

# Factors associated with minimum dietary diversity and meal frequency among children aged 6-59 months in northwest Ethiopia: finding from the baseline survey of nutrition project

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## Research

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# Abstract

**Background:** Studies on the feeding practice of children, including meal frequency and dietary diversity are scarce among children. Therefore, this study aimed to assess dietary diversity and meal frequency and associated factors among children aged 6-59 months at Dabat Health and Demographic Surveillance System (HDSS) site, northwest Ethiopia.

**Methods:** A community based cross-sectional study was conducted at Dabat HDSS site from February to June 2016 on 1,174 mother-child pairs. A multistage stratified sampling followed by a systematic random sampling technique was employed to select the study participants. A binary logistic regression model was fitted to identify factors associated with dietary diversity and meal frequency. Variables having a p-value < 0.2 in the bivariate logistic regression were entered into multivariate logistic regression and a p-value < 0.05 were considered statistically significant with feeding practices.

**Result:** The overall prevalence of a minimum dietary diversity practice and a minimum meal frequency was 27 % (95%CI: 24.4, 29.7) and 83.7 % (95%CI: 86.0, 91.7), respectively. Having antenatal care (ANC) service (AOR = 1.6; 95% CI: 1.18, 2.27) and institutional delivery (AOR = 2.6; 95% CI: 1.85, 3.55) increased odds of adequate dietary diversity. On the contrary, the odds of practicing an adequate dietary diversity was lower among a household obtained food from home gardens (AOR = 0.4; 95% CI: 0.29, 0.52) and currently breast fed children (AOR = 0.6; 95% CI: 0.42, 0.78). The probability of having a minimum meal frequency was decreased among children in the first two years of age (AOR = 0.1; 95% CI: 0.06, 0.15), however increased in children who fed alone (AOR = 1.9; 95% CI: 1.29, 2.69).

**Conclusion:** The proportion of children who received the minimum dietary diversity was low while the proportion of children who obtained minimum meal frequency was good. Providing a health and nutrition counseling on Infant and Young Child Feeding (IYCF) during maternal ANC services and delivery period are recommended for achieving the recommended dietary practices.

## Background

Appropriate feeding practices are important measures to meet nutritional requirements of infants and children [1]. These children, requires a variety of foods and energy-rich food groups in the diet to ensure an adequate intake of essential nutrients and for growth and development [2]. Achieving the minimum dietary diversity for children aged 6-59 months is critical as they require energy and nutrient-dense foods for their physical, mental growth and development [3]. The World Health Organization (WHO) develops a Guiding Principles for complementary feeding of breastfed and non breastfed children of an optimal feeding practices to prevent a rapid deterioration of nutritional status associated with illness/convalescence as part of the WHO-led Global Strategy for the Integrated Management of Childhood Illnesses [4, 5].

Evidences indicate that, most under-nutrition in low and middle income countries occurs during young children as a result of suboptimal breastfeeding and complementary feeding practices [6, 7]. More

importantly, children's nutritional status can deteriorate rapidly following illness, if the additional diversified nutrient requirements associated with illness are not met and nutrients are diverted to immune response against infection [8, 9]. Despite the global progress in reducing child mortality over the past few decades, an estimated 5.4 million under 5 children died in 2017 and roughly half of these deaths occurred in sub-Saharan Africa [10]. More than 50% of child deaths are attributed to common childhood illness, of these 60% were attributed to malnutrition that associated with an inappropriate child feeding practice [11-13]. In Ethiopia, 38 % of children are stunted, 10 % are wasted, and 24 % are underweight which informed the occurrence of both acute and chronic under nutrition. Only 7% and 47.7% of children received the minimum dietary diversity and meal frequency, respectively [14].

