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Determinants of Suboptimal Complementary Feeding Practices among Children Aged 6-23 Months in Selected Urban Slums of Oromia Zones (Ethiopia)

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Abstract

Introduction: Suboptimal complementary feeding including inappropriate breastfeeding practices are the major causes of child under-nutrition in Ethiopia, like many other low income countries. However, the current situations of complementary feeding practices among children 6-23 months were not known in the sub-regions. Therefore, assessment is required, and the newly established WHO four core indicators of IYCF were used in this regards.

Objective: The purpose of this cross-sectional study was to determine prevalence and factors associated with inappropriate complementary feeding practices among children 6-23 months in selected urban slums of Oromia zones.

Method: A cross-sectional household-based survey was employed using semi-structured interview and questionnaires, during the period of January-April 2015.

Results: Analyses of the described indicators were examined against explanatory variables using multiple logistic regressions. ISSS among infants aged 6–8 months was 86.1%. Of children aged 6–23 months, MMF was 85.7%, MDD was 34.8% and MAD was 29.3%. Multivariate analyses found that MK_{Cf} score were salient determinants of inappropriate and delayed introduction of complementary feeding in the area. Child age and age of mother were common predictors of MDD. Predictors of MMF included residence, child age and MK_{Cf}. Age of mother and good MK_{Cf} were again determinant factors for not meeting the requirements for MAD.

Conclusion: Complementary feeding practices among the target children were inadequate in the study setting. Early complementary child age and MK_{Cf} were the most salient determinants which need attention during nutrition interventions.

Keywords: Complementary feeding; Dietary diversity; Meal frequency; Minimum acceptable diet; Urban slums; Oromia zone; Ethiopia

Introduction

Suboptimal complementary feeding including inappropriate breastfeeding practices have detrimental impact on child's growth, health and development [1,2]. Children aged 6 months and beyond needs sufficient quantities of quality complementary foods to support their rapid growth, as breast milk alone is nutritionally insufficient [1,3].

Therefore, optimal complementray feeding are not only effective practices for reducing child malnutrition [1,4], but also for curbing risks of Non-Communicable Diseases (NCDs) later in life [5]. To acknowledge this, WHO/UNICEF Global Strategy for Infant Young Complemntary Feeding (IYCF) provides overall framework for actions needed to protect, promote and support appropriate feeding practices in early childhood [6-9].

According to WHO report of country profile, stunting was 51% and underweight was 35% in Ethiopia for less than five years [10]. Recent Demographic Health Survey (EDHS 2011), however, shows a slight decline (stunting 44.4% and underweight 28.7%) for less than 2 years [11], which is still higher than the stunting rate (38%) for less than 5 years in Sub-Saharan Africa [1]. These were not a surprise, as complementary foods in Ethiopia are not optimal and lack nutritional quality, like many other developing countries [4,12]. Early child foods are poor in diversity [10], commonly cow's milk, porridges [11,13], and mostly thin starchy gruel [1]. The quantity of cow's milk given varied and often diluted at market place or at home [13].

However, data on the present situation of IYCF practices are lacking and demands investigation in the country. The newly established sets of indicators by WHO for IYCF are useful as used elsewhere [14], although not yet been explored in most regions of Ethiopia. Other than EDHS/WHO report; limited research has been done on nutritional quality of complementary feeding in Ethiopia. Moreover, to the best of our understanding no researchers have used regional specific primary data to examine determinants of complementary feeding in the country.

Therefore, we identified research gap on complementary feeding practices in the most part of the country and information is required to improve IYCF practices. The aim of this cross-sectional study was to determine prevalence and risk factors associated with inappropriate complementary feeding practices in selected urban slums of Oromia zones (Ethiopia).

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Methods

Study setting and participants

Our study was conducted in purposively selected urban slums of Oromia zones. Similarity in current agricultural activities, dietary practices and food insecurity across urban slums was considered for selections [15].

We randomly selected our minimum sample households proportionally [Ambo (n=175), Nekemte (n=175), Gimbi (n=117), Shambu (n=117)], taking into account present estimated population. Experienced and trained data collectors, jointly with local Health Extension Workers (HEW) were interviewed mothers. Mothers with children 6-23 months old who were residents in the study settings for 6 months preceding and willing to participate were included.

Study design

A cross-sectional survey was carried out January-April 2015. A semi-structured interview and questionnaires [16] were employed to collect socio-demographic, child feeding history, child morbidity, water consumption, and maternal knowledge on complementary feeding (MK_{Cf}).

Based on mothers'/caregivers response on foods offered to her child 24 h prior to study, IYCF indicators were estimated as per WHO definitions [1,2,16] for: (1) Introduction of Solid, Semi-Solid or Soft Foods (ISSS); (2) Minimum Dietary Diversity (MDD); (3) Minimum Meal Frequency (MMF); and (4) Minimum Acceptable Diet for the breastfed child (MAD).

