Original article

# Food security status and vulnerability to anemia among women of reproductive age in pastoralist communities of Somali regional state, Ethiopia: a comparative, community-based, cross-sectional study

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## Abstract

**Background:** Although the impact of food insecurity and anemia has been shown to be more common among women of reproductive age, there is little information available on the issue in relation to women in Fafan Zone, Somali Region, Ethiopia.

**Objectives:** To compare the levels of anemia among women of reproductive age in food-secure versus food-insecure households in Fafan Zone.

**Methods:** A community-based, cross-sectional study design was employed in rural Ethiopia from February to April 2017. In total, 142 women from food-insecure households and 287 women from food-secure households were recruited and their levels of anemia were measured using a HemoCue spectrophotometer, and then compared. Food insecurity was measured using a modified household food insecurity access scale. Data were entered using Epi data 3.1 and analyzed using Stata version 14.0. Bivariate and multivariate logistic regression analyses with 95% confidence intervals were used to examine the association between anemia and food security. A p-value of less than 0.05 was statistically significant.

**Results:** The prevalence of anemia among women in food-insecure households was 79.53% and ranged from 42.0% to 90.0%; among women in food-secure households, the prevalence was 20.47% and ranged from 12% to 34%. The observed difference between Food Security (FS) and Food Insecurity (FI) was statistically significant indicating a correlation between the two groups. Women who reported food insecurity were about 1.4 times more likely to suffer from anemia than their food-secure counterparts (AOR=1.4; 95% CI=1.02-2.10).

**Conclusions and recommendations:** It appears that four in five women in food-insecure households had anemia, and that there was an overall positive relationship between food insecurity and anemia. To address the level of anemia in food-insecure households, more nutritional support is required, in addition to implementing a poverty alleviation program and weekly iron folic acid supplementation. . [*Ethiop.J. Health Dev.* 2019; 33(1):28-37]

**Key words:** Food insecurity, anemia in women, Somali Region, Ethiopia

## Introduction

Anemia is a global public health problem that affects one in four people. It is highly prevalent among pregnant and non-pregnant women, with the highest incidence in Africa, based on a 2004 World Health Organization (WHO) report (1). It occurs at all stages of the life cycle, though is more common in children, adolescents, pregnant women and women of reproductive age (1,2). Anemia increases the risk of maternal and child mortality and has negative health consequences for the cognitive and physical development of children, and for the social and economic development of adults (3,4).

According to the WHO, about 38% of pregnant women, 29% of non-pregnant women and 29% of all women of reproductive age are anemic globally, which in relative terms means that 496 million non-pregnant women are anemic (5).

In Ethiopia, the magnitude of anemia at the national level is 24% in women of reproductive age group(15-49), with the prevalence among women in Somali Region more than three times the national average, based on the 2016 Ethiopian Demographic Health Survey (6). Although various factors contribute to anemia, an inadequate intake of iron due to food insecurity (FI) referring to the state of being without

reliable access to a sufficient quantity of affordable, nutritious food and infections are the immediate causes (7). Inadequate food intake due to FI affects one in nine people worldwide. A recent estimate from 2012-2014 shows that nearly one seventh of the world's population goes to sleep having missed one of their daily meals, the majority of whom are from developing countries (8,9).

FI and hidden hunger (micronutrient deficiency) affect about 2 billion people globally (10). According to Hailu *et al.*, Ethiopia is among the poor nations that faces repeated macro- and micro-level FI, coupled with environmental degradation and depletion (11). Based on an FAO report, currently more than 10.2 million Ethiopian people experience food shortages (12), indicating the vulnerability to developing a variety of unwanted health outcomes, including anemia (13).

Household food insecurity results in malnutrition, including a range of health problems, such as undernutrition and multiple micronutrient deficiencies, among which iron deficiency is the most common, particularly in women (10). Although the impact of FI and anemia have been shown to be more pronounced among women of reproductive age, some studies report

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an inconsistent association (14) with anemia, while others document a positive relationship (7,15).

The present study – which was undertaken to fill the gap created as a result of these inconsistent findings–, assessed the associations between food security and anemia in apparently healthy women of reproductive age residing in both food insecure and food-secure households. The findings of the present study will generate evidence-based information that contributes to the existing literature, as well support potential interventions that help to improve the health of women who are at risk.