The cause of inappropriate feeding practices is multi-factorial and has diverse contributing factors [15]. Socio-economic and demographic characteristics, household family size, cultural and traditional beliefs were identified in previous studies [16, 17]. The United Nations designs Sustainable Development Goals (SDGs) by the 2015 to decrease the deaths of under-5 children, as low as 25 per 1000 live births in every country by 2030 [18]. Even if, Ethiopia has been implementing strategies like the 2004 National Strategy for Infant and Young Child Feeding (IYCF) and the 2008 National Nutrition Program to improve the levels of child feeding practices among children [19, 20], still in the list of nations with low levels of meal frequency and poor dietary diversity practices. Therefore, we aimed to assess feeding practice and its associated factors among children aged 6-59 months in Dabat Health and Demographic Surveillance System (HDSS) site, northwest Ethiopia.

## Methods

### Study setting and design

This study was based on the baseline survey of five-year project entitled 'Establishing Nutrition Surveillance system and piloting intervention' the baseline survey was conducted from February to June 2016 in Dabat HDSS site which located in Dabat district, northwest Ethiopia. The HDSS site covers a total of 13 kebeles (9 rural and 4 urban kebeles, *smallest administration unit in Ethiopia*) with a total of 17,000 households and 69,468 populations. The kebeles under the surveillance site were selected randomly, and by taking into account of all the ecological zones (high land, middle land, and low land). Dabat HDSS is a full member of the International Network of Demographic Evaluation of Populations and Their Health (INDEPTH), a network of 44 HDSSs from the Global South.

The baseline survey included all children under five years, adolescents, pregnant and lactating mothers living in the Dabat HDSS site. Particularly, data on nutrition, health status and service utilization of children were gathered. For this study, we considered all children aged 6-59 months.

### Sample size and sampling procedure

A sample size for this study was estimated using single population proportion formula using Epi-info version 7 by considering the following assumptions; 38% as the proportion of adequate dietary diversity

among children aged 6-59 months [21], 95% confidence level, 4% margin of error and 10% non-response rate. The total final sample size was 617.

### **Data collection tool and procedure**

The baseline survey questionnaire was initially prepared in English and translated into Amharic and retranslated to English with language and public health experts to ensure the consistency. The questionnaire was pretested in one kebele out of the kebeles under the HDSS site. Experienced 38 data collectors and seven field supervisors who have been permanently working HDSS site were involved in the data collection process. Three days training on interviewing technique and data collection process was given to data collectors and supervisors. Supervisors confirmed the overall baseline survey on a daily basis.

### **Assessment of dietary diversity and meal frequency**

Assessment of the dietary diversity score (DDS) of each child was started by asking the mother to list all food consumed by the child in the last 24 hours preceding the survey. Then, the reported food items were classified into seven food groups: grains, roots and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs; vitamin-A-rich fruits and vegetables; other fruits and vegetables. Children who got four or more food groups were classified as meeting the minimum dietary diversity; otherwise, they were considered as getting inadequate minimum dietary diversity [2]. A meal frequency of the child was assessed by asking the mother how many times the child took solid, semi-solid or soft foods in the last 24 hours preceding the survey. Accordingly, two or more times for breastfed infants 6 to 8.9 months of age, three or more times for breastfed children 9 to 23.9 months and four times for non-breastfed children 6 to 59 months were considered as children who received a minimum meal frequency [2].

### **Data processing and analysis**

Data were entered into EPI INFO version 7 and analyzed using a Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics, including frequencies and proportions were used to summarize the study variables. A binary logistic regression model was fitted to identify factors associated with a minimum meal frequency and a minimum dietary diversity practices. Variables with P-Values of < 0.2 in the bivariate analysis were entered in to the multivariate analysis to control the possible effect of confounders. The Adjusted Odds Ratio (AOR) with a 95% of confidence intervals was used to examine the strength of association, and a p-values  $\leq 0.05$  was used to declare the statistically significant.

## **Results**

A total of 1,174 children aged 6-59 months who had at least the common childhood illness in the last two weeks were included for analysis. The mean age ( $\pm$ SD) of the mothers were 29.06 ( $\pm$  6.58 years) and

1,017(86.6%) were married (Table 1).