Moreover, assessment of MK_{Cf} was done using standard questions [16,17]. To determine MK_{Cf}, mothers/caregivers were asked total of 11 questions with regards to indicators of IYCF practices. Scores were coded as 1 for a correct and 0 for wrong response. Then, overall MK_{Cf} score for each respondent was computed out of 100%. Finally, mothers'/caregivers were categorized into:

(1) Good knowledge (score >70%); (2) Satisfactory knowledge (score, 50-70%); and (3) Poor knowledge: (score <50%).

Sampling

A total of 595 households (50% prevalence, 95% C, ±5 CI width) of optimum size were covered [18,19]. This was proportionally allocated to the selected urban slums and corresponding child age brackets (6-8, 9-11 and 12-23 months age). As obtaining full record of eligible children living in the area was difficult, full support of HEW were used for household-based survey. After randomly identifying the households, supervisors has explained about the study to assure verbal, record consent form, and then preceded interview.

Moreover, data quality assurance procedures were started at field, and reviewed daily by supervisors. While, data processing and analysis was fully operated by principal investigator following standard quality procedures.

Statistical analysis

The prevalence and factors associated with inappropriate feeding practices for indicator variables were examined against sets of independent variables related to individual-level factors, household-level factors, and community-level factors.

IBM SPSS statistics 20 was used to execute descriptive statistics and multivariate logistic regression for dichotomous variables. The statistical significance of indicators was completed using Pearson Chi-square. Factors significantly ($P \leq 0.05$) associated with inappropriate complementary feeding practices were determined by logistic regression analysis. The odds ratios with 95% CI were calculated to assess adjusted risk of independent variables.

Ethical clearance

Approval to conduct research was given by Research Ethics Committee of Wollega University. Also, informed consent was obtained from study participants during survey.

Results

Characteristics of the sample

Table 1 describes distribution of study samples according to attributes related to individual, household and community among children aged 6-23 months in study area.

Nearly, all households' head were male, of which 72.2% had reached at least secondary education and 49.1% were in formal employment. However, majority (49.1%) mothers were housewives. While, 58.8% of mothers were aged 25-34 years; 69.4% of them have good MK_{Cf}. Nearly, all mothers' were married. Of this, 32.3% of mothers reported that their child had been sick during two weeks preceding. Breast feeding was on progress among 87.7%, while rates of bottle feeding practices were 39.0%.

With regards to family size, 73.3% have ≥4 members who usually share same pot. However, only 24.7% of them have more than one under five children. Nearly, 90.0% of households' obtains their foods through purchase. Formal employment (51.8%), casual labor (24.9%) and small scale business (17.3%) were their prominent income sources. Despite noticeably low mothers involvement rates (35.6%) in decision making over family income, 86.3% household's reported that at least a portions of their income were allocated to foods. Respectively, 93.9% and 96.8% of households have access to either water tap or protected well for drinking, and toilet facilities.

Types of foods given and practices of complementary feeding indicators

Table 2 summarized food types given to child and indicators of complementary feeding practices during 24 h proceeding, in study area.

As shown in Table 2a, consumption rates of different food types (especially, meat, leafy vegetables and vitamin-A rich fruits) were relatively lowest for children in the early age bracket (6-8 months). However, consumption of dairy products (41.2%) and fruits (14.4%) were comparable across all age. Overall, there is increasing trend in offering food with increase in child age bracket, except for diary product, vitamin-A rich fruits and fish. The practices of fish consumption were poor, suggesting the limited availability of sea foods in the study area.

With regards to indicators for IYCF practices, result has been presented in Table 2b. Rate of ISSS was 86.1% for age 6–8 months; while, MDD, MMF and MAD were 34.8, 85.7 and 29.3% for age 6–23 months, respectively. In distinctive terms, only 34.8% children aged 6–23 met requirements for MDD set to ≥4 of the seven food groups; despite satisfactory level of MMF. The MDD adequacy rate was even poorest (26.3%) among infants aged 6-8. Further, only 29.3% of breastfed children aged 6–23 had met requirements for MAD; while this was even lower (21.7%) for early age bracket.

Table 1: Individual, household and community-level characteristics of children aged 6–23 months and their parents in urban slums of Oromia Zones (Ethiopia), 2015. Total (n=595), unless stated otherwise within parentheses.

