

1 Does livestock ownership predict animal-source foods consumption frequency among  
2 children aged 6-24 months and their mothers in the rural Dale district, southern  
3 Ethiopia?

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## 32 Abstract

33 **Background.** Would you state about What Animal Source of Feed (ASF) is and its  
34 important first? Low ~~animal-source food~~ASF consumption among children and mothers is a  
35 great concern in many low-income settings. Animal-source food consumption in rural  
36 southern Ethiopia, known for keeping livestock, is not well-documented. This study aimed  
37 to describe animal-source food consumption frequencies among children aged 6-24 months  
38 and their mothers. We also ~~analysed-analyzed~~ the association between livestock ownership  
39 and animal-source food consumption among children and mothers.

40 **Methods.** A community-based cross-sectional study was conducted among 851 randomly  
41 selected households with child-mother pairs. The study was conducted in the rural Dale  
42 District, southern Ethiopia. Structured and pre-tested questionnaires were used to collect  
43 household data including livestock ownership, child and mother background information,  
44 and animal source food consumption frequencies. Ordinal logistic regression analysis was  
45 used to describe associations between animal source food consumption and livestock  
46 ownership.

47 **Result.** Nearly, ~~three-quarters~~three-quarters (74.1%) of the households owned cows, and a  
48 quarter (213) had goats or sheep. Dairy, egg, and meat consumption among children during  
49 the past month was 91.8%, 83.0%, and 26.2%, respectively. Likewise, the consumption of  
50 dairy, eggs, and meat among mothers was 96.0%, 49.5%, and 34.0%, respectively. 6.6% of  
51 the children and 2.9% of the mothers had not consumed any ~~animal-source foods~~ASF during  
52 the month prior to our survey. Dairy consumption was 1.8 times higher among children  
53 (AOR=1.8, 95% CI: 1.3, 2.5) and three times higher among mothers (AOR=3.0, 95% CI:  
54 2.2, 4.2) in households that kept cows than in households without cows. The egg  
55 consumption frequency was positively associated with hen and goat/sheep ownership for  
56 both children and mothers. Meat consumption frequency among children was negatively  
57 associated with cow ownership (AOR=0.66, 95% CI: 0.45, 0.95), however, cow ownership  
58 was not associated with meat consumption among mothers.

59 **Conclusion.** Dairy products were common ~~animal-source foods~~ASFs consumed by young  
60 children and mothers in the study area. On the other hand, meat consumption was low  
61 among children and mothers. Even if the majority of the households were keeping cows, it

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Dont generalise, be specific

62 was negatively associated with meat consumption among young children. Strategies to  
63 improve complementary feedings and mothers' nutrition are warranted in the study area.

64 **Key-words:** Animal-source food, consumption frequency, livestock ownership, young  
65 children, mothers, Dale district, Ethiopia

## 66 Introduction

67 At least a statement is needed about the importance of child and maternal nutrition.

68 Child and maternal ~~under-nutrition~~undernutrition is a global concern associated with high  
69 rates of morbidity and mortality (Prendergast & Humphrey, 2014). Nutritional deficiencies  
70 occurring during early childhood and motherhood cause negative pregnancy outcomes and  
71 sub-optimal child growth, respectively. In resource-poor settings, poor intake of nutrients is  
72 a common reason for child and maternal ~~under-nutrition~~undernutrition (Patel et al., 2018;  
73 Victora et al., 2022). Inadequate intake of both macro- and micro-nutrients is associated  
74 with diets in which no or limited ~~animal-source foods~~ASFs are included (Elmadfa & Meyer,  
75 2017). However, there is a global dilemma concerning whether meat consumption could  
76 sustainably increase among ~~low-meat~~low-meat eaters for health purposes, and most argue  
77 that there should be a reduction among ~~high-meat~~high-meat consumers and that  
78 consumption should ideally be more equitable (Pensel 1998; Wertheim-Heck & Raneri,  
79 2019).

