Heliyon 7 (2021) e06746

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Early breastfeeding and complementary feeding in Ethiopia: cross-sectional data from implementation of nutrition programming on regional inequalities

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ARTICLE INFO

Keywords:
Dietary diversity
Nutritional adequacy
Lactation
Breast feeding
Child feeding
Malnutrition

ABSTRACT

Improving nutrition for young children remains an urgent priority globally. Ethiopia has made great strides over the last two decades in improving health and nutrition for children. The task of scaling improved nutrition services now turns to addressing progress on the regional level. This research sought to highlight regional disparities identified in scaling nutrition services for child nutrition in Ethiopia, by identifying variations in early breastfeeding and child feeding practices and associated socio-demographic characteristics by geographic area in four regions of the country. The cross-sectional study data derived from an evaluation of nutrition services and programming and included 1299 participants, of whom 50% reported practicing recommended early breastfeeding practices. This varied from less than 8% in one zone of Afar region to 84% in a zone of Tigray, with differences also noted by socio-demographic characteristics. Among the total sample, 70% of respondents met the recommendation for minimum number of feedings per day, and 16% met the recommendation for dietary diversity. Less than 8% of families in the service population in Northwestern Tigray zone met the dietary diversity recommendation compared to 36% in South Wollo, Amhara region. Utilizing regional and zonal data will allow for government and other agencies involved in improving nutrition and health outcomes to appropriately provide services and programs for families and children over the life course.

1. Introduction

Improving nutrition for young children remains an urgent priority globally. Ethiopia has made great strides over the last two decades in improving health and nutrition for children. The task of scaling improved nutrition services now turns to addressing progress on the regional level. The country continues to face challenges in child nutrition varying by regions with attendant inequality and health consequences [1]. In 2019, it was estimated that 37% of Ethiopian children were stunted (low height-for-age) and 21% were underweight (low weight-for-age) [2]. Although this represents improvement, compared to 51% and 33% respectively that were stunted and wasted in 2005 [3], there remain too many children suffering undernutrition. The economic losses stemming from child undernutrition extend throughout the life course and in 2012 these were estimated at 4.7 billion USD, or 16.5% GDP, per year in Ethiopia [4].

Suboptimal early breastfeeding and complementary feeding negatively impact nutritional status. Breastfeeding practices impact infant mortality and set the stage for lifelong health through the breastfeeding relationship, leading to benefits for both mother and child [5, 6, 7, 8]. Ethiopia has historically had high rates of breastfeeding [9], yet certain practices may be improved and are part of the national strategy for health promotion [10, 11]. Recommended early breastfeeding behaviors include early initiation (putting the child to breast within the first hour of life), providing colostrum (thick, nutrient-dense milk produced in the first days), and avoiding any liquids other than colostrum and breast milk from birth (prelacteal feeding) [12, 13]. In 2016, 73% of Ethiopian children born in the previous 2 years had been put to the breast within

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https://doi.org/10.1016/j.heliyon.2021.e06746
Received 21 December 2020; Received in revised form 9 March 2021; Accepted 1 April 2021

the first hour of birth, with a low of 42% in Afar, a predominantly pastoral region [9].

Complementary feeding in addition to breast milk is recommended starting at 6 months, and adequately diverse foods and frequent feedings are important [14, 15]. The World Health Organization indicators for assessing adequate meal frequency and dietary diversity in young children have shown positive associations with important anthropometric measures (height-for-age z-score) in Ethiopia, underscoring their relevance for child nutrition and growth [16]. Despite their importance, in 2016, only 13% of Ethiopian children ages 6–23 months had an adequately diverse diet and less than half met the recommended minimum meal frequency [9].

This study sought to analyze data gathered from an evaluation of nutrition services on child feeding practices to understand differences between regions and zones of Ethiopia that illustrate the country's diversity and disparities, including rates of child undernutrition, different predominant livelihoods and religions, and economic resources. The study also adds to a previous one [17] describing dietary composition and animal source food intake.