Characteristics	n (%)	Characteristics	n (%)
(a) Individual-level factors			
Child age (in months)		**Age of mother** (in years)	
Age 6 - 8	194 (32.6)	Age 15 - 24	189 (31.8)
Age 9 - 11	199 (33.4)	Age 25 - 34	350 (58.8)
Age 12 - 23	202 (33.9)	Age 35 - 49	56 (9.4)
Sex of household head		**Marital status**	
Male	555 (93.3)	Married	562 (94.5)
Female	40 (6.7)	Others (single, widow, separated)	33 (5.5)
Occupation of household head		**Occupation of mother**	
Not employed	38 (6.4)	Housewife	293 (49.2)
Employed	292 (49.1)	Employed	149 (25.0)
Small scale trading	93 (15.6)	Small scale trading	77 (12.9
Casual labor	138 (23.2)	Casual labor	61 (10.3)
Other	34 (5.7)	Other	15 (2.5)
Child been sick (2 weeks recall)		**Child ever breastfed**	
Yes	192 (32.3)	Yes	582 (97.8)
No	403 (67.7)	No	13 (2.2)
Child breastfeeding continues (at time of survey visit)		**Practices of bottle feeding** (recall from yesterday)	
Yes	522 (87.7)	Yes	232 (39.0)
No	73 (12.3)	No	363 (61.0)
Maternal knowledge score on complementary feeding practices		**Education level of household head**	
Poor (score <50%)	47 (7.9)	Primary &/or No formal education	165 (27.7)
Satisfactory (score 50-70%)	135 (22.7)	Secondary	209 (35.1)
Good (score >70%)	413 (69.4)	Tertiary	221 (37.1)
Characteristics	**n (%)**	**Characteristics**	**n (%)**
(b) Household-level factors			
Household size (usually eat from same pot)		**How household foods obtained**	
Family size ≤ 3	159 (26.7)	Farming	46 (7.7)
Family size [4 - 6]	358 (60.2)	Buying	529 (88.9)
Family size > 6	78 (13.1)	Other (combination, aid/donation...)	20 (3.4)
Nò of under 5 years children		**Main sources of drinking water**	
One	448 (75.3)	Unprotected (river, well, others,…)	36 (6.1)
Two or more	147 (24.7)	Protected (water tap, protected well)	559 (93.9)
Households main sources of income		**Practices of water treatment before drinking**	
Formal employment	308 (51.8)	Some treatments	127 (21.3)
Casual labor	148 (24.9)	No treatments	468 (78.7)
Small scale business	103 (17.3)		
Other	36 (6.1)		
Estimated percentage of household income allocation for food		**Who decide how family income is used?**	
Large proportion (50 - 70%)	133 (22.4)	Husband/partner	383 (64.4)
Medium proportion (30 - 50%)	380 (63.9)	Wife/Mother	65 (10.9)
Small (< 30%) / no specific allocations	82 (13.8)	Other (both equally involves)	147 (24.7)
Access to toilet facility		**Practices of child faeces disposal**	
Yes	576 (96.8)	Immediately & hygienically	537 (90.3)
No	19 (3.2)	Not disposed/scattered in the compound	58 (9.7)
(c) Community-level factors			
Residence			
Nekemte	177 (29.7)		
Ambo	180 (30.3)		
Gimbi	120 (20.2)		
Shambu	118 (19.8)		

Table 2a: Percentages of children 6–23 months given different types of foods by ages categories during 24 h preceding survey in urban slums of Oromia zones (Ethiopia), 2015. Overall n is 595, unless stated otherwise within parentheses.

Proportions of children given diverse food groups, n (%)										
Child age categories (in months)	**Grain**	**Root and tubers**	**Leafy vegetables**	**Vitamin-A rich fruits**	**Other fruits or vegetables**	**Meats (organ meats)**	**Eggs**	**Fresh or dried fish**	**Bean, pea, lentil, nuts or seeds**	**Dairy products**
Age 6–8 (n=194)	138 (71.1)	57 (29.4)	29 (14.9)	28 (14.4)	47 (24.2)	18 (9.3)	66 (34.0)	8 (4.1)	90 (46.4)	80 (41.2)
Age 9–11 (n=199)	175 (87.9)	68 (34.2)	30 (15.1)	26 (13.1)	55 (27.6)	20 (10.1)	88 (44.2)	7 (3.5)	106 (53.3)	94 (47.2)
Age 12–23 (n=202)	194 (96.0)	68 (33.7)	46 (22.8)	32 (15.8)	69 (34.2)	40 (19.8)	81 (40.1)	5 (2.5)	135 (66.8)	77 (38.1)
Overall, age 6-23	**507 (85.2)**	**193 (32.4)**	**105 (17.6)**	**86 (14.5)**	**171 (28.7)**	**78 (13.1)**	**235 (39.5)**	**20 (3.4)**	**331 (55.6)**	**251 (42.2)**

Table 2b: Indicators of complementary feeding practices among children 6–23 month in urban slums of Oromia zones (2015).

