

Food Insecurity and Its Predictors among Lactating Mothers in North Shoa Zone, Central Ethiopia

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1 **Food Insecurity and Its Predictors among Lactating Mothers in North Shoa Zone, Central**
2 **Ethiopia**

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31 ABSTRACT

32 **Background:** Ending food insecurity is one of the goals of Sustainable Development Goals
33 (SDGs). It is also one of the serious problems of Ethiopia. However, there is a dearth of studies
34 that show the status of food insecurity among lactating mother in Ethiopia including the study area.
35 Therefore, the objective of this study is to assess the predictors of food insecurity among lactating
36 mothers in Ataye District, North Shoa, and Central Ethiopia.

37 **Methods:** A community-based cross-sectional study design was used among 612 lactating mothers
38 aged 15-49 years. The food insecurity was determined by computing nine standards Household
39 Food Insecurity Access Scale (HFIAS) questions. A structured interviewer-administered
40 questionnaire was used to collect the data. Data were entered into EpiData version 4.2 and exported
41 to SPSS (Statistical Package for Social Science) version 24 for analysis. Odds ratio with 95%
42 confidence interval was used for the predictors of food insecurity using bivariable and
43 multivariable logistic regression analysis.

44 **Results:** The prevalence of food insecurity among lactating mothers was 36.8%. No formal
45 education [(AOR=1.82, 95% CL: (1.13, 2.92)], no income-generating activities [(AOR=3.39, 95%
46 CI: ((2.05, 5.64))], no home gardening practices [(AOR=5.65, 95% CI: (3.51, 9.08)], alcohol use
47 by husbands [(AOR=2.02, 95% CI: (1.25, 3.24)], low minimum dietary diversity scores
48 [(AOR=2.94, 95% CI: (1.88, 4.57)], less than three frequencies of meals [(AOR=3.97, 95% CI:
49 (1.65, 9.54)] and three meals only per day [(AOR= 1.86, 95% CI: (1.08, 3.17)] were significant
50 predictors of food insecurity of mothers.

51 **Conclusion:** The prevalence of food insecurity was high in the study area. No formal education,
52 no income-generating activities, no home gardening practice, alcohol use by husbands, low
53 minimum dietary diversity score, fewer than three frequencies of meals and three meals only per

54 day were independent predictors of food insecurity. Therefore, increasing home gardening,
55 decreasing alcohol intake, increasing dietary diversity, and performing income-generating
56 activities are highly recommended to reduce food insecurity.

57 **Keywords:** Food Insecurity, Prevalence, Lactating Mothers, Predictors, Ethiopia

58 **BACKGROUND**

59 Food Insecurity (FI) is a condition in which all people at all times do not have physical, social and
60 economic access to a sufficient, nutritious, and safe food to meet their dietary needs for a
61 productive, effective, and healthy life. It also exists when availability, quality, and quantity of
62 foods are limited or cannot be accessed in a socially acceptable manner that promotes and
63 maintains the health and wellbeing of individuals [1-5]. It can be classified as food secure, mildly
64 food insecure, moderately food insecure and severely food insecure [2, 6].

65 Currently, it has become a global challenge and affects all nations regardless of their wealth status,
66 but it is more severe and prevalent in low- and middle-income countries, especially in the past two
67 decades [7, 8]. Due to the worsening of global economic conditions, food insecurity has received
68 increased attention worldwide. The increment of food insecurity situation and the lack of progress
69 towards the World Health Organization (WHO) global nutrition targets make it imperative for
70 countries to step up their efforts and to create a world without hunger and malnutrition by 2030 [7,
71 9, 10].

72 Lactating mothers need more nutritious and qualified food to satisfy their physical needs and their
73 child needs, because the requirements of calorie and essential nutrients are high during this period.
74 Despite the increased nutritional requirements, especially in Africa, particularly in Ethiopia,
75 lactating mothers are extremely vulnerable to both macronutrient and micronutrient deficiencies

76 [11]. In the condition of food insecurity, mothers are more vulnerable to malnutrition. Food
77 insecurity, being a devastating problem, affects not only mothers but also their infants everywhere
78 in the globe [7, 11].

79 In several developing countries, including Ethiopia, achieving food security for all people at all
80 times remains a great challenge. Ethiopia, which has been plagued with food insecurity for
81 decades, is one of the world's poorest nations with indicators showing low levels of development
82 and increased conditions of malnutrition [9, 12-14].

83 In summary, the prevalence of food insecurity ranges from 17% to 83% in global countries
84 conducted from 2012 to 2018 [11, 15-19], from 31.3% to 91.0% in other African countries
85 conducted from 2013 to 2017 [10, 20-22] and from 6.8% to 77% in Ethiopia conducted from 2013
86 to 2016 [9, 23-27].

