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Assessment of Knowledge, Attitudes and Practices of Mothers' on Pulse Incorporated Complementary Food and Associations with Diet Diversity and Nutritional Status of their Children in Two Rural Districts of Sidama, South Ethiopia

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Abstract

In most low-income countries, the consumption of animal source foods such as flesh foods is low and Complementary Foods (CF) is insufficient both in terms of nutritional quality and quantity. Pulse crops are nutrient rich; however, the consumption of pulse crops particularly in young children, is low in Ethiopia. The aim of this study was to assess maternal Knowledge, Attitude and Practices (KAP) about pulse incorporating CF, nutritional status and Diet Diversity Score (DDS) of young children. A cross-sectional study conducted in two rural districts of South Ethiopia (n=771 mother-child pairs). The mean age of the children was 9+2.6 months. A questionnaire was used to interview mothers. Anthropometric measurements and blood samples were collected from a subset of children (n=97). Mean + SD Diet Diversity Score (DDS) was 2.2+1. Mean KAP scores of mothers were very low (2.6+1.3, 3.9+2.8 and 0.7+0.9 respectively). Mean KAP scores were significantly associated with DDS and mean meal frequency ($p<0.05$). A high rate of undernutrition was observed in these rural districts among young children. Wasting, stunting and underweight were found in 19%, 52% and 36% of the children, respectively. Of the children, 67%, 17% and 10% had anemia, iron deficiency anemia and low serum zinc, respectively. Poor maternal KAP was observed, regarding use of pulse crops, particularly in CF, indicating need for nutrition education in the health promotion program in the area.

Keywords: Pulse; Complementary food; Undernutrition; Diet diversity; Meal frequency; Anemia; Iron deficiency; Zinc deficiency

Abbreviations

LIC: Low Income Countries; SNNPR: South Nations and Nationalities People's Region; CF: Complementary Food; KAP: Knowledge, Attitude, Practice; IDRC: International Development Research Center; SD: Standard Deviation; MUAC: Middle Upper Arm Circumference; IDDS: Individual Diet Diversity Score; WHO: World Health Organization; FANTA: Food and Nutrition Technical Assistance; HHS: Household Hunger Scale; CRP: C-Reactive Protein; Hb: Hemoglobin; SPSS: Statistical Package for the Social Sciences; WLZ: Weight-for-Length Z score; LAZ: Length-for-Age Z score; WAZ: Weight-for-Age Z score; DDS: Diet Diversity Score; HEW: Health Extension Workers

Introduction

Undernutrition is the most common cause of mortality and morbidity in children in Low Income Countries (LIC). Forty-five percent of deaths in children under 5 years result from undernutrition such as deficiencies of iron, vitamin A, zinc and other important micronutrients [1]. According to the recent Ethiopian Demographic and Health Survey [2], Ethiopia has a stunting rate of 40%, a wasting rate of 7% and a rate of underweight of 27% in children under five. Anemia was detected in 44% and 61% of children under five and under two, respectively [3]. Micronutrient deficiencies are also highly prevalent in LIC countries such as Ethiopia mainly due to inadequate dietary intake during periods of rapid growth. Several studies have documented zinc and iron deficiency as public health concerns in the South Nations and Nationalities People's Region (SNNPR) of Ethiopia in pregnant women and young children [4-8].

In many LIC, Complementary Foods (CFs) are insufficient in terms of both quality and quantity, leading to a high risk of nutritional deficiencies especially during the second half of infancy. The consumption of animal source foods in SNNPR is low and the energy intake for children aged 12-23 months is below the estimated needs coming primarily from unrefined maize and wheat [9]. A lack of diversity in the diet is strongly associated with micronutrient deficiency in young children [10]. Root and tuber crops such as kocho (fermented enset) are also commonly given as CF [11]. Unfortified cereal based diets are low in micronutrients and have

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poor bioavailability because of the presence of anti-nutrients such as phytate, polyphenols and oxalate [12]. However, poor CF feeding is not always due to lack of food but also lack of caregiver knowledge who may introduce foods to early, use inappropriate complementary food, or practice unsafe ways of food preparation, including poor sanitation [9,13].