Proportion of infant & children, n (%)				
Complementary feeding indicators	**6–8 months (n=194)**	**9–11 months (n=199)**	**12-23 months (n=202)**	**6-23 months**
Introduction of solid, semi-solid or soft foods rates (proportion of infants 6– 8 months of age who received solid, semi-solid or soft foods), (n=194)	167 (86.1)	NA	NA	NA
Minimum dietary diversity (proportion of children aged 6–23 months who received foods from four or more of the seven food groups)	51 (26.3)	75 (37.7)	81 (40.1)	207 (34.8)
Minimum meal frequency (proportion of children aged 6–23 months who received solid, semi-solid or soft foods including milk feeds for non-breastfed children the minimum number of times or more)	154 (79.4)	177 (88.9)	179 (88.6)	510 (85.7)
Minimum acceptable diet for the breastfed child (proportion of breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day) (n=522)	42 (21.7)	64 (32.2)	47 (23.3)	153 (29.3)

NA: Not Applicable

Table 3a: Factors associated with not timely introducing solid, semi-solid or soft foods among children aged 6–8 months in urban slums of Oromia zones (Ethiopia), 2015.

Predictor variables	**ß**	**S.E.**	**OR**	**95% C.I. for Exp(ß)**	**P-value**
Residence					
Nekemte	-	-	-	-	-
Ambo	0.205	0.400	1.228	[0.560, 2.691]	0.608
Gimbi	-0.348	0.399	0.706	[0.323, 1.543]	0.383
Shambu	0.939	0.368	2.557	[1.243, 5.261]	0.011
Household size (usually eat from same pot)					
Family size ≤3	-	-	-	-	-
Family size [4-6]	-0.066	0.345	0.936	[0.477, 1.839]	0.848
Family size >6	0.747	0.440	2.111	[0.891, 4.998]	0.089
No. of under 5 years children					
One	-	-	-	-	-
Two or more	0.408	0.315	1.504	[0.811, 2.790]	0.196
Child ever breastfed					
Yes	-	-	-	-	-
No	0.620	0.711	1.859	[0.461, 7.493]	0.383
Maternal knowledge score (on complementary feeding practices)					
Poor (score <50%)	-	-	-	-	-
Satisfactory (score 50-70%)	-1.379	0.377	0.252	[0.120, 0.527]	<0.001
Good (score >70%)	-3.633	0.418	0.026	[0.012, 0.060]	<0.001

OR: Odds Ratio (Adjusted ORs by multivariate logistic regression analyses); CI: Confidence Interval

However, our result shows improvements for MDD adequacy with increasing child's age.

Another finding worth mentioning is variations between urban residences with regards to indicators for IYCF practices. Our result revealed that, lower prevalence of timely ISSS were evident in Shambu (77.5%), whereas, poor MDD adequacy was recorded in Ambo (2.2%).

Determinants of inadequate complementary feeding practices

Overall, Table 3a-3d presents multivariate statistical modeling outputs of predicator variables and indicators IYCF practices. Table 3a presents binary predictors for ISSS. However, after controlling potential confounders, our results reveal that only MK_{Cf} had maintained strong association with inappropriate time of ISSS. Mothers with good MK_{Cf} (OR=0.026; 95% CI 0.012, 0.060) had lowered risks of not timely ISSS compared to those with poor MK_{Cf}.

As described in Table 3b, children of mothers from Ambo has shown significantly higher risks of not meeting MDD (OR=33.7; 95% CI 11.2, 101.0); with this situation even highest for children in early age bracket. Which means, being children in the age of 9-11 months (OR=0.49; 95% CI 0.29, 0.86) or 12-23 months (OR=0.54; 95% CI 0.31, 0.92) has lowered risks of not meeting requirements for MDD.

Moreover, children who were from older aged mothers were more

Table 3b: Factors associated with inappropriate dietary diversity among children aged 6–23 months in urban slums of Oromia zones (Ethiopia), 2015.