A quarter (26.0%) of children were born in a health institution, and 696(59.3%) were currently breastfed. Eight hundred forty (71.6%) subjects initiated complementary feeding between 6 to 8 months. Two-thirds, 768 (65.4%), of the mothers attended at least one ANC follow-up and 108 (9.6%) of the mothers had PNC visits. One-fourth (28.8%) of the children had watery diarrhea prior to 2 weeks before data collection (Table 2).

### **Dietary diversity and meal frequency practices**

The proportion of children who received a minimum dietary diversity was 27 % (95% CI: 24.4, 29.7%). A meal frequency among breastfed and non-breastfeed children was 83.9% (95% CI: 81.9, 85.9%) and 57.8 % (95% CI: 54.9, 60.5%), respectively. Cereals and roots were provided to the greatest portion of the children (95.7%), and only 24 (2%) of the children were given vitamin A source foods (Figure 1).

### **Factors associated with dietary diversity and meal frequency**

The result of multivariate analysis revealed that ANC visits, food source and place of birth were statistically and independently associated with dietary diversity practice in the study area. Similarly, child age and preparation of complementary foods were statistically associated with a minimum meal frequency.

Accordingly, children whose mothers had ANC visit had 1.6 times (AOR = 1.64; 95% CI: 1.18, 2.27) more likely to have diversified diet compared to their counterparts. Similarly, higher odds of diversified diet were noted among sick children whose mothers gave birth at health facility (AOR = 2.6; 95% CI: 1.85, 3.55), whereas and children from households using home gardening as prime food source had lower odds of adequate dietary diversity than children from households securing food mainly through purchasing from market (Table 3).

On the other hand, increased odds of having adequate meal frequency was illustrated among ill children whose mothers prepared food for their child alone (AOR = 1.9; 95% CI: 1.28, 2.69) compared to counterparts. However, the odds of adequate meal frequency was lower among children aged 6–23 months compared to those aged 24– 59 months (AOR = 0.1, 95% CI: 0.06, 0.15)(Table 4).

### **Table 1: Parental level Socio-demographic characteristics among children aged 6–59 months at Dabat HDSS, site northwest Ethiopia, 2016**

<b>Variables</b>	Frequency	Percentage
<b>Maternal religion</b>		
Orthodox Christian	1150	98
Muslim	24	2
<b>Residence</b>		
<b>Urban</b>	133	11.3
<b>Rural</b>	1041	88.7
<b>Marital status</b>		
Married	1017	86.6
Single	109	9.3
Divorced	30	26
Windowed	10	0.9
Separated	8	0.7
<b>Maternal educational status</b>		
Unable to read and write	899	76.6
Abel to read and write	35	3.0
Primary education	166	14.1
Secondary education	61	5.2
Higher education	13	1.1

**Table 2: Socio demographic and health care level related characteristics among children aged 6–59 months at Dabat HDSS site, northwest Ethiopia, 2016**

Variables	Frequency	Percentage
<b>Age of the child</b>		
6-23	517	44.0
24-59	657	56.0
<b>Sex of the child</b>		
Female	595	50.7
Male	579	49.3
<b>ANC service</b>		
Yes	777	66.2
No	397	33.8
<b>Birth place</b>		
Health institution	305	26.0
Home	869	74.0
<b>Birth order</b>		
First	160	13.6
Second to fifth	698	59.5
Above fifth	316	26.9
<b>Currently breast feed</b>		
Yes	696	59.3
No	478	40.7
<b>Postnatal care service</b>		
Yes	108	9.6
No	1066	90.8
<b>Time of complementary feeding initiation</b>		
<6months	87	7.4
6-8months	840	71.6
9months and above	247	21.0

Source of complementary food		
Home Garden	838	71.4
Market	336	28.6
Current illness		
Watery diarrhea	303	25.8
Dysentery	97	8.3
RTI	367	31.3
AFI	374	31.9
Ear problem	35	2.7