## Methods
### Study area and population:
A community-based, comparative, cross-sectional study was conducted from February to April 2017 among women of reproductive age (15-49) drawn from two communities with food shortages and food security, residing in Jigjiga district and Jigjiga city council, representing rural and urban populations, respectively, in Fafan Zone, Somali regional state, Ethiopia. The district is 628km to the east of Addis Ababa.

### Sample size and sampling:
The sample size (SS) was estimated based on a double population proportions formula $[n1=\{Z\alpha/2\sqrt{(1+1/r)p(1-p)}-Z\beta\sqrt{P_1(1-P_1)}+[P_2(1-P_2)]/r\}^2]$ / P1-P2; where $Z\alpha/2$ = the Z score at 95% confidence level=1.96; p1=42% among non-exposed; p2=24% nutrition among exposed; r=the ratio between exposed and non-exposed of 1:2; n1=sample size (15). The estimated SS was inflated by 5% non-response and a design effect of 1.5 and reached 468. Accordingly, a total of 198 women from food-secure households and 231 from food-insecure households were recruited, and their anemia levels were measured.

All eligible women available in the households were included after their verbal consent was obtained. Those women who were pregnant or lactating, or who had chronic illnesses at the time of the study, were excluded for ethical reasons.

A two-stage stratified sampling method was employed to sample the study participants. In the first stage, Fafan Zone was purposively selected. From this zone, Jigjiga district and Jigjiga council/town, representing rural and urban settings respectively, were selected. Subsequently, all rural and urban *kebeles* (villages) were stratified by food security status, assuming that food security status varied in the urban and rural communities.

Prior to the enrolment, two *kebeles* each from Jigjiga town and Jigjiga district were selected randomly (first stage). Then, households were registered and listed by food security status to constitute the sampling frame (SF). To make sure that the list obtained was valid, we conducted our assessment of food security status afresh through the HFIAS and noticed a decrease in the number of FIHs, probably due to ongoing interventions. Because of this variation, we tended to increase the ratio of household food insecurity to nearly 2. Subsequently, from the freshly prepared SF, every third (sampling interval) eligible household was selected systematically (second stage) with a random start until the required sample size was reached.

### Data collection instrument and procedure:
Data were collected using a pre-tested structured questionnaire in the Somali language, focusing on factors such as socio-demographic, hygiene and sanitation conditions; nutrition and diet; obstetric history; and FI status.
Two trained female nurses, and one male with a BSc in public health, all with relevant experience, were recruited and trained for two days on the method of the data collection. The training addressed issues such as the content of the questionnaire, basic interviewing skills, and measuring hemoglobin. Face-to-face interviews in a private location were used to collect the required information.

The presence of anemia was determined by measuring hemoglobin concentrations using a portable hemoglobin meter (HemoCue hb301+) on blood samples obtained aseptically from finger pricks using disposable lancets. Nursing technicians who had been properly trained collected the blood samples. HemoCue is a device that has already been validated (16), and has been recommended for use in population-based studies because of its practicality, low invasiveness and because of the possibility of obtaining immediate results. Participants with hemoglobin concentrations less than 12g/dL were considered to be anemic, in accordance with the WHO classification for non-pregnant woman of reproductive age. Hemoglobin concentrations were adjusted for altitude and smoking, using the equation published by Cohen and Hass (1). Prior to data collection, all participants were dewormed with 400mg of albendazole to avoid the contribution of intestinal worms to anemia.

The FI status of households was measured using the household food insecurity access scale (HFIAS), recommended by Food and Nutrition Technical Assistance (FANTA) project, to stratify households as FS (food secure) or FI (food insecure). Households were considered FI when all the 'occurrence' and 'frequency of occurrence' questions gave a response of 'yes' with their grades based on HFIAS developed by FANTA after it has been validated and checked (17).

Data quality management: To maintain the quality of the data, two days' training was given to data collectors on the objectives of the study, measurement procedures and ethical issues. The questionnaires were developed in English and then translated into Somali. A pre-test and demonstration of the instrument was performed on 5% of the sample in similar communities that were not included in the sample. The collected data were checked for completeness and consistency by the supervisors and the investigator. The HemoCue was

regularly checked against the standards provided by the company HemoCue AB.