80 Animal-source foods are rich sources of high-quality nutrients essential for normal  
81 reproductive function and optimal child growth (Adesogan et al., 2020; Iannotti et al., 2017).  
82 Milk, ~~for instance,~~ as an important ~~animal-source food~~ASF nurturing the young, and  
83 stimulates growth by providing energy, protein and micronutrients (Dror & Allen, 2011;  
84 Herber & Bogler, 2020). Egg consumption during pregnancy, lactation, and early childhood  
85 also provides ~~several~~key nutrients which enhance foetal growth, breast milk composition  
86 and child growth, respectively (Lutter et al., 2018). Meat is a rich source of protein and other  
87 nutrients, including iron and vitamin B12, which are either not present in plant-source foods  
88 or have poor bioavailability (McAfee et al., 2010). Fish and poultry are also important  
89 micronutrient and protein sources (Alagawany et al., 2018; Balami et al., 2019). What is the  
90 importance of ASFs as source of the major three essential Amino Acids? (Human need them  
91 but cannot be synthesized by human and animal metabolism?) Inters of the macro and  
92 micronutrients, what is the difference among the different ASFs?

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Ethiopia has a high prevalence of child and maternal under-nutrition (Central Statistical Agency (CSA) [Ethiopia] and ICF, 2016; Ethiopian Public Health Institute & ICF, 2019). Different studies performed in Ethiopia have reported low ~~animal-source food~~ASFs consumption among young children and mothers. A national survey data analysis has reported that the 24-hour consumption of eggs and flesh products among children was 17.5% and 8.7%, respectively (Hamza et al., 2022). The report has also documented great regional variations in animal-source food consumption among young children; the highest (41.7%) being in Addis Ababa and the lowest (5.9%) in Somalia region. Likewise, ~~animal-source food~~ASFs consumption is reported to be low among mothers in the reproductive age group and at household level in Ethiopia (Bosha et al., 2019; Daba et al., 2021). In northern ~~Ethiopia~~, Ethiopia, selected districts of Tigray regional state, ~~animal-source foods~~ASFs are consumed on ceremonial days only, and otherwise home-reared livestock and their products are mainly used for market purposes (Haileselassie et al., 2020).

On the other hand, Ethiopia is known to be the primary producer and exporter of livestock in Africa. Despite vulnerability to drought and climate change, livestock production is the largest component of the Ethiopian agricultural sector, on which the country's economy greatly depends (Gashaw et al., 2014). The rural highlands of some regions are known to have the largest share of the livestock population (Leta & Mesele, 2014; Tilahun & Schmidt, 2012), and rural communities in Ethiopia do not adequately consume animal-source foods (Abegaz et al., 2018; Tiruneh et al., 2021). Other studies have found that consumption of milk, eggs and meat among children in Ethiopia was 48%, 27% and 11%, respectively (Potts et al., 2019). Another study from the Amhara region reported animal-source food consumption among adults at 35.4% (Keflie et al., 2018). However, there are considerable differences among regions in Ethiopia (Central Statistical Agency (CSA) [Ethiopia] and ICF, 2016).

The association between Ethiopia's livestock wealth and low animal-source food consumption in the general population and in specific groups of the population is not well-documented. Likewise, the current animal-source food consumption patterns among children and mothers in rural areas have not been addressed. The ~~aim-objectives~~ of this study ~~was~~ ~~were~~ to describe animal-source food consumption patterns among children and mothers, and to compare these patterns; ~~and. The study also aimed to~~ investigate associations between households' livestock ownership and ~~animal-source food~~ASF consumption frequencies

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**Commented [BHA12]:** your rationale is not innovative/convincing. rewrite. Convive raders why your study is important to be dealt/studied.

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125 ~~among children and mothers~~ in the rural Dale district, Sidama region, ~~southern~~ Southern  
126 Ethiopia.

## 127 **Methods & materials**

### 128 **Study setting**

129 This study was conducted in a rural ~~district of the Sidama region, the~~ Dale district, Sidama  
130 region. The Dale district is one of the 19 districts in the region and comprises 36 rural and  
131 two urban kebeles. A kebele is the smallest administrative unit ~~in the Ethiopian context~~. ~~Our~~  
132 This study was conducted in seven rural kebeles of the district. The total population of the  
133 district was reported at 270,000 in 2017. The main town in the district, Yirga Alem, lies 320  
134 km from Addis Ababa. The Dale district has 33 health posts, ten health centres and a  
135 hospital called Yirga Alem General Hospital. The people living in the study area are  
136 farmers, cultivating maize, ensete (*Ensete ventricosum*), kale, cabbage, and haricot beans.  
137 Coffee, chat (*Catha edulis*) and different seasonal fruits are grown in the area. There is also  
138 a cultural value of keeping livestock such as cows, goats and sheep. Most rural households  
139 also have hens.