Predictor variables	ß	S.E.	OR	95% C.I. for Exp(ß)	P-value
Residence					
Nekemte	-	-	-		-
Ambo	3.517	0.560	33.692	[11.236, 101.025]	<0.001
Gimbi	-0.139	0.276	0.870	[0.507, 1.494]	0.614
Shambu	-0.439	0.282	0.645	[0.371, 1.121]	0.120
Child age (in months)					
Age 6-8	-	-	-	-	-
Age 9-11	-0.724	0.265	0.485	[0.288, 0.815]	0.006
Age 12-23	-0.624	0.274	0.536	[0.313, 0.918]	0.023
Age of mother (in years)					
Age 15-24	-	-	-	-	-
Age 25-34	-0.729	0.252	0.482	[0.294, 0.791]	0.004
Age 35-49	-1.050	0.445	0.350	[0.146, 0.837]	0.018
Occupation of household head					
Not employed	-	-	-	-	-
Employed	0.712	0.569	2.037	[0.668, 6.216]	0.211
Small scale trading	-0.830	0.782	0.436	[0.094, 2.019]	0.289
Casual labor	0.743	0.591	2.103	[0.661, 6.694]	0.208
Other	-0.382	0.753	0.683	[0.156, 2.985]	0.612
Occupation of mother					
Housewife	-	-	-	-	-
Employed	-0.349	0.299	0.705	[0.393, 1.266]	0.242
Small scale trading	0.244	0.372	1.276	[0.616, 2.643]	0.512
Casual labor	-0.851	0.435	0.427	[0.182, 1.001]	0.050
Other	0.504	0.613	1.656	[0.498, 5.504]	0.410
Education level of household head					
Primary and/or No formal education	-	-	-	-	-
Secondary	-0.483	0.341	0.617	[0.316, 1.203]	0.156
Tertiary	-0.802	0.381	0.448	[0.213, 0.946]	0.035
Household size (usually eat from same pot)					
Family size ≤3	-	-	-	-	-
Family size [4-6]	0.192	0.264	1.212	[0.722, 2.033]	0.467
Family size >6	-0.312	0.393	0.732	[0.339, 1.581]	0.427
Households main source of income					
Formal employment	-	-	-	-	-
Casual labor	0.539	0.640	1.715	[0.489, 6.017]	0.400
Small scale business	1.218	0.815	3.379	[0.684, 16.695]	0.135
Other	0.922	0.750	2.513	[0.578, 10.932]	0.219
Estimated percentage of household income allocation for food					
Large proportion (50-70%)	-	-	-	-	-
Medium proportion (30-50%)	0.036	0.283	1.037	[0.596, 1.806]	0.897
Small (<30%)/no specific allocations	0.329	0.457	1.390	[0.567, 3.405]	0.472
Decision making on family income					
Husband/partner	-	-	-	-	-
Wife/Mother	-0.280	0.403	0.755	[0.343, 1.664]	0.486
Other (both equally involves)	0.262	0.246	1.300	[0.803, 2.105]	0.286
Child been sick (2 weeks recall)					
Yes	-	-	-	-	-
No	-0.116	0.248	0.891	[0.548, 1.448]	0.641
Child ever breastfed					
Yes	-	-	-	-	-
No	-0.360	0.753	0.697	[0.160, 3.049]	0.632
Child breastfeeding continued					
Yes	-	-	-	-	-
No	-0.574	0.336	0.563	[0.292, 1.088]	0.088

OR: Odds Ratio (Adjusted ORs by multivariate logistic regression analyses); CI: Confidence Interval

Table 3c: Factors associated with not meeting the requirements for minimum meal frequency among children aged 6–23 months in urban slums of Oromia zones (Ethiopia), 2015.

Predictor variables	ß	S.E.	OR	95% C.I. for Exp(ß)	P-value
Residence					
Nekemte	-	-	-	-	-
Ambo	-2.487	0.677	0.083	[0.022, 0.313]	<0.001
Gimbi	-1.358	0.420	0.257	[0.113, 0.586]	0.001
Shambu	-0.544	0.398	0.580	[0.266, 1.265]	0.171
Child age (in months)					
Age 6-8	-	-	-	-	-
Age 9-11	-0.981	0.360	0.375	[0.185, 0.760]	0.006
Age 12-23	-0.895	0.363	0.409	[0.201, 0.832]	0.014
Occupation of household head					
Not employed	-	-	-	-	-
Employed	0.367	0.739	1.444	[0.339, 6.148]	0.619
Small scale trading	0.396	1.189	1.486	[0.145, 15.275]	0.739
Casual labor	-1.193	0.683	0.303	[0.080, 1.157]	0.081
Other	0.390	0.923	1.477	[0.242, 9.023]	0.672
Education level of household head					
Primary and/or No formal education	-	-	-	-	-
Secondary	-0.316	0.451	0.729	[0.301, 1.766]	0.484
Tertiary	-0.366	0.502	0.693	[0.259, 1.854]	0.465
Households main source of income					
Formal employment	-	-	-	-	-
Casual labor	1.845	0.815	6.326	[1.281, 31.243]	0.024
Small scale business	-0.330	1.221	0.719	[0.066, 7.872]	0.787
Other	-0.748	1.040	0.473	[0.062, 3.634]	0.472
Decision making on family income					
Husband/partner	-	-	-	-	-
Wife/Mother	0.215	0.538	1.240	[0.432, 3.558]	0.689
Other (both equally involves)	0.990	0.341	2.692	[1.381, 5.248]	0.004
Maternal knowledge score (on complementary feeding practices)					
Poor (score <50%)	-	-	-	-	-
Satisfactory (score 50-70%)	-1.469	0.431	0.230	[0.099, 0.535]	0.001
Good (score >70%)	-3.442	0.469	0.032	[0.013, 0.080]	<0.001