87 The major causes of food insecurity of mothers emerged from different sources such as lack of
88 formal education, rural residence, poor occupational status, large family size, increased number of
89 under-five children, absence of income-generating activities, poor dietary diversity practice and
90 low frequency of meals per day [9, 12, 13, 24, 25]. Notwithstanding that, the effect of home
91 gardening practices and alcohol use by their husbands on the food insecurity of mothers has not
92 been well addressed by previous studies.

93 Likewise, previous studies did not address lactating mothers' feelings of uncertainty or anxiety
94 over food, perceptions that food is of insufficient quantity, perceptions that food is of insufficient
95 quality, reported reductions in food intake, reported consequences of reduced food intake, and
96 feelings of shame for resorting to socially unacceptable means to obtain food resources for their
97 household members [1].

98 Moreover, most of the previous studies only addressed the feelings and perceptions of household
99 heads (mostly male), except for some studies that addressed the feelings and perceptions of
100 pregnant women. This indicates that there is a dearth of studies that need to address the feelings
101 and perceptions of lactating mothers on food insecurity.

102 In addition, most of the time in the Ethiopian context, mothers are responsible for preparing and
103 cooking food for all household members. This leads them to know well the presence or absence of
104 sufficient food for all members of the household. For this reason, lactating mothers are the best
105 respondents for food insecurity studies.

106 Furthermore, currently, there are limited findings on food insecurity in low-income countries like
107 Ethiopia among lactating mothers, including the study area. Therefore, the objective of this study
108 was to assess the prevalence of food insecurity and its predictors among lactating mothers
109 including factors that were not included by previous studies in Ataye District, North Shoa Zone,
110 Ethiopia.

111 **METHODS AND MATERIALS**

112 **Study Setting and Design**

113 This study was conducted in the Ataye District, which is 270 km away from Addis Ababa (the
114 capital city of Ethiopia) and 140 km from Debre Berhan Town (the Zonal Town of North Shoa) in
115 central Ethiopia. From the 2007 national census projection, the total population of Ataye District
116 was 110,493, and the current population is estimated to be 170,425. The district has 30 kebeles
117 which is the lowest administrative unit in Ethiopia (Ataye District report, 2017). This study was
118 conducted in two urban and four rural randomly selected kebeles of the District.

119 A community-based cross-sectional study design was used to determine the prevalence and
120 predictors of FI from February to April, 2018. During the study period, the source populations of
121 the study were all lactating mothers aged 15 to 49 years.

122 Regarding the eligibility criteria, mothers aged 15 to 49 years who lived for at least six months
123 and above in the District were included. On the other hand, mothers who were unable to respond
124 to an interview, were severely sick and did not volunteer to respond to the questionnaire were
125 excluded from this study.

126 **Sample Size Determination and Sampling technique**

127 The required sample size for this study was determined and calculated using a single population
128 proportions formula with the following assumptions: proportion of food insecurity among lactating
129 mothers 50% (0.5), $Z_{\alpha/2}$ with 95% confidence level to be 1.96, margin of error to be 0.05, non-
130 response to be 10%, and a design effect of 1.5. Accordingly, the final calculated sample size of the
131 study was 635.

132 Regarding the sampling procedures, considering kebele as clusters, lactating mothers in the
133 households were selected by the cluster sampling technique. Ataye District has 30 kebeles (6 urban
134 and 24 rural). However, the kebeles were selected using a simple random sampling method. Based
135 on the residence of mothers, these kebeles/clusters were classified into urban and rural areas. The
136 sample size was allocated proportionally according to the population size of the selected urban and
137 rural kebeles. The number of lactating mothers found in each kebele was taken from a family
138 folder, which is documented by the Health Extension Workers (HEWs) with respect to their
139 household. Through house-to-house visits, all lactating mothers in randomly selected clusters were
140 included in the study. During the absence of eligible mothers during the time of visit, a revisit was

141 arranged with a minimum of three times and finally if they were not presently considered non-
142 respondents.

143 **Data Collection Methods and Instruments**

144 The study data collection instruments were developed by reviewing different kinds of literature
145 using the search engines such as PubMed, Google Scholar, Hinari, and The Lancet series. A
146 structured interviewer-administered questionnaire was used to collect the data through Amharic
147 language (local language), which was translated from English language.

148 The data collectors of this study were six female grade ten graduated students who were fluent
149 speakers in the local language. The data collectors underwent a community-based face-to- face
150 interview using a structured and pretested Amharic questionnaire. The interviewers were informed
151 of the lactating mothers about all the details of the research. Two-degree health professionals from
152 Ataye District Hospital and Health Center were recruited for the supervision of the data collection
153 procedure.