**Table 3: Bivariate and multivariate analysis of factors associated with minimal dietary diversity among children aged 6–59 months at Dabat HDSS, site northwest Ethiopia, 2016**

Variables	Minimum dietary diversity		Crude OR(95%CI)	Adjusted OR(95% CI)
	Adequate	Inadequate		
<b>Food security</b>				
Secured	234	677	0.75(0.99-1.80)	0.80(0.57,1.08)
In secured	83	180	1	
<b>Food source</b>				
Home garden	169	669	0.32(0.24,0.42)	0.40(0.29,0.52)**
Market	148	188	1	1
<b>ANC service</b>				
Yes	245	532	2.20(1.61,2.91)	1.60(1.18,2.27)**
No	72	333	1	1
<b>Complementary food preparation</b>				
Prepared alone	105	211	1.51(1.14,2.00)	1.30(0.95,1.81)
Prepared with others	212	646	1	
<b>Current breast feeding</b>				
Yes	176	520	0.80(0.62,1.05)	0.60(0.43,0.78)**
No	141	337	1	
<b>Place of birth</b>				
Health institutions	141	164	3.40(2.55,4.47)	2.60(1.85,3.55)**
Home	176	693	1	

\*\*significant at p-value < 0.05 59312/73320

**Table 4: Bivariate and multivariate analysis of factors associated with minimal meal frequency among children aged 6–59 months at Dabat HDSS site, northwest Ethiopia, 2016**

Variables	Meal frequency		Crude OR(95%CI)	Adjusted OR (95% CI)
	Adequate	Inadequate		
<b>Child age</b>				
6-23 months	352	165	0.1(0.05,0.13)	<b>0.1(0.06,0.15)*</b>
24-59 months	633	24	1	1
<b>Residence</b>				
Urban	100	33	0.5(0.35,0.82)	0.7(0.40,1.32)
Rural	885	156	1	1
<b>ANC follow up</b>				
Yes	642	135	0.7(0.53,1.05)	1.1(0.76,1.66)
No	343	54	1	1
<b>Initiation of CF</b>				
Timely	692	156	0.7(0.45,0.94)	0.8(0.55,1.24)
Not timely	293	41	1	1
<b>Preparation of CF</b>				
Prepared alone	765	93	3.6(2.60,4.95)	<b>1.9(1.29,2.69)*</b>
Prepared with others	220	96	1	1
<b>Postnatal care services</b>				
Yes	89	19	0.9(0.53,1.49)	1.4(0.75 ,2.44)
No	896	170	1	1

\*indicate significant at p- value less than 0.05 in multivariable logistic analysis, ANC=antenatal care and CF=complementary feeding

## Discussion

The overall proportion of minimum dietary diversity among under five children that had at least one common childhood illness was 27% which was in lined with a finding in Eastern Ethiopia (25.2%) [22] and Southeast Ethiopia (28.5%) [23].The result was higher than national figure of dietary diversity (7%) [14], Northwest Ethiopia (17%) [24], Kenya (17.9%) [25] and Southern Ethiopia (16%) [26]. The discrepancy might be the national report included remote rural areas but in this study most of them (88.7%) were from urban residence and have a chance to purchase food items and the report include children that had illness as well as healthy child but in this study all the study subjects have at least one common

childhood illness during the study period and their mothers might have health information about increased food frequency and vary during illness from health professionals. In addition, most of study subjects in northwest Ethiopia (87%) were from rural residence and might not have access to buy variety of food groups to improve dietary diversity [24].

The overall prevalence of minimum meal frequency was 83.9% which was higher than a study done in Southeast Ethiopia (68.4%) [22], northwest Ethiopia (72.2%) [23], Ghana (57.3%) [24] Demographic and health survey report of Zimbabwe (59%) [25], Malawi (53.5%) [26], and Indonesia (58.2%) [27]. The discrepancy might be due to a variation of dietary habit and culture. Furthermore 80% of study participants in southeast Ethiopia were healthier at time of data collection [22], whereas the current study participants have at least one common childhood illness during data collection period, thus the care givers might be encouraged for increasing meal frequency during illness and only 60% of the current study participants were breastfed child while 97% of study participant of northwest Ethiopia [23] and 91.6% of study participants in southeast Ethiopia [22] were currently breastfed during the survey therefore the mothers might not increase meal frequency. The other difference might be most of the surveys in Asian countries used DHS data, which contain large populations with ethnic, cultural, and traditional variations on infant and young child feeding practices.