***Data analysis:*** The data were entered and cleaned using EPI data version 3.1, then analyzed using Stata version 14. Data were summarized as frequencies and percentages in tables. Bivariate and multivariate logistic regression analyses were used to identify the independent predictor of anemia with an estimation of odds ratios (ORs) and 95% confidence intervals (95% CIs). All significant variables in the bivariate analysis with a p value $\leq 0.2$ were fitted into the multivariate logistic regression model. $P < 0.05$ was declared statistically significant.

### Results
***Socio-demographic characteristics of women of reproductive age group:*** Table 1 shows the socio-demographic characteristics of respondents by food security status. Altogether, 429 women participated, with a 91.67% response rate. Of the 231 (53.84%) women from food-secure households (FSHs), 27 (11.68%) were from rural areas, 161 (69.69%) were married, 153 (66.23%) lived with their husbands, 131 (56.70%) were housewives, 154 (66.67%) had more than one child, 135 (58.44%) were illiterate, 101 (43.72%) had their source of drinking water piped into

***Ethics approval and consent to participate:*** The study was approved by the School of Public Health Ethics Review Committee, College of Health Sciences, at Addis Ababa University, under protocol number 041/13/SPH. In addition, the study was cleared at the regional health bureaus, as well as the zonal and district health offices. Data were collected from all women who had given their verbal consent to participate in the study after the nature of the study was explained to them in their local language. All anemic participants were linked to nearby health centers so that they could obtain advice.

their place of residence, and 110 (47.61%) washed their hands after toilet use. Of the 198 (46.15%) women in food-insecure households (FIHs), 103 (52.02%) lived in rural areas, 166 (83.84%) were married, 152 (76.77%) lived with their husbands, 92 (46.46%) were housewives, 170 (85.86%) had more than one child, 162 (81.81%) were illiterate, 128 (64.64%) used a tanker truck as their source of drinking water, and over one third (37.87%) did not wash their hands after latrine use. The difference noted between the two groups was statistically highly significant (p<0.01).

**Table 1:** Socio-demographic characteristics of respondents by food security status in Jigjiga district and council, Somali regional state, Ethiopia, June 2017

| Characteristics | FSH | FIH | $X^2$ | p-value |
|---|---|---|---|---|
| *Residence area* | | | | |
| Rural | 27 (11.68%) | 103 (52.02%) | 82.1 | 0.001 |
| Urban | 204 (88.31%) | 95 (47.97%) | | |
| In marital union | | | | |
| No | 70 (30.30%) | 32 (16.16%) | 14.8 | 0.001 |
| Yes | 161 (69.69%) | 166 (83.84%) | | |
| *Lived with:* | | | | |
| Husband | 153 (66.23%) | 152 (76.77%) | 8.6 | 0.03 |
| Father and mother | 57 (24.67%) | 31 (15.65%) | | |
| Relatives | 13 (5.62%) | 6 (3.03%) | | |
| Alone | 8 (3.46%) | 9 (4.54%) | | |
| Women's occupation | | | | |
| Daily laborer | 31 (13.41%) | 64 (32.32%) | 55.7 | 0.001 |
| Housewife | 131 (56.70%) | 92 (46.46%) | | |
| Farmer | 8 (3.46%) | 27 (13.63%) | | |
| Student | 34 (14.71%) | 9 (4.5%) | | |
| Government employee | 27 (11.68%) | 6 (3.03%) | | |
| Had more than one child | | | | |
| Yes | 154 (66.67%) | 170 (85.86%) | 21.2 | 0.001 |
| No | 77 (33.33%) | 28 (14.14%) | | |
| Women's education | | | | |
| Literate | 135 (58.44%) | 36 (18.18%) | 72.1 | 0.001 |
| Illiterate | 96 (41.56%) | 162 (81.81%) | | |
| Drinking water sources | | | | |
| Piped into dwelling | 101 (43.72%) | 16 (8.08%) | 106.2 | 0.001 |
| Piped into yards | 8 (3.46%) | 2 (1.01%) | | |
| Public tap | 75 (32.46%) | 52 (26.26%) | | |
| Tanker truck | 47 (20.34%) | 128 (64.64%) | | |
| Wash hands after toilet use | | | | |
| Always with soap | 110 (47.61%) | 50 (25.25%) | 47.9 | 0.001 |
| Sometimes with soap | 45 (19.48%) | 26 (13.13%) | | |
| Without soap | 49 (21.21%) | 47 (23.73%) | | |
| Do not wash | 27 (11.68%) | 75 (37.87%) | | |