154 The variables of this study were grouped as sociodemographic variables, health service utilization
155 related variables and food source and feeding practice of mother-related variables. The
156 sociodemographic variables were place of residence, maternal age, marital status, maternal
157 educational status, family size, number of under-five, maternal occupation, religion, ethnicity, and
158 sex of household head. The health service utilization related variables were ANC visit, place of
159 delivery, PNC visit, and maternal history of illness. The food source and feeding practice of
160 mothers' related variables were inadequate dietary intake, nutrition knowledge, sources of food,
161 home gardening practice, alcohol intake by husbands, and income generating activities.

162 **Measurements and Operational Definitions**

163 Household food insecurity was measured with the Household Food Insecurity Access Scale
164 (HFIAS), a structured, standardized, and validated tool that developed mainly by FANTA, to
165 classify households as food secure or not [1, 28]. The scale is a valid tool for measuring household
166 food insecurity among both rural and urban areas of Ethiopia with Cronbach's alpha values of 0.76
167 for round 1 and 0.73 for round 2 [29].

168 **Lactating mothers:** In this study, mothers were aged 15-49 years and had 6-23-month-old
169 children who were currently feeding breast milk for her infant/child (30).

170 **Food secure mothers:** Mothers who experience none of the food insecurity (access) conditions or
171 just experience worry, but rarely in the past 4 weeks (6).

172 **Food insecure mothers:** Mothers who experience inability to access sufficient food at all times
173 to lead an active and healthy life (includes all stages of food insecurity; mild, moderate and severe)
174 (6).

175 **Mildly food insecure mothers:** Mothers who worry about not having enough food sometimes or
176 often and/or are unable to eat preferred foods and/or eat a more monotonous diet than desired
177 and/or some foods considered undesirable, but only rarely (6).

178 **Moderately food insecure mothers:** Mothers who sacrifice quality more frequently, by eating a
179 monotonous diet or undesirable foods sometimes or often, and/or have started to cut back on
180 quantity by reducing the size of meals or number of meals, rarely or sometimes. However, it does
181 not experience any of the three most severe conditions (6).

182 **Severely food insecure mothers:** Mothers who have forced cutting back on meal size or number
183 of meals often and/or experience any of the three most severe conditions (running out of food,
184 going to bed hungry, or going a whole day and night without eating), even as infrequently as rarely
185 (6).

186 **Data Quality Control**

187 The data collection instrument was translated back to English by independent language experts in
188 both languages to ensure its consistency, and comparisons were made on the consistency of the
189 two versions. Before the actual data collection, the questionnaire was pretested outside the selected
190 kebeles on 5% of the total sample size to ensure the validity of the tool. After the pretest had done,
191 all the necessary adjustments were made. Some of the adjustments were the questions related to
192 knowledge of nutrition, the approaches of the data collectors and the ability to review the mothers
193 were further modified and improved. Then, the translated, pretested, and structured Amharic
194 version of the questionnaire was used to collect the data.

195 For the six female grade ten graduated students and the two supervisors, two days of training was
196 given on both theoretical and practical aspects. The focus area of training was about interview
197 techniques, ethical issues, rights of the participants, reading through all the questions and
198 understanding them well, and ways of minimizing under/over-reporting and maintaining
199 confidentiality.

200 Interviews were conducted in an area with adequate confidentiality, privacy, and without the
201 involvement of any other person other than the respondent. During the actual data collection, close
202 supervision was made by the principal investigator and the two supervisors. The collected data
203 were cross-checked on each day of activity for consistency, missing data, and completeness.

204 **Data Processing and Analysis**

205 The authors visually checked all the interviewed questionnaires before directly going to analysis.
206 EpiData version 4.2.0.0 software was used to code, enter, and clean the data. To cross-check the
207 data for completeness, double data entry was made by two data clerks. After doing this, the entered
208 data were exported and analyzed with Statistical Package for Social Science (SPSS) version 24

209 software for windows using IBM SPSS Statistics 24 Core System User's Guide. To describe the
210 demographic, socioeconomic, and maternal-related characteristics of the respondents, simple
211 descriptive statistics such as simple frequency distribution, measures of central tendency, measures
212 of variability, and percentages were performed. Tables and figures were used to present the
213 information of respondents.