### 140 **Study design**

141 A community-based cross-sectional study was conducted to assess ~~animal source food~~ ASF  
142 consumption frequencies, livestock ownership and background information,

### 143 **Study participants**

144 This study used a sub-sample of 971 children aged 0-24 months and their caregivers (mainly  
145 mothers) enrolled in a larger study (Household food security and dietary practices in the  
146 rural Dale district, southern Ethiopia). Study procedures, including sample size estimation,  
147 sampling procedures and recruitment are described in a previous paper (Behailu et al.,  
148 2022). In short, the original sample size calculation included 990 households with a child  
149 aged 0-24 months, and their mothers. A census, household listing, proportionality according  
150 to kebele size, and simple random sampling were performed. This study excluded those  
151 younger than six months, as exclusive breastfeeding is recommended for that age group, so  
152 that 853 children aged 6-24 months remained. Of those, two children had no mother or  
153 caregiver eligible for dietary data collection. A total of 851 children aged 6-24 months and  
154 their mothers were included in this study (Fig 1). Among the 851 mothers, four women were  
155 stepmothers, and the rest were birth mothers to their children.

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**Commented [BHA15]:** How did you determine the sample size?

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**Commented [BHA17]:** This could raise question if the stepmothers affect access to ASF. As the number is too small, you can't compare with mothers. Then the question is what is the importance of this description? i.e. you can not compare 847 mothers with 4 (total= 851). Hence, I suggest either using 851 or 847 if you observe differences.

156 **Study variables**

157 The outcome variables in our study were ~~animal-source food~~ASF consumption frequency  
158 among children and mothers. Animal-source foods assessed in this study were dairy  
159 products (milk, yoghurt, cheese and whey), eggs and meat (flesh meat, organ meat, poultry  
160 and fish). Consumption frequency was defined as the usual number of servings per day,  
161 week, month and three months, irrespective of the portion size served to children and their  
162 mothers, respectively. Frequencies were documented as 'never' if never consumed in the  
163 past three months, 'rarely' if consumed less than once in the past one month, 'sometimes' if  
164 consumed one to three times in a month, 'often' if consumed one to six times per week, and  
165 'always' if consumed at least once per day. For the analysis purpose, the frequencies were  
166 assigned with ordered numbers: '0' for 'never' and 'rarely', '1' for 'sometimes', '2' for  
167 'often', and '3' for 'always'.

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168 The independent variables were livestock ownership such as cows, donkeys, oxen, goats or  
169 sheep, and hens at household level. Child characteristics included age and gender,  
170 information about mothers comprised age and educational status, and household background  
171 described household size, food insecurity status and wealth status.

172 **Data collection**

173 Face-to-face interviews with mothers as the primary respondents were used to collect their  
174 own dietary information and that of their children, in addition to household characteristics.  
175 Interviews and observations were conducted at the household level, to assess livestock  
176 ownership. Data collection tools were prepared in English and translated first into Amharic  
177 (the official language) and then into Sidaamu Afoo (the local language) used in the  
178 interviews. Back translations were performed to check consistency. Six data collectors  
179 (nurses and laboratory technicians) and two supervisors were trained and participated in the  
180 data collection. Written consent was obtained before starting an interview. However, the  
181 dietary data for the mother was obtained from her. Some household-related information was  
182 obtained from the father or elder members of the household, when the mother called them  
183 up.

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184 **Household food insecurity**

185 Household food insecurity was assessed using the Household Food Insecurity Access Scale  
186 (HFIAS) tool, validated for use in Ethiopia (Gebreyesus et al., 2015). The tool comprises  
187 nine questions that measure the three domains of food insecurity: uncertainty of food supply,

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poor dietary quality and inadequate food intake (Gebreyesus et al., 2015; Swindale & Bilinsky, 2006). Information was collected about the households' experience of the nine situations in the four weeks preceding this study. All 'yes' responses were followed by the question: 'How many times in the last four weeks?' The frequency of occurrence was then scored as 'one' if it was once or twice; 'two' if it was three to ten times; and 'three' if it was more than ten times. All 'no' responses for the nine food insecurity questions were scored as '0' for the frequency of occurrence. The total HFIAS score ranged from 0 to 27, where a lower value was lower and a higher value was greater food insecurity. Households were classified into four food insecurity levels, based on the Food and Nutrition Technical Assistance (FANTA) classification guideline (Coates et al., 2007). The prevalence of food security, mild food insecurity, moderate food insecurity and severe food insecurity was determined.