2. Materials and methods

2.1. Study design and setting

A cross-sectional survey using multistage probability sampling in eight geographic zones during October–December 2015 interviewed caretakers of children ages 0–36 months living in rural areas in selected zones of four regions in Ethiopia. The survey methods have been described in detail elsewhere and are summarized here [17]. The study was conducted in eight zones within Afar, Amhara, Benishangul-Gumuz, and Tigray regions (Figure 1). Two zones per region were selected to capture variation within each region based on prior research [18, 19].

2.2. Participants

All households in rural areas of the eight selected zones with at least one child aged 0–36 months met the inclusion criteria. In the instance of multiple children in the age range, only the youngest child was included. Responses were excluded from analysis if they were missing all breastfeeding and child feeding questions or if they had invalid responses.

2.3. Ethics approval and consent

Written informed consent was obtained from all participants prior to interviews. Approval was granted by the Tulane University Institutional Review Board for secondary analysis of de-identified data.

2.4. Study size and sampling

The Ethiopian Central Statistical Authority selected 12 clusters per zone using population proportion to size random sampling based on census listing of rural enumeration areas. Local community leaders confirmed geographical boundaries of clusters before survey teams enumerated all eligible households in sampled clusters prior to initiating data collection. Random number tables were used to select 15 households per cluster from the enumerated listing without replacement. Households were revisited three times before marked non-response.

2.5. Data collection

The questionnaire utilized the same questions and order of those used in the Ethiopia Demographic and Health Survey (EDHS) 2011 to measure breastfeeding, young child feeding, and demographic characteristics [19]. The questionnaire was developed in English, translated to multiple local languages, back translated to English for review, and pre-tested (Table S1). Experienced data collectors who spoke the local languages were trained in study procedures. Surveys were conducted in the homes of caregivers with paper questionnaires, reviewed each night by interviewers and field team leaders for completion and accuracy, and data entry persons entered responses into a database in the field. De-identified data was later transferred to SPSS statistics, version 24 (IBM Corp, Armonk, NY, USA) for analysis.

Early breastfeeding and complementary feeding measures were defined according to the World Health Organization (WHO) or as used in the EDHS [12, 19]. Early breastfeeding indicators included early initiation of breastfeeding (child brought to the breast within the first hour of birth), providing colostrum, and avoiding prelacteal foods (anything

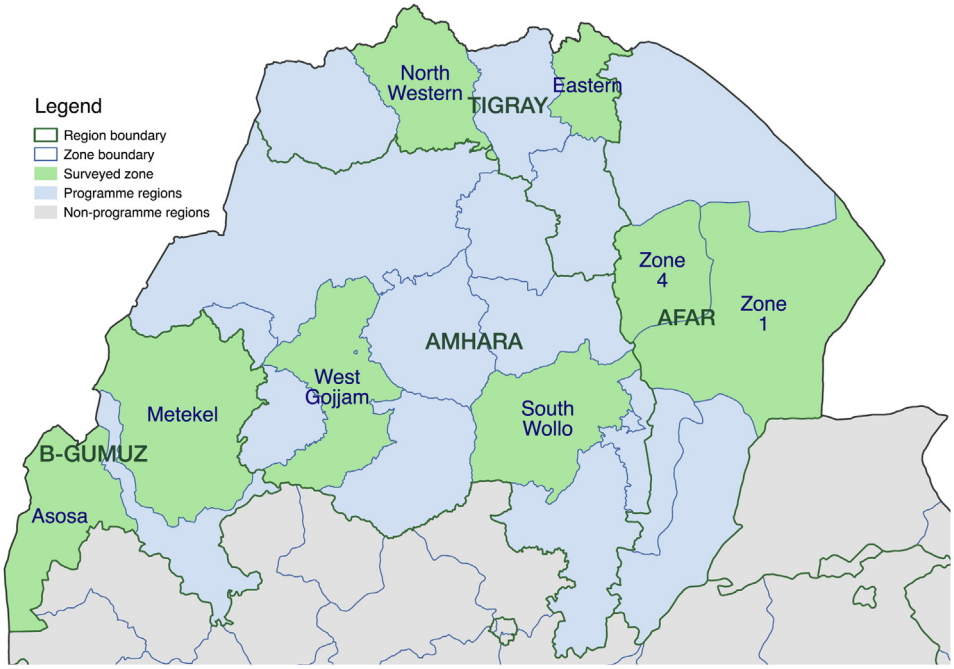

Figure 1. Map of surveyed zones.