Pulse production and consumption in LIC is one means of improving food, nutrition and income security [14]. However, pulse consumption is very low in Ethiopia, especially in SNNPR. Only 9% of people in SNNPR consume pulses [15] and their total contribution to the diet is less than 5% for women and less than 3.3% for children [16]. Thus, the objectives of this study were to assess maternal Knowledge, Attitudes and Practices (KAP) regarding benefits of using pulses in the preparation of complementary foods, the need for incorporating pulses into complementary foods and to assess the nutritional status and diet diversity of young children to determine the type of nutrition education these mothers might need to improve CF.

Materials and Methods

Study area

Two districts of Sidama Zone in SNNPR were chosen: Hawassa Zuria and Boricha. They were selected because:1) they are project sites for an IDRC funded project 'Scaling-up/out pulse innovations for food and nutrition security in Southern Ethiopia"; 2) their pulse production especially haricot (kidney) beans is high [17]; and 3) the prevalence of child malnutrition is high [3,18].

The Hawassa Zuria district is located 22 km from Hawassa, capital city of SNNPR. It has a mean elevation of 1,700 meters above sea level. The annual mean temperature and rainfall ranges from 26-27°C and 900-1,400mm respectively [19]. The district has 23 villages (called kebeles), with a total population of 124,472, of which the estimated number of children under five was 7,468. The Boricha district is located 30km from Hawassa, and is found between 1500-2000 meters above sea level, with average temperature ranges from 26-33°C [20]. The district has 42 kebeles, a total of 288,713 population, with an estimated number of children under five of 17,322 [21].

Four kebeles (LebuKoromo, JaraGalalcha, UmboloKejema and UmboloTenkaka) were selected randomly from Hawassa Zuia and 8 kebeles (SedamoDikecha, KonsereArke, YirbaDiwancho, BonoyaChire, AldadaDela, FulasaAldada, Koranguge and KonsereFulasa) were selected randomly from Boricha district. Number of kebeles and participants were selected using Probability Proportional to Size sampling (PPS).

Study design

This study was cross-sectional and used a structured questionnaire adapted from previous studies [22,23] with modifications. The questionnaire was used to collect data on socio-demographic and socio-economic information, KAP of mothers towards benefit of pulse, household techniques of processing, incorporating pulse in complementary food, and household food insecurity. Blood samples were collected from a subsample of the children to assess iron and zinc status. Before data collection, a support letter was obtained from Hawassa University, College of Agriculture and the Regional Health Bureau of Health. The research sites were visited by the researcher, who explained the purpose of the study for local Health Offices. After selection of the study kebeles, the research team visited the kebele health posts for further explanation of the study and to get sampling frame of the mothers who had children 6-15 months. Using the sampling frame, participant mothers were randomly selected for the study. Data collectors were recruited from local communities who were nurses by profession and who spoke the local language 'Sidamegna'. The questionnaire was pretested and questions were modified accordingly. The questionnaire was administrated through face-to-face interview. Mothers brought their children to a central place (health post) for anthropometry measurements and interview. At the end of data collection on each day, completeness of questionnaires was checked by the principal investigator and supervisors.

Study participants

The study participants comprised 771 mothers who had children aged 6-15 months, recruited from 12 kebeles. Sample size (n) was determined using the mean (μ) + Standard Deviation (SD) of pulse-incorporated complementary feeding practice score of 7.6+1.4 in a study conducted in Wolayita zone, SNNPR [22]. The expected change (Δ) from the intervention was taken to be ≈0.3, based on Cohen's design effect size calculation which ranges from 0.2 to 0.5 (for this calculation, effect size of 0.2 is taken), at 95% level of confidence (z1=1.96) and the power (1- β) 100%, is taken to be 80% (z2=0.84). A 19% contingency for loss to follow-up was added. Data reported here are base lines for an intervention study and we determined the final sample size to implement nutrition education intervention after collection of baseline data. Informed consent was obtained from mothers before data collection. Hawassa University and the University of Saskatchewan research committees approved the study.