#### **Wealth index**

A household's economic status was determined using Principal Component Analysis (PCA) in SPSS. The possession of household assets, such as radio, television and mobile phone, and the ownership of livestock, such as cows, sheep, goats, donkeys and hens, were assessed. Housing materials and sources of drinking water were also included in the computation of the wealth index. The Kaiser Meyer Olkin (KMO) sampling adequacy test was 62%, with a significant ( $<0.001$ ) Bartlett's Test of Sphericity. Four out of nine components had an eigenvalue greater than one. Finally, households were ranked on the basis of percentile scores, and their economic status was grouped into three: lower, middle and upper percentiles.

#### **Data quality control**

Close supervision was applied throughout the data collection period. Techniques to minimise recall bias, such as repeating questions, and giving them a chance to ask for further clarification, were used. Questionnaires were checked for completeness before leaving the household. The data was double-entered and validated using the Epi Data version 3.1 (EpiData Association, Odense, Denmark).

#### **Statistical analysis**

The data was analysed using SPSS version 25 (IBM Corp, 2017). Frequencies, percentages and means were used to describe continuous and categorical variables. Ordinal logistic regression (OLR) analysis was used to explain the association between the outcome

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220 variable, which was a composition variable including dairy, egg and any meat consumption,  
221 and predictor variables. Before running the multivariable ordinal logistic regression,  
222 bivariable ordinal logistic regression was conducted. Variables with a ~~P~~p value < 0.2 in the  
223 bivariable ordinal regression were included in the multivariable ordinal logistic regression.  
224 Multi-collinearity was also checked before running the adjusted ordinal logistic regression.  
225 The unadjusted odds ratio (UOR) and the adjusted odds ratio (AOR), with the 95%  
226 confidence intervals (CI), were used to explain associations between the outcome and the  
227 exposure variables. ~~P~~p value < 0.05 was used to determine level of statistical set as the  
228 significance level.

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229 **Ethical statement**  
230 Ethical approval was obtained from Hawassa University College of Medicine and Health  
231 Sciences Institutional review board, Ethiopia (reference number; IRB/025/10), and from  
232 Norwegian Regional Ethical Committee (REK), Norway (reference number; 2018/90/REK  
233 Vest). All the necessary official letters were obtained from the concerned bodies at regional  
234 and district levels. The respondent's signature or finger stamp was obtained before  
235 enrolment to signify their willingness to participate in our study. The data is kept  
236 confidential and no personal or household identifiers were used to communicate our  
237 findings.

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238 **Results**

**Commented [BHA24]:** Which variables of your study showed statistical significance? It is not well captured. These are the most important that you have to justify

239 **Background characteristics**

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240 Out of 851 children analysed in this study, 50.9% (433 children) were females and the mean  
241 age in months was 15.4 (95% CI: 15.1, 15.8) ~~months~~. The mean age of their mothers was  
242 26.9 (95% CI: 26.5, 27.2) years. Nearly half (45.1%) of the mothers had attended primary  
243 school, while 16.3% (139) of the mothers had never attended school. The mean household  
244 size was 4.8 (95% CI: 4.7, 4.9) persons and 51.5% (438) of the households had less than five  
245 members. About 54% (459) of the households were moderately and severely food insecure  
246 (*Table 1*).

247 **Livestock ownership**

248 Nearly, three quarters (74.1% or 631 households) owned cows, and 25% (213) of the  
249 households had goats or sheep. While 20.7% (176) of the households kept all types of  
250 livestock (sheep/goats, cows, and hens), 17.4% (148) of the households had none of these



251 animals. Oxen and donkeys were found in a few households, comprising 2.9% (25  
252 households) and 6.5% (55 households), respectively (*Table 2*).