other than breast milk given in the first 24-hours). An additional dichotomous variable was calculated from these three practices to identify those with and without ideal early breastfeeding practice. Child feeding indicators included meeting the recommendation for minimum meal frequency, minimum dietary diversity, and minimum acceptable diet. Each measure is calculated specific to the child's age, and minimum acceptable diet is an overall measure that identifies those meeting both meal frequency and dietary diversity recommendations [12]. The analysis of these practices includes children ages 6–36 months, since complementary feeding is not recommended until 6 months. Socio-demographic characteristics were chosen based on their broad relevance to the study regions and the potential for use in identifying high risk groups for targeting of services. Education was coded as a dichotomous variable, identifying caretakers reporting any versus no formal or informal (e.g., religious schooling that includes learning to read) education. The variable improved assets was defined as a dichotomous variable specifying those with *any* versus *no* improved assets from a set of three basic housing features: roof material, toilet, and water source. Each of these were considered improved based on standard definitions [20, 21]. Livelihood/occupation was determined through questions of agricultural and livestock activities of the household or reported occupation. Religion was classified as Ethiopian Orthodox Christians, Muslims, and other religions.

2.6. Statistical analysis

Complementary feeding and breastfeeding practices were described by percentage and 95% confidence interval among the total sample, and by zone, education, improved assets, livelihood/occupation, and religion. Pearson's chi-squared test was conducted to calculate p-values for differences across socio-demographic characteristics. P-values were not calculated for analysis by zones due to the large number of categories assessed. Numbers missing varied across variables and were generally small (<10%, provided in tables). All non-missing data available for each analysis was used. Imputation methods were not used given small nonresponse rates.

3. Results

A total of 1299 households were interviewed within 88 clusters reached among the eight zones (range: 10–12 clusters per zone). Among the clusters reached, nonresponse was minimal. Four zones had 0% nonresponse and the remaining four had 1%–6% household nonresponse (total nonresponse was 2%). A sample of participants from Benishangul-Gumuz were excluded from the complementary feeding analysis due to invalid responses.

3.1. Participant characteristics

Participant characteristics are provided in Table 1. The mean age of respondents was 29 years, 65% had no formal or informal education, and 24% lived in homes with unimproved roof, toilet and water source. The mean age of the index child was 16.6 months and 51% were male.

3.2. Early breastfeeding practices

Early breastfeeding practices are shown in Table 2. Early initiation of breastfeeding was reported by 61% of the total sample, and 79% said the child was provided colostrum, but 22% also provided prelacteal foods. There was substantial variation in these practices across zones. In Afar Zones 1 and 4, 19% and 27% reported early initiation while 93% reported this in Eastern Tigray. The majority across all zones practice giving colostrum, however, the practice of providing foods other than breastmilk during the first day of life differed substantially by zone. No one from North Western Tigray reported prelacteal feeding whereas 74% and 75% from Afar Zones 1 and 4 did this. All of the early breastfeeding practices were statistically significantly different by socio-demographic characteristics except that there were no differences in the proportion reporting that they provided colostrum by livelihood/occupation or religion (Table 2).

Table 1. Socio-demographic characteristics of the study participants from four regions of Ethiopia, 2015.

Variable (missing)		
Continuous variables	**Mean**	**SD**
Age of child in months (10)	16.6	10.1
Respondent age in years (50)	29.1	6.2
Categorical variables	**%**	**Frequency**
Sex of child (15)		
Male	51.4	668
Female	47.4	616
Respondent Education (13)		
No education	64.9	843
Any education	34.1	443
Improved assets[a] (0)		
No improved assets	23.6	306
Any improved assets	76.4	993
Religion (7)		
Muslim	52.8	686
Orthodox	40.0	519
Other[b]	6.7	87
Livelihood/Occupation (5)		
Pastoral	17.6	229
Agro-pastoral	29.6	384
Agricultural/Farmer	43.4	563
Housewife	3.3	43
Other[c]	5.8	75
Total	**100.0**	**1299**

SD: standard deviation.
[a] Improved assets is based on whether or not the household has an improved roof, improved toilet, or an improved water source.
[b] Protestant, Catholic, No Religion and Other.
[c] Wage worker, daily laborer, trader, other self-employed, retired, physically challenged, and other.