214 The outcome variable (food insecurity) was determined by computing nine standard household
215 Food Insecurity Access Scale (HFIAS) questions adapted from the FANTA (Food and Nutrition
216 Technical Assistance) project. The tool consists of nine questions that show frequency-of-
217 occurrence and measures the severity of food insecurity in the last four weeks in terms of Likert
218 Scale question responses [0 = never, 1 = rarely (once or twice), 2 = sometimes (three to ten times),
219 3 = often (more than ten times)]. The mothers were expected to answer these questions on behalf
220 of all household members in their household. This tool was used to assess access to food for all
221 household members at the time of data collection. To determine the cumulative score of food
222 insecurity among mothers, the nine items ranged from 0–27, and a higher score indicated that the
223 household members experienced more food insecurity.

224 For analysis, all “Yes” responses were coded in “1” and “No” responses were coded in “0”, and
225 the responses were summed to obtain the household food insecurity status. The HFI status, which
226 had a high internal consistency (Cronbach’s alpha = 0.927), was further dichotomized as “food
227 insecure” and “food secure” household, which were coded as “1” and “0”, respectively, for
228 analysis.

229 The knowledge of mothers about nutrition was assessed and computed based on six questions
230 using a mean score. The questions include about the awareness of mothers about nutrition, dietary
231 diversity practice and taking varieties of food groups, types of varieties of food groups, definitions

232 of the term varieties food groups, definitions of the term malnutrition, causes of malnutrition and
233 consequences of malnutrition. Mothers who scored above the mean cut-off point were considered
234 to have good knowledge and coded as “1”, whereas those who scored below this cut-off point
235 were considered to have poor knowledge and coded as “0”.

236 To see the association between each independent variable and the outcome variable, the bivariate
237 analysis and crude odds ratio along with a 95% confidence interval (CI) were used. In addition,
238 independent variables with a P value of ≤ 0.25 were included in the multivariate analysis to control
239 for confounding factors.

240 To see the linear correlation among the independent variables, multicollinearity was checked using
241 standard error (SE). Variables with a standard error of ≥ 2 were dropped from the multivariate
242 analysis. Hosmer-Lemeshow’s goodness-of-fit model test coefficient was used to test the fitness
243 of the model which was found to be insignificant with a large P value (P=0.860).

244 To identify the predictors of food insecurity, adjusted odds ratios along with 95% CIs were
245 estimated using multivariate logistic regression analysis. All tests were two-sided and the level of
246 statistical significance was declared at a P value less than 0.05.

247 **RESULTS**

248 **Sociodemographic Characteristics of Respondents**

249 Out of 635 respondents, 612 responded to the interview resulting in a response rate of 96.23%.
250 The nonparticipation was due to the absence of study participants during different visits at the time
251 of data collection. The mean age of mothers (\pm SD) was 30.61 (\pm 6.44) years. Of the total mothers,
252 398 (65%) were rural by residence, 331 (54.1%) were in the age group of 15-30, 526 (85.9%) were
253 Orthodox Tewahido Christian by religion, 547 (89.4%) were Amhara by ethnicity, 482 (78.8%)

254 were married by their marital status, 494 (80.7%) were male household heads, 250 (40.8%) had
 255 no formal education and 374 (61.1%) were housewives by their occupation (**Table 1**).

256 Table 1: Sociodemographic characteristics of respondents in Ataye District, 2018 (n = 612)

Variables	Category	Frequency (%)
Residence	Urban	214 (35)
	Rural	398 (65)
Age	15-30	331 (54.1)
	31-45	274 (44.8)
	>45	7 (1.1)
Ethnicity	Amhara	547 (89.4)
	Oromo	49 (8.0)
	Tigrai	11 (1.8)
	Others	5 (0.8)
Religion	Orthodox Tewahido Christian	526 (85.9)
	Muslim	47 (7.7)
	Protestant	39 (6.4)
Marital status	Single	39 (6.4)
	Married	482 (78.8)
	Divorced	54 (8.8)
	Widowed	26 (4.2)
	Separated	11 (1.8)
Sex of household head	Male	494 (80.7)
	Female	118 (19.3)
Educational status	No formal education	250 (40.8)
	Read and write	133 (21.7)
	Primary education	98 (16)
	Secondary education	51 (8.3)
	More than secondary education	80 (13.1)
Occupational status	Housewife	374 (61.1)

	Merchant	74 (12.1)
	Daily laborer	54 (8.8)
	Government employee	54 (8.8)
	Self-employed	52 (8.5)
	Others	4 (0.7)
Family size	1-3	131 (21.4)
	4-6	339 (55.4)
	>6	142 (23.2)
Number of under 5 children	1-2	580 (94.8)
	>2	32 (5.2)

257 **Health Service Utilization of Mothers**

258 More than half of mothers (56.9%) had ANC visits greater than or equal to four visits. On the other
 259 hand, nearly half of the mothers (47.9%) delivered in the Health Center and 46.7% of them had
 260 postnatal care follow-up. Three-tenths of mothers had an illness in the last 2 weeks (**Table 2**).