253 **Animal-source food consumption frequencies among children aged 6-24 months in the**  
254 **Dale-district**

255 Fifty (28 female and 22 male) children aged above six months were not getting any foods  
256 other than breast milk. The age of those 50 children was six to seven months (n=25), seven  
257 to eight months (n=20), eight to nine months (n=3), and above nine months (n=2) (*Table 3*),  
258 respectively. More than 85% (745) of the children had consumed dairy products daily or up  
259 to six times per week, and 70 children had never consumed dairy products during the past  
260 month. Eggs were served one to six times per week for 36.5% (311 children), while 17%  
261 (146 children) had not eaten eat eggs during the past month. No child consumed meat on a  
262 daily basis. Almost three fourths (73.8%) had not eaten meat in the past month. The  
263 remaining one fourth had consumed meat at frequencies ranging from a maximum of six  
264 times per week to a minimum of once per month. Out of the 851 children in total, 6.6% (56)  
265 had not consumed any animal-source foods during the past month (*Table 3*).

266 **Animal-source food consumption frequencies among mothers of children aged 6-24**  
267 **months in the Dale-district**

268 The dairy product consumption of mothers during the past month was 96% (817 out of 851  
269 mothers) (*Table 4*). More than 50% (430 mothers) had not eaten eggs during the past month  
270 and 31.3% (266 mothers) had eaten eggs one to three times per month. Overall, 2.2% (19  
271 mothers) did not consume any ~~animal-source food~~ASF during the month prior to our survey  
272 (*Table 4*).

273 **Comparison of animal-source food consumption between children (male and female)**  
274 **and mothers**

275 Animal-source food consumption among children and mothers was also described. While  
276 meat and egg consumption was highest among children, dairy product consumption was  
277 highest among mothers. The descriptive analysis showed little difference between male and  
278 female children's animal-source food consumption: dairy product consumption was 92.6%  
279 (387 out of 418 male children) and 91% (394 out of 433 female children). Similarly, meat  
280 consumption was 26.8% (111 out of 418 male children) and 25.6% (112 out of 433 female  
281 children) (*Table S1*).

**Commented [BHA26]:** I hope you have a justification in the discussion.

**Commented [BHA27]:** I hope you agree this depends on the supply from their parents and sex of the children. Does this result has a logical reason to justify. so you may delete?

## **Animal-source food consumption among child-mother pairs at household level**

Animal-source food consumption at household level was also described according to child-and-mother pairs. Households in which only the child, only the mother or both, consumed or did not consume ~~animal-source foods~~ASF during the month prior to this study were described. In 13% of the households both the child and the mother had not consumed meat, while this was 47% for eggs and 89% for dairy products. Children ate a little more meat and eggs than their mothers, while mothers ate a little more dairy product than their children (*Table S2*).

## **Associations between livestock ownership and ~~animal-source food~~ASFs consumption frequencies among children aged 6-24 months**

The frequency of dairy product consumption was 1.8 times higher among children in households owning cows than among those which did not (aOR=1.8; 95% CI: 1.3, 2.5). In contrast, the frequency of meat consumption was lower among children in households keeping cows (aOR=0.66; 95% CI: 0.45, 0.95), compared with those that did not have cows. Goat or sheep ownership was associated with a 1.7 times greater frequency of egg consumption among children, than for households without goats or sheep (aOR=1.7; 95% CI: 1.2, 2.3). Furthermore, owning goats or sheep increased the child's dairy product consumption frequency more than twofold (aOR=2.3; 95% CI: 1.6, 3.3). Egg consumption frequency among children was 3.5 times higher among households that kept hens than among those which did not (aOR=3.5; 95% CI: 2.6, 4.8) (*Table 5*).

## **Associations between livestock ownership and ~~animal-source food~~ASFs consumption frequencies among mothers of children aged 6-24 months**

Livestock ownership was associated with dairy, egg and meat consumption frequency among mothers of children aged 6-24 months. While goat or sheep ownership was associated with all ~~animal-source food~~ASFs consumption frequency, cow ownership was solely associated with dairy product consumption frequency (aOR=3.0; 95% CI: 2.2, 4.2). The frequency of dairy product consumption among mothers was also greater in households keeping goats or sheep (aOR=1.9; 95% CI: 1.3, 2.6) than among mothers in households without these animals. Regarding egg consumption, there was a 2.3 and 2.0 greater frequency among mothers in households with goats or sheep (aOR=2.3; 95% CI: 1.6, 3.1) and hens (aOR=2; 95% CI: 1.5, 2.7), respectively. Having hens was also associated with meat and egg consumption frequencies among mothers. Meat consumption frequency

among mothers was 1.8 times (aOR=1.8; 95% CI: 1.3, 2.5) higher in households that had goats or sheep than in those that did not. Likewise, ownership of hens was associated with a 1.5 increased frequency of meat consumption among mothers (aOR=1.5; 95% CI: 1.1, 2.2) (Table 6).