Anthropometrics

Anthropometric measures of the children were obtained using standardized techniques with calibrated equipment [24]. Weight was measured using an electronic scale (Seca 770) and young children were draped in a light cloth of known weight during the measurement. The recumbent length was measured to the nearest 0.1cm using the Shorr measuring board. The Middle Upper Arm Circumference (MUAC) of the left arm of young children was measured using arm circumference insertion tape.

Knowledge, attitudes and practices assessment

KAP scores were calculated based on mothers response to questions related to pulse benefit, household processing techniques and incorporating pulse in complementary foods. One score was given for each correct response, and 70% was used as a cut off for being knowledgeable, have positive attitude, and using good practices as recommended by [25]. There were a total of 9 knowledge questions, 12 attitude questions and 4 practice questions. Regarding benefit, incorporating pulse in complementary food and processing of pulse.

Dietary assessment

In order to assess children's intake, an interactive comprehensive multiple pass-24 hour recall assessment was conducted. It was repeated on a different day of the week in 10% of the total sample [26]. Using a structured questionnaire, mothers were asked the type and amount of meals consumed by young children in the previous 24 hours [26]. For each child, an Individual Diet Diversity Score (IDDS) was calculated [27] using the following seven food groups: 1) grains, roots and tubers; 2) legumes and nuts; 3) vitamin A rich fruits and vegetables; 4) other fruits and vegetables; 5) meat, poultry and fish; 6) milk and milk products; and 7) Eggs. A sum of the total numbers of food groups consumed calculated for each child and proportion of children consuming meals from four or more food groups was determined. Finally, the frequency of pulse consumption for young children was assessed using a seven-day food frequency questionnaire.

Household food insecurity

To assess food insecurity of the household in the study area, a standardized questionnaire adapted from Food And Nutrition Technical Assistance (FANTA) the "Household Hunger Scale "(HHS) was used [28]. The questionnaire included three standardized questions to assess household hunger. Food insecurity was assessed with a recall period in the last four weeks (30 days) prior to the data collection.

Child morbidity

Child morbidity for the four weeks before the visit was assessed through maternal recall of signs and symptoms related to common childhood diseases such as respiratory infections (cough, runny nose), diarrhea, and loss of appetite, vomit and fever. Diarrhea was defined as passing three or more liquid or semi-liquid stool within 24 hours. Fever was assessed based on maternal reports of an elevation body temperature from the normal body temperature.

Blood sample collection and examination

Venous non-fasting blood samples from a subset of 97 randomly selected young children (whose mothers were willing) were collected by a phlebotomist using standard procedures to determine serum iron, serum zinc and CRP. Capillary blood from finger (finger prick) was taken from the same children and hemoglobin measured using HemoCue® Hb 301 System, (Ängelholm, Sweden). Disposable lancet, alcohol and swabs, trace mineral-free gloves, trace element free evacuated containers, and pipettes were used to collect blood specimens [29]. The serum was transferred to plastic trace mineral-free vials and stored at -20°C in Hawassa University facilities. Later they were kept in ice box and transported to Ethiopian Public Health Institute for analysis. Serum zinc was analyzed using Varian SpectrAA® Flame Atomic Absorption Spectrometer. Serum ferritin and C - Reactive protein (CRP) was analyzed using Cobas® (Roche, Germany) and Cobas e411 (Roche, Germany) respectively. Hemoglobin was adjusted for ethnicity (100g/dl suggested as cut off for African) and further adjusted for altitude and <108g/dl was considered as low hemoglobin. Serum ferritin was adjusted for CRP and <12μg/L without infection and <30μg/L with infection were used. A cut off <65μg/L for morning blood and <57μg/L for afternoon blood used for serum zinc.

Statistical analysis

Statistical analyses were performed using IBM SPSS Version 20. Descriptive statistics, nonparametric tests, Pearson's chi square tests and correlation analysis were employed for statistical analysis. Length, weight, age, length-for-age, weight-for-age, weight-for-length hemoglobin concentration, serum ferritin, serum zinc, CRP, maternal knowledge, attitude and practice were the continuous variables. Groupings such as knowledgeable and non-knowledgeable, positive attitude and negative attitude, practiced and not-practiced, anemic and non anemic, stunted and non-stunted, wasted and non-wasted were treated as categorical variables. Socio-economic and demographic, morbidity, diet diversity and meal frequency, frequency of pulse consumption and child morbidity were treated as independent variables having different levels. Pearson's chi square tests were used to analyze categorical variables. Correlation analysis was used to find out strength of linear associations between two continuous variables. For significant results further multivariate analysis performed in the

Table 1: Socio-demographic characteristics of study participants at Boricha and Hawassa Zuria districts, Sidama Zone, Southern Ethiopia, 2016 (N= 771).