Mothers had ANC (Antenatal care) visit during pregnancy were more likely provided the recommended dietary diversity for their child compared with the counterpart This finding was supported by a study conducted in India [28]. This could be due to antenatal care service improves maternal counseling and community conversations program about the child feeding practices which enhance the understanding of mothers about how to prepare and feed their children with diversified foods. In addition, 31.8% of mothers who had ANC service provided the minimum recommended dietary diversity while only 17.9% of mothers who didn't had ANC service provided the minimum recommended dietary diversity thus ANC visits may become the key area to inform the care givers about the importance of providing diversified food groups to their children. Accordingly, intensified efforts are needed to improve the level of ANC service utilization for providing nutrition counseling to mothers on IYCF practices.

Mothers who purchased food source for households were more likely provide diversified food for their child compared with mothers obtained food source from home gardens. The finding was strengthened by a report, on which low income countries, like Ethiopia, the consumption of fruits and vegetables that are produced in home garden do not reach even one-third of the minimum recommended daily intake [29]. Furthermore most of the house hold produce monotonous food source that likely to be nutritionally inadequate in protein, fats and micronutrients to fill the recommended daily dietary intake [30].

The higher proportion of children who were delivered in the health institution were more likely provided diversified food than children were delivered at home. Similar findings have been reported by the previous studies done in east Africa region [31], southern Ethiopia [32] and northwest Ethiopia [33]. The possible explanation might mothers at post delivery period specifically the first 6 hours and 6 days might be counseled about the importance of timely initiation of complementary food and providing diversified

food groups to their children [34]. Thus, intensified efforts are needed to improve the level of institutional delivery service utilization and provide nutrition counseling to mothers on IYCF practices.

The likelihood of feeding children with minimum dietary diversity was less among mothers who currently breast feed their children than the counterparts. Similar finding has been reported by a study conducted in Filipino [35]. The possible explanation might be, if the age of the child increases energy demand will be increased therefore, to achieve nutritional requirement, meal frequency will be increased. Furthermore most of the study subjects (88.7%) were from rural resident and unable to read and write thus they might not considered that, if the child had breastfed, it is enough for his/her growth and development.

Children in the age group of 6–23 months were about less likely to receive the recommended meal frequency as compared to children in the age group of 24–59 months. The probably reason might be most of young children at this age have breastfed in order to attain nutritional requirements and prevent irreversible nutritional problem and mothers give special attention on breastfeeding rather than increasing frequency of complementary food. Furthermore, older children have an opportunity to eat food that may increase the meal frequency.

This study also indicated that; the likelihood of adequate meal frequency was higher among children whose mothers/care givers prepared food for the index child alone than mothers prepared food with other children. The explanation might be, if the number of children in the household increases, the food availability per head was frequently lower compared with households that have a single index child.

## **Conclusion**

In this study, the proportion of children who received the minimum dietary diversity and meal frequency were low. ANC follow, household food source, breastfeeding and place of delivery were significantly associated with dietary diversity. Similarly, Age of children and ways of complementary food preparation had a significant association with meal frequency. Therefore, Improving the level of maternal and child health care utilization, providing nutrition counseling for mothers who use home gardening as a food sources and providing health and nutrition counseling on IYCF during maternal ANC service recommended for achieving the recommended dietary practices.