261 Table 2: Health service utilization of mothers in Ataye District, 2018 (n = 612)

Variables	Category	Frequency (%)
Number of ANC visits	No visit	106 (17.3)
	≤ three	348 (56.9)
	≥ four	158 (25.8)
Place of delivery	Home	201 (32.8)
	Health center	293 (47.9)
	Hospital	118 (19.3)
Postnatal care follow-up	Yes	286 (46.7)
	No	326 (53.3)
Presence of illness in the last 2 weeks	Yes	180 (29.4)
	No	432 (70.6)

262 **Food Source and Feeding Practice of Mothers**

263 The main source of food for the mothers was their own production, 346 (56.5%). Nearly three-
 264 fifths of mothers had home gardening practice in their yard. In addition, more than two-thirds of
 265 (68.8%) mothers had three frequencies of meals per day. Regarding the knowledge of nutrition,
 266 minimum dietary diversity score, and income-generating activity, 344 (56.2%), 308 (50.3), and
 267 346 (56.5) had good knowledge, high MDD score, and income-generating activity respectively
 268 (Table 3).

269 Table 3: Food source and feeding practice of mothers in Ataye District, 2018 (n = 612)

Variables	Category	Frequency (%)
Source of food	Own production	346 (56.5)
	Purchasing	256 (41.8)
	Food aid/relief	8 (1.3)
	Other sources	2 (0.3)
Home gardening practice	Yes	352 (57.5)
	No	260 (42.5)
Use alcohol	Yes	171 (27.9)
	No	441 (72.1)
Meal frequency	Less than three meals	47 (7.7)
	Three meals	421 (68.8)
	Above three meals	144 (23.5)
Knowledge of nutrition	Poor	268 (43.8)
	Good	344 (56.2)
Minimum dietary diversity score	Low (≤ 5 food groups)	304 (49.7)
	High (≥ 5 food groups)	308 (50.3)
Income-generating activity	Yes	346 (56.5)
	No	266 (43.5)

270 **Prevalence of Food Insecurity Status among Mothers**

271 Of the nine HFIAS items, worry about food (37.3%), unable to eat preferred foods (30.9%) and
 272 eat just a few kinds of foods (22.5%) were the most frequently reported occurrences of food
 273 insecurity items in mothers (**Table 4**).

274 Table 4: Descriptions of the nine (9) items of HFIAS food access questions of mothers in Ataye
 275 District, 2018 (n = 612)

HFIAS 9 items	Response (%)		Frequency of occurrence (%)		
	Yes	No	Rarely	Sometimes	Often
Worry about food	37.3	62.7	22.5	10.1	4.7
Unable to eat preferred foods	30.9	69.1	17.8	8.5	4.6
Eat just a few kinds of foods	22.5	77.5	16.8	3.8	1.9
Eat foods they really do not want eat	20.4	79.6	9.8	5.9	4.7
Eat a smaller meal	12.4	87.6	8.3	3.4	0.7
Eat fewer meals in a day	8.5	91.5	5.7	2.6	0.2
No food of any kind in the household	5.2	94.8	3.1	2.0	0.2
Go to sleep hungry	4.4	95.6	2.6	1.8	0.2
Go a whole day and night without eating	3.1	96.9	2.1	0.5	0.5

276 In this study, more than three-fifths of mothers, 387 (63.2%) were food secure whereas, 225
 277 (36.8%) were food insecure (**Figure 1**).

278 **Predictors of Food Insecurity among Mothers**

279 In the bivariate logistic regression analysis, sex of household head, educational status, number of
 280 children under 5, alcohol use, income-generating activities, postnatal follow-up, main source of
 281 food, home gardening practice, meal frequency, knowledge of nutrition, and minimum dietary

282 diversity score were associated with food insecurity of mothers and became candidates for further
283 multivariate analysis (**Table 5**).

284 Using the enter method, those variables with a P value of ≤ 0.25 in the bivariate logistic regression
285 analysis were entered into a multivariate logistic regression analysis to identify the independent
286 predictors of food insecurity. Accordingly, no formal education, alcohol use by husbands, no
287 income-generating activities, no home gardening practice, low minimum dietary diversity score,
288 and meal frequency less than three and three meals only were the significant predictors of food
289 insecurity of mothers (**Table 5**).

290 Mothers who had no formal education were 1.82 times [(AOR = 1.82, 95% CL: (1.13, 2.92))] more
291 likely to have food insecurity than those who had formal education. Regarding income-generating
292 activities, mothers who had no income-generating activities were 3.39 times [(AOR = 3.39, 95%
293 CI: (2.05, 5.64))] more likely to be food insecure than their counterparts (**Table 5**).