3.3. Complementary feeding practices

The minimum meal frequency recommendation was met by 70% of the total sample (>6 months) whereas 16% met the minimum dietary diversity recommendation and 8% were classified as having a minimally acceptable diet, defined as meeting both recommendations (Table 3). All zones had 50% or greater proportion of children meeting the meal frequency recommendation with the highest found in Zone 1, Afar, where 86% met this. Proportions meeting dietary diversity recommendations were much lower across all zones. North Western Tigray had only 8% of sampled children receiving a minimally diverse diet and the zone with the highest proportion was South Wollo, Amhara, where 36% met this. Given the small proportions meeting dietary diversity recommendations, the proportions meeting the definition of a minimally acceptable diet was also low at less than 20% across all zones with several having 5% or fewer children meeting this guideline.

There were also differences in complementary feeding practices observed by socio-demographic characteristic. Proportions meeting the meal frequency recommendation did not differ much by education, improved assets, or religion, but there were some larger differences seen by livelihood/occupation (Table 3). Among pastoralists 83% met the minimum meal frequency compared to 65% among agriculturalists/farmers. There were statistically significant differences in proportions

Table 2. Early breastfeeding practices by zone and socio-demographic characteristics (measured among children ages 0–36 month).

	Early initiation of breastfeeding		Gave colostrum		Gave prelacteal feeds		All three ideal practices	
	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N
Zone								
Afar								
Zone 1	19.0 (12.0, 26.0)	121	78.0 (71.4, 84.6)	150	74.3 (67.4, 81.2)	152	7.5 (2.8, 12.2)	120
Zone 4	26.8 (19.9, 33.7)	157	80.7 (74.9, 86.5)	176	75.0 (68.5, 81.5)	168	11.6 (6.6, 16.6)	155
Amhara								
South Wollo	78.4 (72.1, 84.7)	162	79.5 (73.3, 85.7)	161	13.6 (8.3, 18.9)	162	65.4 (58.1, 72.7)	162
West Gojjam	69.8 (62.4, 77.2)	149	75.2 (68.3, 82.1)	149	3.3 (0.4, 6.2)	150	58.1 (50.2, 66.0)	148
Benishangul-Gumuz								
Asosa	64.8 (57.8, 71.8)	179	72.8 (66.3, 79.3)	180	3.3 (0.7, 5.9)	180	51.4 (44.1, 58.7)	179
Metekel	47.6 (39.5, 55.7)	147	73.6 (66.5, 80.7)	148	7.3 (3.1, 11.5)	150	42.1 (34.1, 50.1)	145
Tigray								
Eastern	92.7 (88.9, 96.5)	177	90.4 (86.1, 94.7)	177	1.7 (0.0, 3.6)	177	84.2 (78.8, 89.6)	177
North Western	73.8 (66.5, 81.1)	141	84.5 (78.5, 90.5)	142	0.0 (0.0, 3.2)*	142	65.2 (57.3, 73.1)	141
Socio-demographic characteristics								
Education								
None	56.4 (53.0, 59.8)	800	77.6 (74.8, 80.4)	838	26.4 (23.4, 29.4)	834	45.2 (41.7, 48.7)	797
Any	69.3 (64.9, 73.7)	424	83.3 (79.8, 86.8)	436	14.8 (11.5, 18.1)	438	59.4 (54.7, 64.1)	421
p-value	0.000		0.017		0.000		0.000	
Improved Assets[a]								
No improved assets	37.4 (31.7, 43.1)	278	74.2 (69.2, 79.2)	298	55.9 (50.3, 61.5)	299	22.7 (17.8, 27.6)	277
Any improved assets	67.6 (64.6, 70.6)	955	81.0 (78.6, 83.4)	985	12.1 (10.1, 14.1)	982	57.9 (54.8, 61.0)	950
p-value	0.000		0.010		0.000		0.000	
Livelihood/Occupation								
Pastoral	33.3 (26.8, 39.8)	204	78.0 (72.6, 83.4)	227	68.2 (62.1, 74.3)	223	19.3 (13.9, 24.7)	202
Agro-pastoral	71.8 (67.2, 76.4)	372	80.8 (76.8, 84.8)	380	11.3 (8.1, 14.5)	381	60.6 (55.6, 65.6)	371
Agricultural/Farmer	64.5 (60.5, 68.5)	550	77.5 (74.0, 81.0)	560	9.8 (7.3, 12.3)	561	54.5 (50.3, 58.7)	550
Housewife	47.2 (30.9, 63.5)	36	90.5 (81.6, 99.4)	42	46.3 (31.0, 61.6)	41	28.6 (13.6, 43.6)	35
Other[b]	61.4 (50.0, 72.8)	70	84.9 (76.7, 93.1)	73	23.0 (13.4, 32.6)	74	57.4 (45.6, 69.2)	68
p-value	0.000		0.166		0.000		0.000	
Religion								
Muslim	49.4 (45.5, 53.3)	632	78.2 (75.1, 81.3)	679	37.8 (34.1, 41.5)	674	36.9 (33.1, 40.7)	629
Orthodox	75.3 (71.6, 79.0)	514	81.9 (78.6, 85.2)	515	4.1 (2.4, 5.8)	517	66.6 (62.5, 70.7)	512
Other[c]	57.6 (47.1, 68.1)	85	74.4 (65.2, 83.6)	86	11.5 (4.8, 18.2)	87	46.4 (35.7, 57.1)	84
p-value	0.000		0.140		0.000		0.000	
Total	**60.8 (58.1, 63.5)**	**1233**	**79.4 (77.2, 81.6)**	**1283**	**22.3 (20.0, 24.6)**	**1281**	**50.0 (47.2, 52.8)**	**1227**