Socio-demographic characteristics	Frequency	Percent
Age of the mother (years)		
15-20	128	16.6
21-30	547	70.8
31-40	96	12.6
Educational status		
No schooling	297	38.5
Primary school	381	49.4
Secondary school	91	11.8
Tertiary school	2	0.3
In charge of food purchase		
Yes	308	39.9
No	463	60.1
Source of income generate activities by woman		
Yes	111	14.4
No	660	85.6
Family size		
2-4	383	49.6
5-11	388	50.3
Occupation		
Farmer	686	89.0
Gov't employed	14	1.8
Petty trading	71	9.2
Owning electronic equipment		
None	594	77
Electricity	23	3
Radio	152	19.7
Television	1	0.1
All (electricity, radio, television)	1	0.1
Age of the children (months)		
6-8	369	47.9
9-11	233	30.2
12-15	169	21.9
Gender		
Male	412	53.4
Female	359	46.6

Table 2: Mean anthropometry measurements and prevalence of under-nutrition by gender of children aged 6-15 months in Hawassa Zuria and Boricha, Sidama Zone, South Ethiopia (N=771).

Anthropometric indicators	Male	Female	All	Male	Female	*p*
	%	%	N	Mean±SD	Mean±SD	
Length (cm)	53.7	46.3	771	69.6±4.4	68.6±4.5	0.01
Weight (kg)	53.7	46.3	771	8.4±1.3	7.9±1.2	0.01
MUAC (cm)	53.7	46.3	771	13.8±1.0	13.5±1.0	0.01
Wasting (WHZ<-2)	20.1	17.5	146	-0.02	0.1	0.1
Severe wasting (WHZ<-3)	0.5	0.3	3	-	-	-
Underweight (WAZ<-2)	40.1	30.0	273	-0.73	-0.42	0.01
Severe underweight (WAZ<-3)	2.4	0.3	11	-	-	-
Stunting (LAZ<-2)	47.6	41.5	345	-1.25	-0.83	0.01
Severe stunting (LAZ<-3)	9.5	4.7	56	-	-	-
MUAC Z score (<-2)	36.7	33.2	270	-0.71	-0.56	0.01
MUAC Z score (<-3)	0.5	0	2	-	-	-

WHZ: Weight-for-Height Z score; WAZ: Weight-for-Age Z score; LAZ: Length-for-Age Z score

Table 3: Biochemical indicators of young children (6-15 months) in Boricha and Hawassa Zuria districts.

Biochemical indicators	Frequency	Percent
Hbconcentration (g/L) (unadjusted) n=97		
>110 (normal)	30	30.9
100-109 (mild anemia)	10	10.3
70-99 (moderate anemia)	37	38.1
<70 (severe anemia)	20	20.6
Hbconcentration (g/L) (adjusted for altitude and ethnicity) n=97		
>108 (normal)	31	32
107.9-90 (mild anemia)	18	18.6
89.9-70 (moderate anemia)	28	28.9
<69.9 (severe anemia)	20	20.6
Serum ferritin (µg/L) n=83 (unadjusted for CRP)		
≥12 (normal)	67	80.7
<12 (deficient)	16	19.3
Serum ferritin (µg/L) (adjusted for CRP) n=82		
≥12 or ≥30 (normal)	65	79
<12 or <30 (deficient)	17	20.7
Serum Zinc (µg/L) n=76		
≥65 (normal for morning blood)	33	44
<65 (deficient for morning blood)	4	5.3
≥57 (normal for afternoon blood)	34	43.3
<57 (deficient for afternoon blood)	4	5.3

form of Multiple Classification Analysis (MCA). Normality test was done using univariate analysis and variables which are not normally distributed were analyzed using Kendall's tau_b correlation tests, and medians are presented. Statistical significant was set at $p<0.05$.