294 On the other hand, the odds of food insecurity were 5.65 times higher among mothers who had no
295 home gardening practice [(AOR = 5.65, 95% CI: (3.51, 9.08))] than their counterparts. Lactating
296 mothers who had a husband who used alcohol in the last time were approximately 2.02 [(AOR =
297 2.02, 95% CI: (1.25, 3.24))] times more likely to have food insecurity status than their counterparts
298 (**Table 5**).

299 The odds of food insecurity were nearly three times [(AOR = 2.94, 95% CI: (1.88, 4.57))] more
300 common among mothers who had low minimum dietary diversity scores than among mothers who
301 had high minimum dietary diversity scores (**Table 5**).

302 Concerning the meal frequency of mothers, mothers who had less than three meals and three meals
303 only were 3.97 and 1.86 times more likely to be food insecure than those who had four meals and

304 above [(AOR = 3.97, 95% CI: (1.65, 9.54)] and [(AOR = 1.86, 95% CI: (1.08, 3.17)], respectively
 305 (Table 5).

306 Table 5: Bivariable and multivariable logistic regression¹ analysis of predictors of food insecurity
 307 among lactating mothers in Ataye district, 2018 (n = 612).

Variables	Food security status		COR (95% CI)	AOR (95% CI)
	Insecure (%)	Secure (%)		
Sex of household head				
Male	190 (35.5)	304 (61.5)	1.00	1.00
Female	35 (29.7)	83 (70.5)	0.67 (0.44, 1.04)	0.80 (0.46, 1.38)
Educational status of mothers				
No formal education	167 (49.4)	171 (50.6)	3.64 (2.54, 5.21) *	1.82 (1.13, 2.92) *
Formal education	58 (21.2)	216 (78.8)	1.00	1.00
Number of <5 children				
1-2	209 (36)	371 (64)	1.00	1.00
>2	16 (50)	16 (50)	1.77 (0.87, 3.62)	1.45 (0.57, 3.67)
Source of food				
Own source	160 (46.2)	186 (53.8)	1.00	1.00
No known source	65 (24.4)	201 (75.6)	2.66 (1.87, 3.77)	1.05 (0.60, 1.85)
Income-generating activities				
Yes	81 (23.4)	256 (76.6)	1.00	1.00
No	144 (54.1)	122 (45.9)	3.86 (2.73, 5.46) *	3.39 (2.05, 5.64) *
Frequency of meal per day				
Less than three meals	27 (57.4)	20 (42.6)	5.13 (2.53, 10.37) *	3.97 (1.65, 9.54) *
Three meals	168 (39.9)	253 (60.1)	2.52 (1.62, 3.95) *	1.86 (1.08, 3.17) *
Above three meals	30 (20.8)	114 (79.2)	1.00	1.00
Postnatal care follow-up				
Yes	109 (33.4)	217 (66.6)	1.00	1.00
No	116 (40.6)	170 (59.4)	1.36 (0.98, 1.89)	0.69 (0.45, 1.09)
Alcohol use by husband				

Yes	72 (42.1)	99 (57.9)	1.37 (0.95, 1.97)	2.02 (1.25, 3.24) *
No	153 (34.7)	288 (65.3)	1.00	1.00
Home garden practice				
Yes	46 (17.7)	241 (82.3)	1.00	1.00
No	179 (50.9)	173 (49.1)	4.82 (3.29, 7.04) *	5.65 (3.51, 9.08) *
Knowledge of nutrition				
Poor	121 (45.1)	147 (54.9)	1.90 (1.36, 2.65)	0.19 (0.51, 1.26)
Good	104 (30.2)	240 (69.8)	1.00	1.00
Minimum dietary diversity score				
Low	160 (52.6)	144 (47.4)	4.15 (2.91, 5.92) *	2.94 (1.88, 4.57) *
High	65 (21.1)	243 (78.9)	1.00	1.00

308 COR-Crude Odds Ratio, AOR-Adjusted Odds Ratio, CI-Confidence Interval, ¹Hosmer and
309 Lemeshow Test (0.86)

310 DISCUSSION

311 The findings of this study showed that 36.8% of mothers developed food insecurity in the study
312 area. This study also identifies the sociodemographic, health service utilization-related and food
313 source-and feeding practice-related factors of food insecurity among mothers. Accordingly, no
314 formal education, alcohol use by husbands, no income-generating activities, no home gardening
315 practice, low minimum dietary diversity score, and meal frequency less than three and three meals
316 only were the significant predictors of food insecurity of mothers.