CI: confidence interval.

Note: % is out of the total non-missing sample size (N) for each row-group, including all children (0–36 months) non-missing on breastfeeding and relevant demographic variables.

[a] Improved assets is based on whether or not the household has an improved roof, improved toilet, or an improved water source.

[b] Wage worker, daily laborer, trader, other self-employed, retired, physically challenged, and other.

[c] Protestant, Catholic, No Religion and Other.

* 95% CI upper limit when 0 counts were observed was estimated by the Agresti-Coull and Brown et. al. method [41, 42].

achieving the minimum dietary diversity and acceptable diet by education and improved assets, but not by livelihood or religion. For example, those with any improved assets had 20% of sampled children meeting the dietary diversity recommendation compared to only 8% among those with no improved assets.

4. Discussion

The study identified important variations in early breastfeeding and complementary feeding practices across zones and by certain socio-demographic characteristics which impact on the national progress towards improving child nutrition, health, and development. Different feeding practices varied across zones and regions, further complicating efforts to plan for services needed in the community. For example, the zones in Afar had low practice of ideal early breastfeeding behaviors, but they also had the highest proportions of children meeting minimum meal frequency. There were also differences in feeding observed by socio-demographic characteristics, such as livelihood and religion, important factors in assessing health and nutrition disparities to scale nutrition programs and services. These findings emphasize the importance of tailoring child feeding messaging based on the community. For example, messaging regarding avoidance of prelacteal foods may be more relevant for communities with predominantly pastoral livelihoods, among whom 68% reported prelacteal feeding in this sample, and in the region of Afar, where 74% and 75% in Zone 1 and 4 respectively reported prelacteal feeding. Whereas agricultural communities and those with a high proportion of Orthodox residents may not need this message since, in this sample, less than 10% of farmers and fewer than 5% of Orthodox Christians reported this practice. The Health Extension Workers who deliver messaging and implementation of nutrition programs are likely knowledgeable of the local context of such child-feeding variations. They should be empowered to use their local knowledge and apply cultural

Table 3. Child feeding practices by zone and socio-demographic characteristics among children ages 6–36 months.