**Socio demographic variables associated with animal-source food ASFs consumption among children and mothers**

Child age, household size and educational status of the mother were associated with animal-source food ASFs consumption frequencies among children and mothers. Child age was positively associated with dairy (aOR=1.05; 95% CI: 1.03, 1.08), egg (aOR=1.07; 95% CI: 1.04, 1.09) and meat (aOR=1.06; 95% CI: 1.03, 1.09) consumption among children. It was also positively associated with egg (aOR=1.04; 95% CI: 1.01, 1.06) and meat (aOR=1.05; 95% CI: 1.02, 1.07) consumption among mothers. Secondary education of the mother was positively associated with meat consumption among children (aOR=1.9; 95% CI: 1.3, 3.0), and with dairy (aOR=2.1; 95% CI: 1.4, 3.2) and meat (aOR=1.8; 95% CI: 1.1, 3.1) consumption among mothers. In addition, the primary education of the mother was positively associated with all animal-source food ASFs consumption among mothers. On the other hand, household size was negatively associated with dairy consumption among children (aOR=0.84; 95% CI: 0.8, 0.9) (Tables 5), and with dairy (aOR=0.85; 95% CI: 0.8, 0.9) and egg (aOR=0.8 95% CI: 0.67, 0.85) consumption among mothers (Table 6)

**Discussion**

Our study showed that animal-source food ASFs consumption among children and their mothers varied. One fifth never consumed any animal-source foods ASFs, and dairy products constituted the most common animal source. Children had a higher consumption frequency of eggs and meat than their mothers. This study also showed that livestock keeping, especially cows and hens, is common in rural households. Goats and sheep are found among a quarter of the total number of households. While goat/sheep and hen ownership was positively associated with meat consumption, cow ownership was inversely associated with meat consumption in children.

**Association between livestock ownership and dairy, egg and meat consumption frequencies among children aged 6 to 24 months**

Cow ownership was positively associated with children's milk consumption; the milk consumption frequency was nearly double in households owning cows compared to those

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that did not own cows. This finding is in line with studies that reported similar positive associations (Broaddus-Shea et al., 2020; Hetherington et al., 2017; Temesgen et al., 2018). However, cow ownership was not associated with egg consumption and was negatively associated with meat consumption among children in this study. For most rural households in Ethiopia, the number of cows or cattle is a measure of wealth (Acharya et al., 2021), source of income by selling dairy products or cows. However, households practice traditional animal husbandry and low productivity (Jembere et al., 2020) which makes households unable to afford eggs and meat. Although milk and milk products are the main animal source foods ASFs consumed by young children and their mothers in the study area, further analysis of the quality of the milk used to meet household demand is required, as it is mostly diluted before use.

Owning goats/sheep and hens demonstrated a positive association with egg consumption among children. The egg consumption frequency of children from households keeping hens was 3.5 times higher than for children from households without hens. This positive association was also reported by different studies (Broaddus-Shea et al., 2020; Mosites et al., 2017). However, there are studies that have found no association between hen ownership and egg consumption (Dumas et al., 2018). ~~Our~~ This study showed that egg consumption among young children is influenced directly by keeping hens and indirectly by keeping goats/sheep. As discussed above, goats/sheep are used mainly for income generation purposes, which indirectly increase the household's ability to afford eggs from the local market.

While owning goats/sheep and hens did not show any association with meat consumption frequency among children, keeping cows demonstrated a negative association with what? This lack of association between goat/sheep ownership and children's meat consumption is supported by a study from Nepal (Broaddus-Shea et al., 2020). These animals may be used mainly for income generation purposes and thereby explain that finding. Studies from Ethiopia and other countries support this (Bundala et al., 2020; Kocho 2007; Tesfa et al., 2021). A study from Kenya also documents that in many regions of Sub-Saharan Africa, livestock production is mainly used to generate income for poor rural households (Jin & Iannotti, 2014). Similarly, households mainly keep hens for the production of eggs for sale, or for household use, rather than for poultry consumption at household level (Daba et al., 2021).