$X^2$ = chi square test; FSH = Food-secure households; FIH = Food-insecure households

***Obstetric-related characteristics:*** Table 2 displays the obstetric and selected morbidity history of the respondents stratified by food security status. Of the 231 (53.84%) women in FSHs, 46 (19.91%) experienced regular menses, 48 (20.78%) used contraception (with pills used by 39 (81.25%) of them), 55 (23.81%) received iron supplementation during their last pregnancy, seven (3.03%) had malaria and 30 (29.13%) were counseled for anemia. Of the 198 (46.15%) women in FIHs, 17 (8.58%) had regular menses, 15 (7.58%) used contraception (with pills used by 11 (73.3%) of them), 21 (10.61%) received iron supplementation, 10 (5.05%) had malaria and 11 (15.71%) were counseled for anemia. The difference noted was significant between the groups (p<0.04), except for types of contraceptive used (p=0.62) and malarial incidence (p=0.28).

**Table 2:** Obstetric-related characteristics of respondents by food security status in Jigjiga district and council, Somali regional state, Ethiopia, June 2017

| Characteristics | FSH | FIH | $X^2$ | p-value |
|---|---|---|---|---|
| *Had regular menses* | | | | |
| Yes | 46 (19.91%) | 17 (8.58%) | 10.9 | 0.001 |
| No | 185 (80.08%) | 181 (91.41%) | | |
| *Used contraceptives* | | | | |
| Yes | 48 (20.78%) | 15 (7.58%) | 14.8 | 0.001 |
| No | 183 (79.22%) | 183 (92.42%) | | |
| *Used methods (type)* | | | | |
| Injectables | 5 (10.42%) | 3 (20%) | 0.96 | 0.62 |
| Pills | 39 (81.25%) | 11 (73.3%) | | |
| Natural methods | 4 (8.33%) | 1 (6.67%) | | |
| *Received iron supplementation* | | | | |
| Yes | 55 (23.81%) | 21 (10.61%) | 12.7 | 0.001 |
| No | 176 (76.19%) | 177 (89.39%) | | |
| *Had malaria* | | | | |
| Yes | 7 (3.03%) | 10 (5.05%) | 1.1 | 0.28 |
| No | 224 (96.97%) | 188 (94.95%) | | |
| *Counseled on anemia* | | | | |
| Yes | 30 (29.13%) | 11 (15.71%) | 4.1 | 0.04 |
| No | 73 (70.87%) | 59 (84.29%) | | |

$X^2$ = chi square test; FSHs = Food-secure households; FIHs = Food-insecure households

***Nutritional and dietary characteristics:*** Table 3 indicates the types of food consumed by respondents by food security status. Of the 231 (53.84%) women in FSHs, 99 (42.86%) consumed maize, 199 (86.15%) had a meal pattern of three times a day, 183 (79.22%) consumed meat daily, 160 (69.26%) consumed green leafy vegetables (with 79 (49.37%) consuming them twice per week), and 51 (22.07%) consumed fruits daily. Of the 198 (46.15%) women in FIHs, 128 (64.65%) consumed maize, 125 (63.13%) had a meal pattern of three times a day, less than half (46.46%) consumed meat daily, 50 (25.25%) consumed green leafy vegetables (with 21 (42%) consuming them twice per week), and 17 (8.59%) consumed fruits daily. The differences noted between the groups were significant (p<0.001).

**Table 3:** Nutrient and diet characteristics of respondents by food security status in Jigjiga district and council, Somali regional state, Ethiopia, June 2017