## **Abbreviations**

ANC: Antenatal Care; AOR: Adjusted Odd Ratio; COR: Crude Odd Ratio; EDHS: Ethiopian Demographic and Health Survey; HDSS: Dabat Health and Demographic surveillance System; IYCF: Infant and Young child feeding; SPSS: Statistical Package for Social Science; WHO: World Health Organization

## **Declarations**

Ethics approval and consent to participate

Ethical clearance was obtained from the Ethical Review Committee of the Institute of Public Health the University of Gondar (Ref: 2284/06/08). An official permission letter was obtained from the Dabat HDSS site, informed written consent was obtained from study participants in their local language after explaining the purpose of the study, potential risks and benefits of the study, and the right to withdraw from the study at any time. The participants were also assured that the data was confidential.

Consent to publish

Not applicable

Availability of data and materials

Full data set and materials pertaining to this study can be obtained from corresponding author on reasonable request.

Competing interests

We the authors declare that there is no any competing interest.

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Authors' Contributions

Authors' contributions: GA designed and supervised the study and ensured quality of the data and made a important contribution to the local implementation of the study. EA and MTH have cleaned and analyzed the data; as well as interpreted the results and drafted the manuscript.

SS,KA,AK,ZA,AT,ME,TA,AF,EG,YK, KA, AA and KF participated in preparing data collection tools, gave training for data collection. GA, AT, MM, AF has critically reviewed the manuscript. All authors read and approved the final manuscript.

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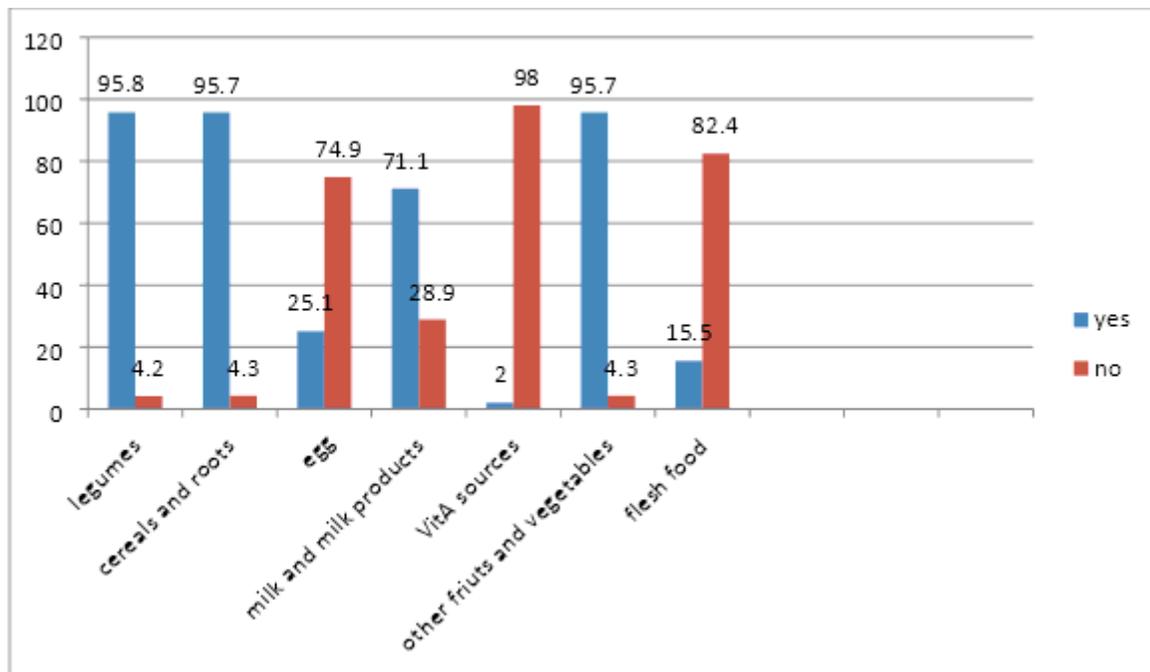
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## Figures



**Figure 1**

Types of food groups given to children aged 6-59 months old, Dabat HDSS site, northwest Ethiopia.