OR: Odds Ratio (Adjusted ORs by multivariate logistic regression analyses); CI: Confidence Interval

likely of meeting MDD adequacy. Mother's in the age of 25–49 years or were shown 52-65% lower risks (OR=0.35; 95% CI 0.15, 0.84) of not meeting the MDD for their children compared to early aged once.

Unlike ISSS; inappropriate MDD were not shown association with MK_{Cf}. However, it was significantly associated with household's head higher level of education. Which means, children from household's head who had tertiary level of education were found to protective factors towards practices of inappropriate MDD (OR=0.45; 95% CI 0.21, 0.95).

Table 3c and 3d also shows factors associated with inadequate MMF and MAD. Similar with ISSS; higher MK_{Cf} was negatively associated with both not meeting adequate MMF and MAD. For example, children from mothers who had satisfactory or good MK_{Cf} (OR=0.03; 95% CI 0.01, 0.08) had shown lower risks of not meeting adequate MMF compared with those children who were from poor MK_{Cf}.

Another predictor of MMF was residence. Children who sampled from Ambo (OR=0.08; 95% CI 0.02, 0.31) and Gimbi (OR=0.26; 95% CI 0.11, 0.59) were shown lower risks of not meeting MMF compared with those from Nekemte. Our result also shows early child age bracket as risk group for inadequate MMF. There is lower risk of not meeting the MMF for children whose age were 9-11 months or 12-23 months (OR=0.41; 95% CI 0.20, 0.83) compared with early age bracket.

As already highlighted, children with mothers who had good MK_{Cf} (OR=0.17; 95% CI 0.07, 0.42) were also shown lower risks to not meeting MAD. Further, our analyses also revealed that not breastfeeding status was significantly associated with insufficient MAD. Children who dropped breastfeeding were about 56.3% lower risks of not meeting MAD compared with those who are on progress during survey.

Discussion

In this study, WHO indicators for IYCF practices have been used as outcome variable to assess prevalence and determinants of inappropriate complementary feeding practices among children 6-23 months in selected urban slums of Oromia zones (Ethiopia).

In the present study, prevalence estimates varied according to IYCF indicators, residence and child age. Overall, rates of appropriate complementary feeding practices as defined by timely ISSS, MDD, MMF and MAD were 86.1%, 34.8%, 85.7% and 29.3%, respectively. The overall rates of complementary feeding fell short of the rates recommended by WHO/UNICEF to improve feeding practices and reduce child morbidity and mortality in the sub-region.

Table 3d: Factors associated with not meeting the requirements for minimum acceptable diet among children aged 6–23 months in urban slums of Oromia zones (Ethiopia), 2015.