| Dietary intake | FSH | FIH | $X^2$ | p-value |
|---|---|---|---|---|
| *Staple* | | | | |
| Maize | 99 (42.86%) | 128 (64.65%) | 29.6 | 0.001 |
| Milk | 25 (10.82%) | 10 (5.05%) | | |
| Sorghum | 3 (1.30%) | 7 (3.53%) | | |
| Others | 104 (45.02%) | 53 (26.77%) | | |
| *Meals per day* | | | | |
| Two | 22 (9.52%) | 70 (35.35%) | 29.3 | 0.001 |
| Three | 199 (86.15%) | 125 (63.13%) | | |
| Four or more | 10 (4.33%) | 3 (1.52%) | | |
| *Consumed meat daily* | | | | |
| Yes | 183 (79.22%) | 92 (46.46%) | 9.7 | 0.001 |
| No | 48 (20.78%) | 106 (53.54%) | | |
| *Consumed green leafy vegetables (GLVs)* | | | | |
| Yes | 160 (69.26%) | 50 (25.25%) | 82.6 | 0.001 |
| No | 71 (30.74%) | 148 (74.74%) | | |
| *Frequency of GLV consumption* | | | | |
| Daily | 35 (21.87%) | 6 (12%) | 20.9 | 0.001 |
| Twice a week | 79 (49.37%) | 21 (42%) | | |
| Once every two weeks | 36 (22.5%) | 11 (22%) | | |
| Once a month | 10 (6.25%) | 12 (24%) | | |
| *Consumed fruits daily* | | | | |
| Yes | 51 (22.07%) | 17 (8.59%) | 14.6 | 0.001 |
| No | 180 (77.92%) | 181 (91.41%) | | |

$X^2$ = chi square test; FSHs = Food-secure households; FIHs = Food-insecure households

**Anemia by food security status**

The proportion of anemia was 79.53% (95% CI=0.42-0.90) in FIHs and 20.47% (95% CI=0.12-0.34) in FSHs, and the difference was statistically significant (p<0.01). When the level of food insecurity was further disaggregated, the proportion of women with anemia in mildly, moderately and severely FIHs was 14 (8.19%), 23 (13.45%) and 99 (57.89%), respectively, indicating that anemia was a severe public health problem among households suffering severe food shortages (Figure 1).

Figure 1: **Distribution of anemia by food security status of respondents from Jigjiga district and council, Somali regional state, Ethiopia, June 2017**
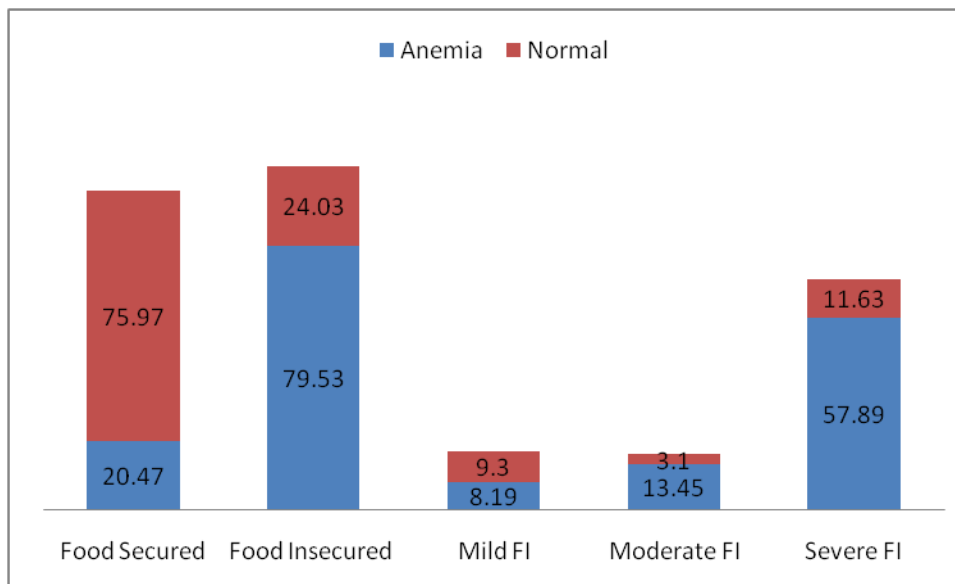


Anemia in FIHs = 79.53% (95% CI = 0.42-0.90)

Anemia in FSHs = 20.47% (95% CI = 0.12-0.34)

P<0.05

Although several sociodemographic characteristics were observed to have close associations with anemia, only low consumption of meat and fruits and FI remained significant in the multivariate analysis. The odds of developing anemia were nearly 10 times more likely among non-meat consumers (AOR=9.87; 95% CI=1.28-76.16) and five times more likely among non-fruit consumers (AOR=5.46; 95% CI=1.48-20.15), suggesting that the causes of anemia are nutritional in origin. Women who reported FI (AOR=1.4; 95% CI=1.02-2.10) were about 1.4 times more likely to suffer from anemia compared to their food-secure counterparts (Table 4).