	Minimum meal frequency		Minimum dietary diversity		Minimum acceptable diet	
	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N
Region, Zone						
Afar						
Zone 1	85.6 (79.4, 91.8)	125	15.1 (8.8, 21.4)	126	3.3 (0.1, 6.5)	123
Zone 4	77.3 (70.0, 84.6)	128	10.4 (5.4, 15.4)	144	5.0 (1.4, 8.6)	139
Amhara						
South Wollo	70.2 (62.1, 78.3)	124	36.2 (27.8, 44.6)	127	17.2 (10.3, 24.1)	116
West Gojjam	64.8 (55.7, 73.9)	105	17.8 (10.9, 24.7)	118	10.7 (5.0, 16.4)	112
Benishangul-Gumuz*						
Asosa	55.1 (46.7, 63.5)	136	22.1 (14.7, 29.5)	122	12.9 (6.8, 19.0)	116
Metekel	50.0 (40.4, 59.6)	104	11.9	84	3.7 (0.0, 7.8)	81
Tigray						
Eastern	79.0 (72.2, 85.8)	138	18.8 (12.4, 25.2)	144	6.6 (2.4, 10.8)	136
North Western	71.3 (63.0, 79.6)	115	7.8 (2.9, 12.7)	116	5.3 (1.2, 9.4)	113
Socio-demographic characteristics						
Education						
None	68.5 (64.9, 72.1)	645	15.5 (12.7, 18.3)	656	6.2 (4.3, 8.1)	625
Any	71.7 (66.8, 76.6)	322	22.4 (17.8, 27.0)	317	12.2 (8.5, 15.9)	304
p-value	0.306		0.009		0.002	
Improved Assets[a]						
No improved assets	71.4 (65.4, 77.4)	217	8.4 (4.7, 12.1)	214	3.3 (0.9, 5.7)	211
Any improved assets	69.1 (65.8, 72.4)	758	20.3 (17.5, 23.1)	767	9.5 (7.4, 11.6)	725
p-value	0.516		0.000		0.004	
Livelihood/Occupation						
Pastoral	82.8 (77.3, 88.3)	180	12.0 (7.4, 16.6)	192	4.3 (1.4, 7.2)	185
Agro-pastoral	70.1 (64.7, 75.5)	278	20.5 (15.8, 25.2)	283	8.2 (4.9, 11.5)	267
Agricultural/Farmer	64.7 (60.2, 69.2)	430	18.6 (14.9, 22.3)	414	10.4 (7.4, 13.4)	396
Housewife	51.6 (34.0, 69.2)	31	11.4 (0.9, 21.9)	35	8.8 (0.0, 18.3)	34
Other[b]	73.2 (61.6, 84.8)	56	21.1 (10.5, 31.7)	57	3.7 (0.0, 8.7)	54
p-value	0.000		0.115		0.105	
Religion						
Muslim	69.8 (65.9, 73.7)	523	18.9 (15.5, 22.3)	524	8.0 (5.6, 10.4)	499
Orthodox	71.2 (66.7, 75.7)	389	17.3 (13.6, 21.0)	411	9.0 (6.2, 11.8)	391
Other[c]	56.7 (44.2, 69,2)	60	7.0 (0.0, 14.6)	43	2.3 (0.0, 6.8)	43
p-value	0.073		0.138		0.317	
Total	**69.6 (66.7, 72.5)**	**975**	**16.4 (14.1, 18.7)**	**981**	**8.1 (6.4, 9.8)**	**936**

Note: % is out of the total non-missing sample size (N) for each row-group, including all children (6–36 months) non-missing on child feeding and relevant demographic variables. *The samples from Benishangul-Gumuz zones are slightly smaller due to some errors in data collection of food recalls.

[a] Improved assets is based on whether or not the household has an improved roof, improved toilet, or an improved water source.

[b] Wage worker, daily laborer, trader, other self-employed, retired, physically challenged, and other.

[c] Protestant, Catholic, No Religion and Other.

relevance to customize the messaging that is most needed for their constituents.