Results

Socio-demographic characteristics of study participants

A total of 772 mother-child pairs was recruited from Boricha and Hawassa Zuria districts of Sidama Zone, South Ethiopia for the study with 100% response rate, but one pair was excluded because the child had severe acute malnutrition and was referred to a local health post for therapeutic feeding. The mean + SD age of mothers was 25.5+4.7 years of which the majority 547 (71%) were 21-30 years. About half the women were in primary school (a provision allowed for adults in Ethiopia who had not finished primary school) or completed primary school. Most (60%) mothers responded that they were not in charge of food purchases and 85.6% of mothers did not have a means of generating their own income. The mean family size in the study participant was 4.8+1.7 and the major source of income for the household was farming 89%. The mean age of young children was 9+2.6 months with about half of them between 6-8 months. Table 1 summarizes the socio-demographic characteristics of study participants.

For household food insecurity status based on HHS, 67.2% were foods secure (no hunger); 7.8 % were mildly food insecure (mild hunger); 22.8 % were moderately food insecure (moderate hunger) and 2.2% were severely food insecure (severe hunger).

Health status and anthropometric characteristics of young children

Data on morbidity of children in the past four weeks showed 54.2% children who had diarrhea of whom 5.6% had blood in their stool: 282 (36.6%) had been given Oral Rehydration Solution and 31.9% were given zinc tablets at least once and 6.4% had been given medicine to treat diarrhea by their mothers. Over one-third (37.1%) children had had fever. Of the 35.4% children who had experienced cough, most of them had had a breathing problem.

One-fifth (19.3%), more than half (52%) and over one-third (36.8%) of children were wasted, stunted and underweight, respectively. The mean + SD WLZ was 0.05+1.2, LAZ was -1.11+1.3 and WAZ was -0.58+1.2. Growth measures and prevalence of under-nutrition by gender are presented in Table 2.

Biochemical indicators of young children

Ninety-seven mothers consented to have both a finger prick and

Table 4: Association of KAP of mothers by mean diet diversity score of their children (N=771).

Knowledge variables (%)	Diet Diversity score					
	Low	Medium	High	X^2	df	*P*
Do you know that inadequate CF result under-nutrition to your child?						
Yes (92.6)	476	200	38	1.2	2	0.53
No (7.4)	42	13	2	-	-	-
Do you know CF prepared only from cereals are poor quality?						
Yes (8.4)	47	14	4	1.4	2	0.50
No (91.6)	471	199	36	-	-	-
Do you know pulses are rich in macro-and micronutrients?						
Yes (30.9)	145	77	16	6.4	2	0.04*
No (69.1)	373	136	24	-	-	-
Do you know giving pulse-cereal mix CF to your child each day improves your child's health?						
Yes (38.3)	185	92	18	5.1	4	0.28
No (69.7)	333	121	22	-	-	-
Do you know giving germinated pulse-cereal mix CF to your child each day improves your child health?						
Yes (1.3)	7	2	1	5.3	4	0.26
No (98.7)	511	211	39	-	-	-
Do you know pulse based CF improves the nutritional status of your child?						
Yes (39.8)	190	98	19	6.8	4	0.15
No (60.2)	328	115	21	-	-	-
Do you know if the pulse based foods are prepared without soaking of the pulse and eaten by the young child, the child will have abdominal cramp and excessive flatulence?						
Yes (4.4)	25	6	3	9.9	4	0.04*
No (95.6)	493	207	37	-	-	-
Do you know incorporating pulse in CF preparation improves the quality of the food?						
Yes (30.2)	137	81	15	14.2	4	0.01*
No (69.8)	381	132	25	-	-	-
Do you know soaking and germination of pulse enhance the nutrient content?						
Yes (0.9)	6	0	1	7.6	4	0.11
No (99.1)	512	213	39	-	-	-
Attitude (%)						
How serious do you think under-nutrition is for a baby's health?						
Very serious (84.6)	430	183	36	2.0	2	0.3
Not serious (15.8)	88	30	4	-	-	-
Do you think under-nutrition impairs the child's health, growth and development?						
Yes (81.2)	412	178	36	5.1	4	0.2
No (18.3)	102	35	4	-	-	-
Do you believe under-nourished children are highly susceptible for infection?						
Yes (84.0)	429	182	37	3.7	4	0.4
No (15.7)	87	31	3	-	-	-
Do you believe pulses should be used for the preparation of CF?						
Yes (37.1)	176	90	20	8.8	4	0.06
No (61.7)	334	122	20	-	-	-
Do you believe pulse based CF are not tasty and suitable to be eaten by the young children?						
Yes (63.4)	343	127	19	11.1	4	0.02*
No (36.6)	175	86	21	-	-	-