Predictor variables	ß	S.E.	OR	95% C.I. for Exp(ß)	P-value
Residence					
Nekemte	-	-	-	-	-
Ambo	3.616	0.562	37.204	[12.354, 112.043]	0.000
Gimbi	-0.319	0.287	0.727	[0.414, 1.276]	0.267
Shambu	-0.373	0.282	0.689	[0.396, 1.197]	0.186
Child age (in months)					
Age 6-8	-	-	-	-	-
Age 9-11	-0.749	0.273	0.473	[0.277, 0.808]	0.006
Age 12-23	-0.476	0.279	0.621	[0.359, 1.074]	0.088
Age of mother (in years)					
Age 15-24	-	-	-	-	-
Age 25-34	-0.596	0.260	0.551	[0.331, 0.916]	0.022
Age 35-49	-1.062	0.440	0.346	[0.146, 0.820]	0.016
Occupation of household head					
Not employed	-	-	-	-	-
Employed	0.762	0.575	2.143	[0.695, 6.609]	0.185
Small scale trading	-0.484	0.785	0.617	[0.132, 2.869]	0.538
Casual labor	0.915	0.607	2.496	[0.760, 8.202]	0.132
Other	0.593	0.769	1.810	[0.401, 8.179]	0.441
Occupation of mother					
Housewife	-	-	-	-	-
Employed	-0.212	0.297	0.809	[0.452, 1.448]	0.475
Small scale trading	0.287	0.375	1.333	[0.638, 2.782]	0.444
Casual labor	-1.016	0.453	0.362	[0.149, 0.879]	0.025
Other	0.348	0.629	1.416	[0.413, 4.858]	0.580
Education level of household head					
Primary and/or No formal education	-	-	-	-	-
Secondary	-0.473	0.340	0.623	[0.320, 1.214]	0.165
Tertiary	-0.652	0.377	0.521	[0.249, 1.091]	0.084
Household size (usually eat from same pot)					
Family size ≤3	-	-	-	-	-
Family size [4-6]	0.099	0.270	1.104	[0.651, 1.872]	0.715
Family size >6	-0.501	0.396	0.606	[0.279, 1.317]	0.206
Households main source of income					
Formal employment	-	-	-	-	-
Casual labor	0.378	0.646	1.459	[0.412, 5.172]	0.558
Small scale business	1.011	0.822	2.748	[0.548, 13.769]	0.219
Other	0.565	0.748	1.759	[0.406, 7.624]	0.451
Estimated percentage of household income allocation for food					
Large proportion (50-70%)	-	-	-	-	-
Medium proportion (30-50%)	-0.071	0.287	0.931	[0.531, 1.633]	0.804
Small (<30%)/no specific allocations	0.073	0.474	1.076	[0.425, 2.727]	0.877
Child been sick (2 weeks recall)					
Yes	-	-	-	-	-
No	0.056	0.256	1.058	[0.640, 1.748]	0.827
Child ever breastfed					
Yes	-	-	-	-	-
No	-0.661	0.730	0.517	[0.123, 2.162]	0.366
Child breastfeeding continued					
Yes	-	-	-	-	-
No	-0.828	0.338	0.437	[0.225, 0.847]	0.014
Maternal knowledge score (on complementary feeding practices)					
Poor (score <50%)	-	-	-	-	-
Satisfactory (score 50-70%)	-0.837	0.488	0.433	[0.167, 1.127]	0.086
Good (score >70%)	-1.778	0.470	0.169	[0.067, 0.424]	<0.001

OR: Odds Ratio (Adjusted ORs by multivariate logistic regression analyses); CI: Confidence Interval

Our study revealed some socio-demographic characteristics, child diet history, and MK_{Cf} significantly associated with suboptimal complementary feeding practices. This paper is one of the first articles in the country to describe factors associated with complementary feeding using recently established indicators for IYCF. Therefore, our finding provided critical insights sufficiently for each indicator.

Introduction of solid, semi-solid or soft foods (ISSS)

Providing nutritionally adequate diet at 6 months and beyond has benefits [16]. In this study, 86.1% of infants 6–8 months received food on the previous day; suggesting most mothers comply with WHO recommendations for timely ISSS. This rate is comparable with Sri-Lanka (83.9%) [14], and even better than Bangladesh (71%) [4], Nepal (69.7%) [20], Brazil (77.2%) [9], and other West African countries [21].

Our study finding revealed that MK_{Cf} was key determinant for inappropriate ISSS. Mothers' with satisfactory or good MK_{Cf} promotes appropriate time of ISSS among children 6-8 months. This result may reflect the crucial role of MK_{Cf} in meeting requirements for infant nutrition, and influence child growth, health and development.

Moreover, our finding of the influence of better MK_{Cf} on ISSS using the new WHO indicator is one of the first articles. However, there is evidence indicating that appropriate IYCF practices in the community were strongly influenced by their knowledge about appropriate IYCF practices [20]. Study report from across Asian also proved lack of maternal education as determinants of inappropriate complementary feeding practices [22]. Many other studies [1,2,14,21] indicated maternal illiteracy could be associated with inappropriate complementary feeding practices.

Other factors predicting time of ISSS was residence. Such geographic differences were observed in previous comparison studies in West Africa [1,23]. However, unlike many other previous studies [12], our data shows no associations between family religion and ISSS.

Overall, despite satisfactory rates of appropriate time for ISSS; improvements of MK_{Cf} need to target families with poor MK_{Cf}. This demonstrates that MK_{Cf} practices were critical for better adherence to WHO recommendations for appropriate complementary feeding.

Minimum Dietary Diversity (MDD)

MDD has been associated with overall dietary quality, micronutrient intake, household food security and nutritional status in developing countries [2,12]. Our key finding in this regard was lower rate (34.8%) of MDD in study area. This value was above the national rate (3.9%) previously reported by WHO [10], and also better than rate in India (15%). However, it's far below that of Sri-Lanka (71%) [24].

We found that early child age bracket, younger mothers, and household head higher education level were risk factors for not meeting for MDD. Our study result is also in consistent with many other previous studies [1,12,14,23] which have reported that young children were significantly associated with inadequate dietary diversity.