Very few other studies are available reporting early breastfeeding practices at the level of administrative area presented in the current study, but those few which are available point to similar patterns of variation and potential explanation by socioeconomic and cultural factors. A study in Zone 3 of Afar also conducted in 2015 found 40% had initiated breastfeeding within one hour of birth [22], a higher rate compared to this study, where 19% and 27% reported early initiation in Zones 1 and 4 of Afar respectively. The discrepancy could be partly explained by the study in Zone 3 including more agropastoralists and urban households. Urban areas were excluded from the present sample. Studies from other sub-regions conducted in years prior to the present study identified 50–65% timely initiation of breastfeeding [23, 24]. One study, conducted in 2016 in the Southern part of the country (SNNPR region), identified 26% of children surveyed under 6 months old had received prelacteal foods at birth [25]. While that research was conducted in a different region, taken as a whole the literature confirm challenges and variation in feeding practices across the country.

Drivers of variation in early breastfeeding practices may be related socio-economic and cultural factors. Several studies identified rural residence [22, 24] and lack of maternal education [22, 26] as associated with challenges to recommended early breastfeeding practices. Socio-cultural factors including livelihood and religion have also been associated with early breastfeeding in other studies as well [25, 27, 28]. Chea and Asefa found that two-thirds of mothers who gave prelacteal feeds were following parental advice to do so, indicating that traditional familial beliefs are also important drivers of this practice [25]. Health-care access, including assistance after birth and postnatal counseling, and knowledge about breastfeeding best practices, also play a role [24, 25, 26]. Finally, another possible explanation for some variation in early initiation of breastfeeding may be error related to differential interpretation of the same survey questions by Ethiopian mothers. Salasibew et al. found that some mothers report that breastfeeding was not initiated if their milk had not yet come in, despite putting the baby to the breast early [29].

Several other studies have reported dietary diversity and meal frequency among young children within smaller administrative units in

Ethiopia. Some of these took place in the same zones and at a similar time as the current study. In South Wollo, Amhara, a study conducted in 2014 found that 7% of young children met the dietary diversity recommendations [30]. This was much lower than the 36% reported here one year later. The discrepancy could be explained by the 2014 study being conducted within a smaller and particularly food insecure area of South Wollo. Another study conducted in 2015 in a district within Benishangul-Gumuz identified 24% and 33% of children 12–24 months meeting the recommendations for dietary diversity and meal frequency, respectively [31]. The two zones surveyed from this region in the current study had more children meeting the meal frequency recommendations at greater than 50% each, but a similar or lower level for dietary diversity (22% and 11% in Asosa and Metekel respectively). A study in a town within North Western Zone Tigray reported 13% and 50% minimum dietary diversity and minimum meal frequency respectively [32], as compared to the 8% and 71% found in this study. Each of these aforementioned comparisons show significant differences can result from sampling larger or smaller geographic areas, illustrating variations that emerge at lower administrative areas.

Other studies have also reported these practices within livelihood and religious groups. A study conducted in a predominantly agricultural community further found very similar rates of children meeting meal frequency (67%) and dietary diversity (19%) recommendations as compared with the agricultural respondents in this sample, among whom 65% and 19% met the frequency and diversity recommendations [33]. A secondary analysis of the 2010 Ethiopian National Food Consumption Survey also found low dietary diversity among pastoralist households [34]. In 2016, a survey conducted in an Orthodox Christian community in the North Western Zone reported 13.6% of children surveyed met the dietary diversity recommendation [35], which is slightly lower than what was reported among Orthodox Christians in the present study (17%), but the 2016 survey was conducted during a religious fasting season, another important factor in relation to dietary diversity [28].