**Commented [BHA31]:** Confusing. Why: Accessibility? Affordability? u

**Commented [BHA32]:** ?????

**Commented [BHA33]:** never mix. You know that the price of a liter of milk is higher than that of eggs. Then why there is high milk consumption than egg? I suggest you discuss one by one for interpretation of factors affecting consumption of each ASF.

**Commented [BHA34]:** Quality is another issue. You didn't study the quality parameters. Your study is more of on accessibility. Your discussion shall focus on this

**Commented [BHA35]:** not clear. What is the association of goat/sheep with hens?

**Commented [BHA36]:** if they have hens, why they should go to market?

**Commented [BHA37]:** This means livestock ownership is not positively associated with meat consumption. state why?

**Commented [BHA38]:** If they get income why they don't buy meat? The price of live animal is high, they don't want to sacrifice their animal and meat per kg is high.....this may be the good answer. Indirectly describe with the practical evidences why meat is not consumed.

378 The higher milk consumption demonstrated by our study may suggest that caregivers  
 379 consider milk to be enough for young children and ignore other ~~animal-source foods~~ ASFs,  
 380 particularly meat. However, milk and meat provide different micronutrients in different  
 381 amounts (Dror & Allen, 2011). In addition, food taboos concerning meat and poultry  
 382 consumption by young children might be present (Melesse & van den Berg, 2021). Although  
 383 no food taboos were reported in our study, other studies in Ethiopia reported social norms  
 384 and beliefs as common barriers to animal-source food consumption among young children  
 385 and mothers (Haileselassie et al., 2020). Even though the majority of the households keep  
 386 hens, the prevalence of childhood stunting was high (39.5%) in our recent publication about  
 387 the nutritional status of the children (Behailu et al., 2022). Does this mean egg is not  
 388 nutritionally dense? Or there are other factors? Have you related stunting with animal  
 389 ownership? This gap needs to be strongly addressed and nutrition education, especially  
 390 about complementary feeding, should be promoted.

**Commented [BHA39]:** What is the major deficiency that a milk has that should be supplented by meat /egg?

#### 391 **Association between livestock ownership and dairy, egg and meat consumption** 392 **frequencies among mothers**

393 Mothers who had consumed meat during the past month accounted for 34%, which was  
 394 lower than in a report of a study undertaken in Gondar town, north-western Ethiopia, which  
 395 reported 92% (Aserese et al., 2020). This difference may be explained by the variation in  
 396 dietary practices among mothers, especially after delivery. The study settings can provide an  
 397 additional explanation: rural- and community-based in our study, compared to urban  
 398 (Gondar town) and facility-based in the other study. On the other hand, meat consumption  
 399 among mothers in our study was higher than in a study from the Afar region, in which this  
 400 was reported at 11% among lactating mothers (Mulaw et al., 2021). Goat/sheep and hen  
 401 ownership also demonstrated a positive association with mothers' meat consumption. A  
 402 study from Kenya has reported a similar association (Thumbi et al., 2015). However, our  
 403 study did not assess the number of livestock of each type. Likewise, hen ownership was  
 404 associated with meat consumption among mothers, but not among children. As we discussed  
 405 above, this indicates that feeding poultry to children may not be culturally accepted.

**Commented [BHA40]:** This is reporting not discussion.

406 Even though eggs were mainly given to children (83%), around 50% of the mothers had  
 407 consumed eggs during the past month. Keeping hens was associated positively with  
 408 mothers' egg consumption; the egg consumption frequency was almost double among  
 409 mothers who kept hens, compared to those who did not. In addition, the egg consumption

frequency of mothers who kept goats/sheep was 2.3 times higher than for mothers who did not keep these animals. This finding may explain the indirect positive association of goat/sheep husbandry with increasing the purchasing ability of the household (Workicho et al., 2016).

