016
	No	81	265	1	1
Nutritional education	Yes	65	231	1	1
	No	50	95	1.870 (1.205, 2.902)	0.005
Sources of nutritional education	Health professionals	55	196	1	1
	Mass media	10	35	1.018 (0.474, 2.185)	0.963
WDD mean score	<5	46	99	1.529 (0.983, 2.377)	0.060
	≥5	69	227	1	1
Household food security	Food secure	95	282	1	1
	Mildly food insecure	6	16	1.109 (0.422, 2.916)	0.834
	Moderately food insecure	7	24	0.863 (0.360, 2.066)	0.740
	Severely food insecure	7	4	5.176 (1.483, 18.073)	0.010

Multivariable logistic regression analysis: In multivariable logistic regression analysis, variables like maternal education, number of pregnancy, family size, presence of toilet and number of antenatal care visits shows significant association with under nutrition.

Mothers who are unable to read and write were almost four times more likely to be undernourished compared to those with secondary and above educational levels (AOR (95% CI)=3.93 (1.700, 9.091)). Respondents who experienced 5-6 number of pregnancies were 2.45 times more likely to be undernourished compared to those who experienced 1-2 pregnancies (AOR (95% CI)=2.453 (1.051, 5.728)).

Similarly, respondents who have family size of 4-6 members were 2.3 times more likely to be under nourished compared to those who have family size of 1-3 members (AOR (95% CI)=2.289 (1.171, 4.472)).

Respondents who live in the household with no toilet were 6.4 times more likely to be undernourished compared to their counterparts (AOR (95% CI)=6.407 (3.556, 11.545)). Respondents who visited <4 ANC were 2 times more likely to be under nourished compared to those who visited greater than or equal to four (AOR (95% CI)=2.053 (1.185, 3.559)) (**Table 4**).

Table 4. Multivariable logistic regression showing factors associated with under nutrition among lactating mothers in Arba Minch Zuria district, Southern Ethiopia, 2018.

Variables	Category	Under-nutrition		COR (95% CI)	AOR (95% CI)
		Yes	No		
Maternal educational level	Unable to read and write	48	76	4.478 (2.164, 9.269)	3.931 (1.700, 9.091)*
	Able to read and write	39	53	5.218 (2.453, 11.097)	3.991 (1.690, 9.425)*
	Primary	17	119	1.103 (0.450, 2.278)	0.803 (0.329, 1.961)
	Secondary and above	11	78	1	1
Husband's educational level	Unable to read and write	58	101	4.651 (2.237, 9.672)	2.403 (0.964, 5.986)
	Able to read and write	25	64	3.164 (1.417, 7.065)	1.065 (0.377, 3.014)
	Primary	22	80	2.227 (0.992, 5.001)	1.791 (0.674, 4.757)
	Secondary and above	10	81	1	1
Number of pregnancy	1-2 pregnancies	36	192	1	1
	3-4 pregnancies	36	71	2.704 (1.582, 4.623)	1.312 (0.630, 2.731)
	5-6 pregnancies	26	36	3, 852 (2.077, 7.142)	2.453 (1.051, 5.728)*
	>6 pregnancies	17	27	3.358 (1.662, 6.786)	1.720 (0.684, 4.327)
Family size	1-3 members	25	117	1	1
	4-6 members	65	123	2.473 (1.461, 4.186)	2.289 (1.171, 4.472)*
	>6 members	23	73	1.360 (0.732, 2.530)	0.786 (0.366, 1.687)
Presence of toilet	Yes	50	260	1	1
	No	65	66	5.121 (3.242, 8.089)	6.407 (3.556, 11.545)*
Number of ANC visit	<4 visits	64	98	2.99 (1.965, 4.692)	2.053 (1.185, 3.559)*
	≥visits	45	206	1	1
The last time menstruation have seen	In this month	24	94	1	1
	Before 1month	31	100	1.214 (0.665, 2.218)	0.864 (0.394, 1.893)
	Don't know	60	132	1.780 (1.035, 3.062)	1.143 (0.562, 2.327)
Maternal diarrheal	Yes	34	61	1.824 (1.120, 2.970)	1.786 (0.953, 3.347)

disease	No	81	265	1	1
Nutritional education	Yes	65	231	1	1
	No	50	95	1.870 (1.205, 2.902)	1.439 (0.787, 2.632)
WDD mean score	<5	46	99	1.529 (0.983, 2.377)	1.005 (0.535, 1.890)
	≥5	69	227	1	1
Household food security	Food secure	95	281	1	1
	Mildly food insecure	6	16	1.109 (0.422, 2.916)	1.685 (0.485, 5.857)
	Moderately food insecure	7	24	0.863 (0.360, 2.066)	0.570 (0.159, 2.045)
	Severely food insecure	7	4	5.176 (1.483, 18.073)	2.004 (0.349, 11.505)

Keys: COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval; WDD: Women Dietary Diversity

*=P-value<0.05

DISCUSSION

In this study, about 26.1% of lactating mothers were undernourished. Under nutrition was more common among mothers who are unable to read and write those who experienced high number of pregnancies, those with high family size, those who reside in the household with no toilet, and those who have less than four ANC visits for their last pregnancy.