There is no surprise to see only a slight decline of child malnutrition in Ethiopia over past years [11,13], looking into the low MDD recorded here. Further, the present study revealed that young child age bracket and children who belongs to younger mother were risk factor for inadequate dietary diversity. This may be partly explained by the fact that early child foods in Ethiopia are mostly thin starchy gruel, which are low in nutrient density [11,13]. Also, lack of experience by young mothers on the quality and quantity of food needed by children transitioning to family foods were clearly observed in our study.

In contrary to many African countries [2,21], we found no poor cultural beliefs prohibiting children from eating nutritious foods in the study setting. However, the below achievement of MDD adequacy may also be due to lack of resources to purchase necessary foods.

Unlike Bangladesh [4], we found not both but only household heads with tertiary level of education less likely associated with not meeting for MDD. Our finding is consistent with the study based on children from Liberia and Sierra Leone [1] which suggest that children from fathers who had lower level of education were in higher risk of not meeting requirement for MDD.

Further, the association between residence and not meeting MDD requirement among children in Ambo could be due to the poor cultural practices. However, we found importance to further investigate this situation particularly in meeting MDD. Nevertheless, key finding of this study highlight the need for nutrition interventions to improve dietary quality and feeding practices. Efforts should be made to promote intake of food items such as meat, fish, fruits and vegetables more often by young children as long as there is no nutrient supplements or fortified products used in the area [12].

Minimum Meal Frequency (MMF)

Timeliness & meal frequency are important indicators of IYCF practices [1], used as proxy for energy intake from foods other than breast-milk [9,25]. Overall, 85.7% children has achieved MMF; despite low dietary quality. The rate was comparable with South Asian countries [24]. However, the rates of achieving MMF have shown variations by child age and MK_{Cf} in study area. Early child age bracket were risk factor to not meeting for MMF. This contradicts with findings from Heidkamp [26] where children 6-8 months age were much more likely to achieving MMF than older children.

Moreover, our result showed no clear-cut relationship between inappropriate complementary feeding practices and households' income source. However, children who were from households' dependent on casual labor as main income sources were found to be protective factor towards not meeting MMF. It's also worthwhile to mention variation in MMF across most residences in the sub-region.

Minimum Acceptable Diet (MAD)

One of key observations made in our investigation was the close relationship of acceptable diet with MDD. Prevalence and risk factors for MAD (29.3%) were largely dictated by MDD (34.8%) than by MMF (85.7%). Child age and age of mothers were risk factors for both indicators.

According to WHO report of IYCF indicators for 40 countries, only–Peru (65.6%), Republic of Moldova (60.3%) and Honduras (51.9%)–recorded a MAD rate above 50% [10]. Recently, in Sri Lanka the rate was 68% [14]. The corresponding WHO rate reported for Ethiopia was 2.9% which was poorest by any measure.

Our finding was in consistent with comparison study in South Asia [24] which suggests that the rate of MAD was close to that of MDD in countries where the MMF was high. However, in another comparison study from West Africa [21] reported as both low MDD and MMF resulted in low rates of MAD.

Another factors associated with inappropriate acceptable diet were child breastfeeding status and good $MK_{Cf.}$ Also, it's not surprising to see being children from residence of Ambo are promoting factors towards inappropriate MAD as the MDD rate recorded was very low for Ambo compared with other.

Strengths and limitations

The strength of this study was the use of WHO indicators for monitoring feeding practices in the specific socio-cultural and traditional feeding practices. The study provides evidence on the prevalence and determinants of complementary feeding practices that would help to develop strategies to improve nutrition pertinent to age and residence based on local resources.

A limitation of this study was that it focused on consumption data only from urban slums. We did not investigate also association of IYCF indicators and child growth outcomes, but we feel huge information gap in the area whether these new indicators would be predictive of child nutritional status.

Conclusion

Overall, our study has demonstrated important gaps in meeting the recommended minimum criteria of the newly established WHO indicators for IYCF practices in children in the study area.

Although, the energy intake adequacy represented by MMF for most children are satisfactory; the micronutrients density represented by MDD and MAD was poor. The adequacy rates were low for all indicators among early child age bracket, suggesting the initial period of complementary feeding most critical phase of the diet. Multiple-level determinants factors were identified and emphasis are required on MK_{CF}, child age, age of mother, residence, household head education, breastfeeding status, family income source, maternal occupation, and decision making over family income.

However, further research is warrant to provide data on children's diet in relation to quantity and quality of consumption. Nevertheless, this paper can provide valuable information for researchers in future nutrition intervention program for improving complementary foods using locally available resources.

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Contributions

Mr. Berra, Wondu Garoma conceived and designed the study, implementation, data interpretation, wrote the manuscript and provided critical revisions of the manuscript. Professor Nianhong Yang participated in the manuscript review.

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