More than 95% of the mothers had consumed dairy products during the past month. In most rural areas, the watery portion of the milk after fat extraction is used. Otherwise, whole milk is rarely used to meet household demand. In our study, mothers who kept cows consumed dairy products 1.9 times more frequently than those who did not. A similar association was reported in studies performed in Ethiopia (Daba et al., 2021; Melesse & Beyene, 2009) and the study from Kenya (Thumbi et al., 2015). In general, our finding indicates that keeping cows is a positive predictor of frequent consumption of dairy products among rural households. Goat/sheep ownership was also positively associated with mothers' milk consumption frequency. This association can be explained in two ways: by purchasing milk from the local market after selling live goats/sheep, and by using goat's milk. There is a study reporting on the use of goat's milk in Ethiopia (Azeze et al., 2015).

#### **Animal-source food consumption among children and mothers in relation to different socio demographic characteristics**

The age of the child was associated significantly with all animal-source food consumption, whereby older children consume ~~animal source foods~~ASFs more frequently than younger children. ~~Our~~This finding was in line with a study undertaken in four different regions of Ethiopia (Potts et al., 2019). This association may also be due to cultural practices whereby some ~~animal source foods~~ASFs are forbidden for young children (Haileselassie et al., 2020). We also found that in larger families children consumed dairy products less frequently. This finding shows that larger families are mostly unplanned and indicative of women and girls being uneducated (Kim, 2016). These larger families are poor and cannot afford most ~~animal source foods~~ASFs (Haileselassie et al., 2020). Hence, children and mothers in larger families do not consume, or less frequently consume, ~~animal source foods~~ASFs that entail relatively high costs (Daba et al., 2021). In addition, the educational status of the mother is also independently positively associated with most ~~animal source food~~ASFs consumption among children and mothers (Hamza et al., 2022). This finding also supports the above description that education, particularly female education, is crucial for information exposure,

**Commented [BHA41]:** what about scientific explanation about digestibility of ASFs versus child age?

**Commented [BHA42]:** ????? Dont mixup be specific

including nutrition and health aspects (Kim, 2016). Furthermore, educated mothers will be aware of the contribution of proper feeding of children and maternal dietary practice to children's growth and health (Dhami et al., 2021).

### Strengths and limitations of our study

Our study had strengths: it was a community-based study using a random sampling technique, collecting a comprehensive set of data at the child, mother and household level, and using the ordinal logistic regression model to describe associations between the outcome and exposure variables. Checking independent associations between each livestock type with each ~~animal-source food~~ ASF is also an additional strength, since this helps to address indirect associations between livestock ownership and consumption of specific animal-source food. Moreover, assessing the food frequency over one month helps to address food items with infrequent consumption. On the other hand, the limitations of our study include the inherent limitations of the cross-sectional design: one can never rule out reverse causality. Between the mapping and the actual cross-sectional study there was replacement of households due to people leaving their residence prior to the data collection. Recall bias for self-reported data, such as age and food frequencies, could be a source of bias. To minimise the recall bias, however, we used the strategies described under data quality control measures in the method section. Survivor bias might also exist, since our samples were mother-child pairs, and mothers who had lost their children were not included. We did not assess the food portions consumed, the number of livestock and to whom they belonged (the mother or the father), which is also a limitation.

### Conclusion

Our study findings showed that meat consumption was generally low among young children and their mothers in the rural Dale district of Sidama region. While eggs were more frequently served to young children, dairy products were almost equally served to both mothers and young children in the household. Livestock ownership was also identified as an important factor determining animal-source food consumption among young children and their mothers in rural settings. Moreover, various different livestock ownership was positively and negatively associated with specific animal-source food consumption. Our findings suggest that livestock diversification should be considered, so as to facilitate the consumption of animal-source foods. Nutrition education should be incorporated into child and maternal healthcare services at the community level.

**Commented [BHA43]:** awareness for dietary Diversity intake?

**Commented [BHA44]:** Conclusion is not summary. It is the key message/finding that you would like readers to now. Align the Key success? Key challenge? Key recommendation?

**Commented [BHA45]:** As a reader your finding in ASFs is 1. Meat is less consumed than milk and egg  
2. Meat and egg are not easily affordable to your study participants.  
If you answer why in your discussion, it will lead you to appropriate, specific and practical recommendation



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**Commented [BHA46]:** Data collectors are contributing a lot to your data source. Hence, is it ethical to exclude them from authorship?



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