The prevalence of under nutrition in this study was comparable with findings of study conducted in Rayitu district of Ethiopia (24%) [13], Alamata, Tigray (24.6) [14] and Womberma district of North West Ethiopia (25.4%) [15]. However, the prevalence is lower than study conducted in Samre district of Tigray (31%) [3] and Dedo and Seka chekors's of Jimma district (40.6%) [16]. The difference might be as a result of improvement in nutritional education, improvement in socio-economy and difference in geographical setting. But, the finding of this study is higher than study conducted in Tanzania (11%) [17], Nigeria (5%) [18], Nekemte town (20%) [2], Ambo districts (21.5%) [19] and Offa district of Wolayta zone (15.8%) [20]. The reason for this discrepancy may be due to difference in socio-economy, geographical settings and seasonal variation.

Mothers who are unable to read and write were almost four times more likely to be under nourished compared to those who have secondary and above educational level. This finding is consistent with studies conducted in Bangladesh [21], Ambo district [19], Adama district [22] and Offa district [20]. The possible reason may be since those who are able to read and write can get nutritional information through reading books, posters and magazines than those who are unable to read and write.

Respondents who experienced 5-6 pregnancies were 2.5 times more likely to be under nourished compared to those who experienced 1-2 pregnancies. The finding of this study

was inconsistent with study conducted in Alamat highland of Tigray in which respondents who have higher pregnancies were 44% less likely to be undernourished compared to those who have lower pregnancies [14]. However, this finding is supported by study conducted in Babile, Ethiopia, which shows, as parity increased by one unit, the BMI of the lactating mothers decreased [23]. The possible reason may be, because of the fact that, as the number of pregnancy increases, exposure to different health problems including under nutrition may occur. In addition, the mother herself may be biologically depleted from too frequent births, which could also negatively affect the nutritional status of herself and her newborn.

Respondents whose family size is greater than four members were 2.29 times more likely to be under nourished compared to those who have less family size. This finding is supported by the study conducted in Womberma district of North West Ethiopia [15] and Nekemte town [2]. This may be due shortages of food in the household with high family size and culturally mothers always eat least food (some time leftover) at the last which leads to under nutrition.

Respondents who have toilet were 6.4 times more likely to be undernourished compared to their counterparts. This is supported by study conducted in Adama district [22]. The reason might be due to the fact that, open defecation, because of lack of toilet results in an increased risk of diarrheal disease, which might contributes to under nutrition. In addition, poor handling and disposal of household wastes including human excreta are major causes of environmental pollution, which creates breeding grounds for pathogenic microorganism that causes under nutrition.

Respondents who visited ANC <4 times were two times more likely to be undernourished compared to those who visited ≥ 4 times. This finding is consistent with the study conducted in Samre district of Tigray [3] and Rayitu districts

of Ethiopia [13]. This may be because of the fact that, ANC time is a time when nutritional information and other support for healthy behaviors is widely provided and might contribute to the lower probability of getting under nutrition.

LIMITATIONS OF THE STUDY

- Since some question asks about past events, recall bias may occur.
- An anthropometric measurement error may also occur.

CONCLUSION AND RECOMMENDATION

Conclusion

The result of this study shows slightly high proportion of under nutrition among lactating mothers. Predictors of under nutrition among lactating mothers in this study includes: maternal educational level, number of pregnancy, family size, presence of toilet and number of ante natal care visits.

Recommendations

Based on the finding of this study, the following recommendations were made:

Arba Minch woreda health office:

- Should strengthen health education programs on proper maternal and child dietary practices and the need of adequate dietary intake during pregnancy and lactation in order to improve health and nutrition outcomes of lactating mothers and their children.
- Since health extension workers are more close to the community, woreda health office should work with health extension workers to increase awareness of lactating mothers on how to improve their own nutritional status.
- Woreda health office should have to work with different sectors like; educational and agricultural sectors to improve women educational level and then, their nutritional status.

Health extension workers:

- Health extension workers should have to closely work with the community and provide health information like; importance of adequate nutrition during lactation, importance of having few children based on their capacity, importance of having toilet and proper use of it and importance of antenatal and post natal visits for the community.

Researchers:

- Further research that uses advanced design is needed to identify more variables that determine the nutritional status of lactating mothers.

DECLARATION

Ethical approval and consent to participate

Ethical clearance was obtained from Arba Minch University Research Ethic review committee to conduct the study. In addition permission was obtained from Gamo Gofa Zone Health Department, managers of health centers. Confidentiality was secured by informing and giving awareness to the data collectors not to record identifiers of the client and disseminate any information obtained from client.

Consent for publication

Not applicable

Availability of data and materials

The data collected for this study can be obtained from the corresponding author based on a reasonable request.

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Authors' contribution

GK wrote the proposal, participated in data collection, analyzed the data and drafted the paper. FG and HH approved the proposal with great revisions and revised subsequent drafts of the paper. MS and MD contributed in the designing of the methodology and write-up. All authors and read and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest regarding the publication of the paper.

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