Determinants of complementary feeding practices are multifactorial though many are socioeconomic related. Male-headed household and owning livestock have been positively associated with better child dietary diversity [36], while low income, lack of maternal education, and rural residence have all been associated with less-than-ideal young child feeding practices, especially dietary diversity [32, 33, 35]. Low income and rural residence point to lack of access to resources to purchase diverse foods and low availability of diverse foods nearby as potential root causes of inadequately diverse diets, as has been identified previously [37]. In addition, the influence of religious fasting on children's dietary diversity should not be overlooked, especially among Ethiopian Orthodox Christian communities who observe many fasting days throughout the year. Even when children are exempt from religious fasting, caregivers may be hesitant to prepare separate foods for children due to fear of contaminating the family foods [28, 35]. Beliefs about what children can and cannot eat also influence the diversity of children's diets. For example, a study in Tigray found fears about children choking on meat and the belief that children cannot digest meat limited consumption of animal-source foods [37]. Some studies have found positive influences from counseling by health extension workers on young child feeding behavior [30, 38], which can contribute to improved knowledge and practices. Seasonality is another contributor to dietary diversity [39]. This study took place during the onset of the 2015 El Nino induced drought that affected most of the study areas which may have impacted child nutrition especially in places with limited access to road networks [40].

This study is unique by reporting key differences in child feeding practices across multiple regions and zones measured in the same study, thereby identifying geographical variation in program need. Geographic clustering of religious groups, occupation, and socioeconomic status (proxied by education level and housing assets) partially explains the regional and zonal differences observed. These findings highlight sociodemographic factors as key drivers of child-feeding practices.

The country is committed to continuing on the path of improving child nutritional status, as evidenced by the National Nutrition Programme and the Sequota Declaration, the government's commitment to end child undernutrition by 2030 [10,11]. The diversity and size of the country requires further consideration of the variation in young child feeding practices, including at sub-regional levels, to continue to improve child health outcomes through appropriate targeting and design of programs. The public health significance of these findings is to emphasize that program implementation can and should be targeted based on what is needed at sub-regional levels. Understanding the specific needs of communities in terms of child-feeding knowledge can improve knowledge transfer and subsequent changes in practice. Programs formulated at national or even international levels should be malleable enough to adopt to what is needed in specific communities. This message may be useful for similarly diverse international settings beyond Ethiopia, where cultures and relevant child feeding practices vary across localities.

The study had some important limitations. Data collection errors resulted in the need to exclude a small proportion of participants from Benishangul-Gumuz for the analysis of complementary feeding indicators. These participants, however, are unlikely to be systematically different from those who were not excluded. Sample sizes for each zone were generally small which decreases the precision of the results. The use of larger age groups (up to 36 months rather than 24 months) than the typical WHO indicators may have reduced comparability with other studies, but improves the understanding of feeding practices in the communities studied by increasing the available sample size. Although sample sizes are large enough to produce stable estimates at levels above the zone (e.g. the total sample, and by other characteristics such as livelihood and religion), the survey was not designed to represent those groups and so may have a lower degree of external validity at these levels especially given the non-contiguous nature of the total sample in terms of geographic area. The survey was conducted during a lean season and at the onset of a drought in most of the survey regions (all were affected except Benishangul-Gumuz) [40]. An analysis from before and after the drought concluded that child undernutrition was impacted in places with poor road networks, which could include parts of the survey areas for the current study [40]. This may partly explain the low dietary diversity seen in most areas, but suboptimal dietary diversity has historically been a challenge in these communities.

5. Conclusion

Providing infant and child nutrition services at scale in Ethiopia remains challenging due in part to variations in early feeding practices. Utilizing regional and zonal data will allow for the government and other agencies involved in improving nutrition and health outcomes to appropriately provide services and programs for families and children over the life course.

Declarations

Author contribution statement

Kaitlin S. Potts, Alessandra N. Bazzano: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Megumi Asaba, Afework Mulugeta: Analyzed and interpreted the data; Wrote the paper.

Funding statement

This work was supported by UNICEF Ethiopia (contract number 43180740) and the United Kingdom Department for International Development. Kaitlin S. Potts is supported by the National Heart Lung and Blood Institute of the National Institutes of Health under award number F31HL151232.

Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

Supplementary content related to this article has been published online at https://doi.org/10.1016/j.heliyon.2021.e06746.

Acknowledgements

The authors wish to acknowledge all those involved in the research, especially the mothers and children who participated in data collection. We are deeply grateful to John B. Mason (1944–2018) for initiating and supervising the study.

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