317 The finding of this study (36.8%) is consistent with the study conducted in Ambo District (38.4%)
318 [23]. On the other hand, it is higher than the study conducted in Vietnam (34.4%) [17], Canada
319 (17%) [18], Nigeria (31.3%) [22], and Dedo and Seqa-Chekorsa Districts in Jimma Zone (6.8%)
320 [27]. However, this finding is much lower than those of studies conducted in India (78.9%) [11],
321 the Urban Resettlement Colony in North India (77.2%) [16], Iran (44%) [19], Malesia (83.9%)

322 [15], Tanzania in two seasons (80% and 69%) during the long rainy season and immediately after
323 the harvest season [10], South Africa Limpopo Province (53%) [21], South Africa (91%) [20],
324 Farta District (70.7%) [9], Babile District (57%) [24], Benshangul Gumuz Region (72%) [26],
325 Shashemene (55.7%) [25] and Bule Hora District (77%) [12]. These inconsistencies could be due
326 to the difference in some sociodemographic characteristics of the study participants. Since this
327 study was done in the postharvest season and the other studies have a preharvest season, seasonal
328 variation may be another important factor for the perceived difference.

329 Regarding the predictors of food insecurity of mothers, the odds of food insecurity were nearly
330 two-fold higher among mothers who had no formal education than those who had formal
331 education. This is in line with the study conducted previously in the rural area of Ethiopia (Farta
332 District and Babile District) and South Africa in a community-based setting. [9, 21, 24]. This is
333 because mothers who have no formal education may not have good knowledge to understand how
334 to grow, improve, manage, and produce enough types of farms to sustain the food security status
335 of their households and themselves.

336 Food insecurity was nearly four-fold more common in mothers who had no income-generating
337 activities than in mothers who had income-generating activities. This is similar to the study
338 conducted in Bule Hora District, Babile District, Farta District and Belo-Jingany District [9, 12,
339 24, 26]. This is because mothers who have no income-generating activities (off-farm sources)
340 cannot challenge food insecurity unless they have an additional source of food in the absence of
341 food in the household.

342 Lactating mothers who had husbands who used alcohol were two times more likely to have food
343 insecurity than their counterparts. This is because mothers who have husbands to expense much

344 money on alcohol drinking will be highly exposed to food insecurity. To date, the association
345 between food insecurity and alcohol use is not supported by previous studies.

346 The odds of food insecurity were six times higher among mothers who had no home gardening
347 practice than their counterparts. Those mothers who had no practice in a home garden in their
348 compound will have a high probability of developing food insecurity. Because they cannot easily
349 access different types of vegetables, fruits, and other important crops in their backyard, in case
350 they cannot prevent temporal food insecurity. To date, it is not supported by previous evidence.

351 The odds of food insecurity were nearly three times more common among mothers who had low
352 minimum dietary diversity scores than mothers who had high minimum dietary diversity scores.
353 This is supported by the study conducted in Tanzania [10]. This is because mothers who had not
354 taken different groups of food indirectly it indicate that they have no good food security status in
355 their household.

356 Regarding the meal frequency of mothers, mothers who had two meals only or below and three
357 meals were four and two times more likely to have food insecurity than those who had four meals
358 and above, respectively. This is consistent with the study done in northwestern Ethiopia [13]. If
359 lactating mothers do not have at least two meals above they usually take, they are highly at risk of
360 developing undernutrition. This directly indicates that food insecurity is the direct cause of
361 malnutrition for mothers and thereby for their children.

362 Thus, the government of Ethiopia, particularly the Ataye District Health Office, should design
363 intervention programs aimed at improving maternal food security status through appropriate food-
364 based approaches for mothers to have good coping strategies. In addition, the district should
365 strengthen nutrition education programs, creating strong multisectoral collaboration targeted at
366 improving the mother's educational status, home gardening practice, income generating activities

367 and dietary diversity practice. Since food insecurity has multiple factors, a further study with a
368 stronger study design, like prospective cohort study, is needed to identify other independent
369 predictors of food insecurity in mothers in different seasons.

370 Related to the methodological limitations of the study, the cross-sectional study design inhibits
371 any causal inferences between food insecurity and its predictors. This study design cannot generate
372 the temporal relationship between the outcome variable and the correlates.