**Table 4:** Factors associated with the level of anemia among respondents from Jigjiga district and council, Somali regional state, Ethiopia, June 2017

| Characteristics | Categories | Anemic | Normal | AOR (95% CI) |
|---|---|---|---|---|
| Residence area | Rural | 110 (64.32%) | 102 (39.53%) | 0.54 (0.01-40.33) |
| | Urban | 61 (35.67%) | 156 (60.46%) | 1 |
| Married | Yes | 148 (86.55%) | 179 (69.38%) | 4.44 (0.14-14) |
| | No | 23 (13.45%) | 79 (30.62%) | 1 |
| Women lived with: | Husband | 140 (81.87%) | 165 (63.95%) | 15.23 (0.35-657.2) |
| | Father and mother | 31 (18.12%) | 93 (36.04%) | 1 |
| Employment type | Daily laborer | 19 (11.11%) | 36 (13.95%) | 0.25 (0.02-3.34) |
| | Housewife | 48 (28.07%) | 97 (37.57%) | 0.47 (0.06- 3.70) |
| | Farmer | 96 (56.14%) | 104 (40.31%) | 0.2 (0.02-2.49) |
| | Government employee | 8 (4.68%) | 21 (8.13%) | 1 |
| Had formal education | Yes | 27 (15.79%) | 79 (30.62%) | 1 |
| | No | 144 (84.21%) | 179 (69.37%) | 0.59 (0.14-2.46) |
| Drinking water sources | Piped into dwelling | 4 (13.45%) | 7 (2.71%) | 1 |
| | Public tap | 49 (27.49%) | 63 (24.42%) | 0.88 (0.47-1.65) |
| | Tanker truck | 87 (59.06%) | 96 (37.20%) | 0.43 (0.25-8.38) |
| | Rain water | 31 (18.12%) | 92 (35.65%) | 0.18 (0.11-25.24) |
| Always wash hands with soap | Yes | 16 (9.35%) | 20 (7.75%) | 1 |
| | Sometimes | 20 (11.69%) | 31 (12.01%) | 15.87 (1.44-144.4) |
| | Without soap | 37 (21.64%) | 46 (17.83%) | 0.913 (0.2-4.2) |
| | Do not wash at all | 98 (57.31%) | 161 (62.40%) | 0.09 (0.01-1.22) |
| Meal frequency | Two times a day | 106 (61.98%) | 158 (61.24%) | 1.52 (0.07-33.31) |
| | Three times a day | 62 (36.25%) | 93 (36.04%) | 1.58 (0.22-11.15) |
| | Four or more | 3 (1.75%) | 7 (2.71%) | 1 |
| Consumed meat | Yes | 42 (24.46%) | 123 (47.67%) | 1 |
| | No | 129 (75.44%) | 135 (52.32%) | 9.87 (1.28-76.16)** |
| Consumed GLVs | Yes | 19 (11.11%) | 67 (25.67%) | 1 |
| | No | 152 (88.89%) | 191 (74.03%) | 6 (0.28-14.25) |
| Consumed fruits | Yes | 7 (4.10%) | 18 (6.97%) | 1 |
| | No | 164 (95.90%) | 240 (93.02%) | 5.46 (1.84-20.15)** |
| Used contraceptives | Yes | 15 (8.77%) | 48 (18.60%) | 0.62 (0.13-2.95) |
| | No | 156 (91.23%) | 210 (81.31%) | 1 |
| Supplemented with iron | Yes | 13 (7.60%) | 26 (10.08%) | 1 |
| | No | 158 (92.40%) | 232 (89.92%) | 0.29 (0.75-1.2) |
| Food security status | Secure | 35 (20.47%) | 196 (75.97%) | 1 |
| | Insecure | 136 (79.53%) | 62 (24.03%) | 1.4 (1.02-2.10)** |

1 = reference

* Significant at p-value of ≤ 0.2

** Significant at p-value of ≤0.05; others = government/students

### Discussion

Food insecurity, through the causation of anemia, can lead to several health consequences and increase susceptibility to infection, poor pregnancy outcomes, including low infant birth weight, preterm birth, perinatal mortality, and maternal morbidity and mortality. In Ethiopia, FI and anemia are of major public health concern, although epidemiological evidence on the association between household food security and anemia is scant. Thus, because of the important role of anemia in health, the present study was conducted to examine the association between FI and the risk of anemia in the pastoralist communities for some programmatic initiatives.