373 On the other hand, seasonal variation may be one of the limitations of the study since this study
374 was conducted in the postharvest season of Ethiopia. Even if self-reporting and dietary recall are
375 very common and effective means of collecting data in nutrition and epidemiological studies,
376 especially in resource poor countries like Ethiopia, the self-reported nature and a one-month recall
377 of data collection for food insecurity and a 24-hour recall for dietary diversity make the
378 information prone to social desirability bias, reporting bias and recall bias, which underestimates
379 the power of the study. These biases were minimized by probing and giving detail information
380 about the event. Another limitation is that this study uses previous studies that were conducted at
381 the household level with male household head respondents due to the lack of studies conducted on
382 mothers, which may not be the real comparator of this study.

383 **CONCLUSIONS**

384 The prevalence of food insecurity was high among the study participants in the study area. The
385 major predictor factors for this high prevalence of food insecurity were no formal educational
386 status of mothers, alcohol use by husband, no income-generating activities, no home gardening
387 practice, decreased meal frequency, and low minimum dietary diversity score were the significant
388 predictors of food insecurity of mothers.

389 **Abbreviations**

390 EDHS-Ethiopian Demographic and Health Survey

391 FI-Food Insecurity

392 FAO-Food and Agricultural Organization of the United Nation

393 FANTA-Food and Nutrition Technical Assistant

394 IHRERC-Institutional Health Research Ethics Review Committee

395 HFI-Household Food Insecurity

396 HFIAS-Household Food Insecurity Access Scale

397 UNICEF-United Nation Children’s Fund

398 USAID-United States Agency of International Development

399 WHO-World Health Organization

400 **Ethics approval:** Ethical approval was obtained from the College of Health and Medical Science
401 Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University. It
402 was dated 15 January 2018 and numbered with Ref C/AC/R/D/897/18. The clear description of
403 the study title, purpose, procedure, duration, possible risks and benefits of the study was explained
404 for each study participant and obtained before informed consent. Then written informed consent
405 was obtained from each respondent before starting the interview.

406 **Availability of data statement:** The datasets used and/or analyzed during the current study are
407 available from the corresponding author on reasonable request.

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411 **Authors' contributions:** LG: Participated in the conception, and design of the study, performed
 412 the data collection, performed the statistical analysis and served as the lead author of the manuscript.
 413 GE: Participated in the design of the study, revised subsequent drafts of the paper and contributed
 414 to the finalization of the manuscript. AB, YA, SD, HA, AT and WA: Assisted in the design of the
 415 study, statistical analysis, intellectual and revised subsequent drafts of the manuscript. All authors
 416 read and approved the final manuscript.

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518 **Figure legend**

519 Figure 1: Food security status of mothers in Ataye District, 2018

Figures

Food insecurity status

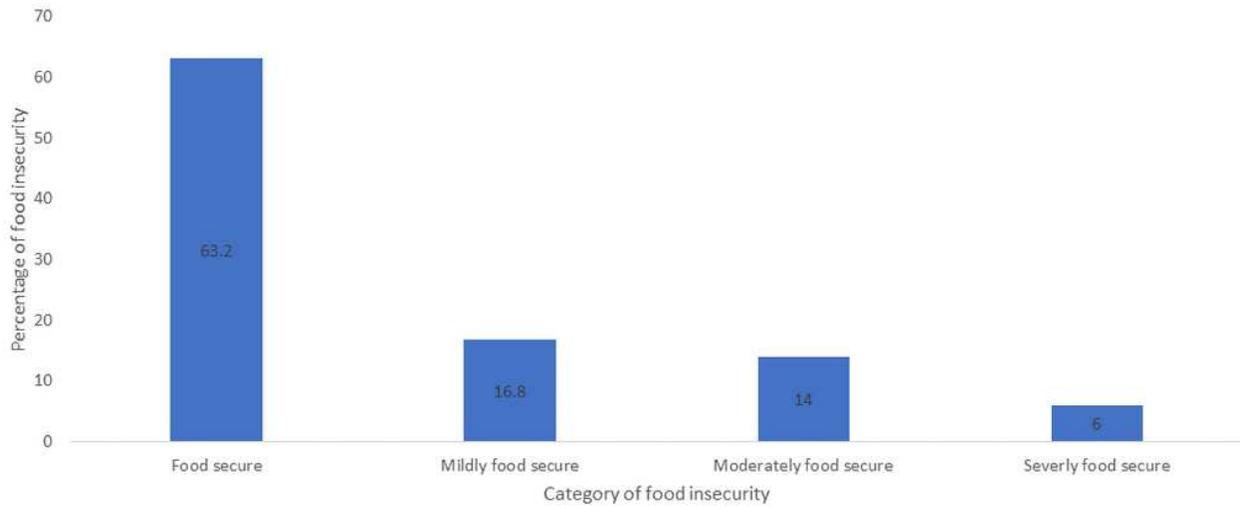


Figure 1

Food security status of mothers in Ataye District, 2018