As expected, our study has demonstrated an association between FI and anemia among women of childbearing age in the rural communities of eastern Ethiopia, with more cases of anemia from FIHs than FSHs (79.53 vs. 20.47%). This level of anemia is likely among FIHs, since the type of foods consumed are donated, and in most cases are low in iron content, and iron-rich food is unaffordable. This demonstrates that the under-consumption of nutritious food, and over-consumption of energy-dense but nutrient-poor food, which are increasingly becoming a cheaper source of calories, is common. Furthermore, the present study uncovered that households which were food insecure had a meal pattern of two times per day and nearly none of the

women in these households consumed meat, green leafy vegetables or fruit, all of which point to why anemia was higher among food-insecure women. This finding concurs with some previous studies conducted in the country (6,18,19).

Nonetheless, the present figure is lower compared to the 2016 Ethiopian Demographic Health Survey report for Somali Region, which reported 59.0% (6), and it is lower compared to Umeta *et al'survey* of Afar Region (79.4%), which is malaria-endemic, and Dire-Dawa (55.7%) administrative region (20), as well as surveys by Meda *et al.* (59%) (21), Alene *et al.* (56.8%) (22), Verma *et al.* (49.82%) (23) and Lilare *et al.* (49.5%) (18). Such variations are likely when the participants differ in age, reproductive health status and occurrence of malaria, as well when there are differences in ecology. For example, Umeta *at al.* used a larger sample size of women, constituting pregnant and lactating, the most vulnerable segment of population, and this might have inflated the prevalence of anemia compared to the present figure 79.53%.

On the other hand, compared with studies in Somali Region conducted by Gebremedhin *et al.* (27.5%) (24), Haidar *et al.* (29.4%) (3) and Kefiyalew *et al.* (27.9%) (25), the present figure is higher. This is probably due to the prevailing drought, which affected food consumption.

In this study, more than one-third of women (39.86%) were suffering from different levels of anemia and nearly half (46.15%) of the anemia cases were from FIHs. The difference in the occurrence of anemia between the groups (FSHs vs. FIHs) was statistically significant (P=0.001). Our finding is consistent with some studies conducted in Bangladesh and Mexico, which documented that households that experienced FI had higher levels of anemia than those that were food secure, suggesting that anemia was associated with the level of FI (10,15). In contrast to our finding, a study from Nepal demonstrated that FI was not associated with anemia, suggesting that FI alone is not a sufficient factor to develop anemia. Such conflicting results might be explained by the fact that, in the present study, we used primary data together with the HFIAS to estimate the food security level, unlike the Nepal study, which used secondary data and a different food security assessment, which might have led to some discrepancies in the occurrence of anemia.

The strength of the present study is that we included both urban and rural residences and had a 91.67% response rate. In addition, hemoglobin was adjusted for altitude and was measured using a HemoCue, an appropriate test in the field setting. The validated tool of HFIAS scale developed for Africa and validated in Ethiopia by the FANTA project was used. This study has contributed to the existing literature and will help to improve the health of women who are at risk.

**Study limitations**
Due to the nature of the study design, it was not possible to tell whether anemia preceded the predisposing factors or vice versa.

**Conclusions and recommendations**
It appears that four in five women in FIHs had anemia, and that there was an overall positive relationship between FI and anemia. In order to effectively address these two issues, national food and nutrition policy-makers need to reinforce weekly iron folic acid supplementation and consider subsidizing nutritious foods for poor consumers. Special emphasis should be given to keeping the price of staple grains within an affordable range and encourage healthy eating patterns by making meat and fruit and vegetables more affordable. National anemia prevention programs need to be integrated with those that target women's socioeconomic empowerment and promote household food security. Further cohort studies with longer follow-up periods are required to support the possible relationship between FI and anemia risk.

**Authors' contributions**
SA and JH conceptualized the study, wrote the manuscript, and approved the final version.

**Competing interests**
The authors declare that they have no competing interests.

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