Do you think if the pulse based CF preparation waste time and fuels?						
Yes (27.1)	126	67	16	9.7	4	0.04*
No (61.6)	392	146	24	-	-	-
How difficult is it for you to give pulse-cereal mix CF for your child?						
Yes (69.0)	359	148	25	1.8	4	0.7
No (31.0)	159	65	15	-	-	-
How difficult is it for you to give germinated pulse-cereal mix CF food for your child?						
Very difficult (93)	478	202	38	5.7	4	0.2
Not difficult (6.9)	40	11	2	-	-	-
Do you think germinate pulse or cereals are good for health?						
Yes (1.4)	7	3	1	8.8	4	0.06
No (98.6)	511	210	39	-	-	-
Do you think have a good knowledge about preparation of pulse based CF for your child?						
Yes (13.1)	58	36	7	6.8	4	0.14
No (92.1)	500	177	33	-	-	-
How confident do you feel in preparing pulse-cereal mix CF for your child?						
Confident (13.5)	60	36	8	6.1	4	0.2
Not confident (86.5)	458	177	32	-	-	-
How confident do you feel in preparing germinated pulse-cereal mix CF for your child?						
Confident (1.4)	9	2	0	19.6	4	0.01*
Not confident (98.6)	509	211	40	-	-	-
Practice (%)						
Do you prepare pulse-based CF for your child?						
Yes (44)	204	117	18	14.8	2	00.001**
No (56)	314	96	22	-	-	-
Do you always soak and germinate pulse products before preparing the child's food?						
Yes (0)	0	0	0	-	-	-
No (100)	518	213	40	-	-	-
If you prepare CF for your child from cereal and pulse in what proportion do you commonly prepare?						
Not mixing (85.1)	462	160	34	34.3	10	00.001**
1/4th pulse with 3/4th cereal (10)	32	42	3	-	-	-
1/2 pulse with 1/2 cereal (3.8)	18	8	3	-	-	-
3/4th pulse with 1/4th cereal (0.6)	3	2	0	-	-	-
Other (0.13)	1	0	0	-	-	-

*P values are significant at <0.05, **P values are significant after applied Bonferonni correction P<0.017

venous blood samples taken from their child. The mean + SD adjusted hemoglobin was 95+2.7g/dl, unadjusted serum ferritin concentration was 27+17.9μg/L, unadjusted serum zinc was 86.4+26.6μg/L and median C-RP was 1.6+21.3mg/L. The distribution of children above and below cut-offs for adequacy using these indicators is shown in Table 3.

Almost 90% of young children had serum zinc in the normal range (>65μg/L for morning blood and >57μg/L afternoon blood). Four young children (4.8%) had depleted iron stores (serum ferritin <12μg/L), 66 children (67.7%) had anemia (Hb<108g/dl) and 14 children (16.9%) had iron deficiency anemia (Hb<108g/dl and serum ferritin <12μg/L).

Child feeding practice

All children were breastfed and almost all children (94%) had started on complementary foods. In the past 24 hour prior to data collection, 9.1% of children did not eat solid or semi-solid foods; 3.6% were fed twice; 36.8% were fed three times; 37.6% were fed four times; and 12.7% fed were 4 or more times a day. Complementary food given to children was mainly prepared as a form of porridge (40.9%) mainly from maize. The rest 50.1% complementary food prepared as a form of flat bread and gruel. More than half of mothers (56.9%) reported that they were using pulse crops in complementary food mainly boiled haricot bean (54.7%). Eighty eight percent of children consumed fruits mainly banana and avocado likely due to them being in-season. None of the children consumed dark green leafy vegetables except for

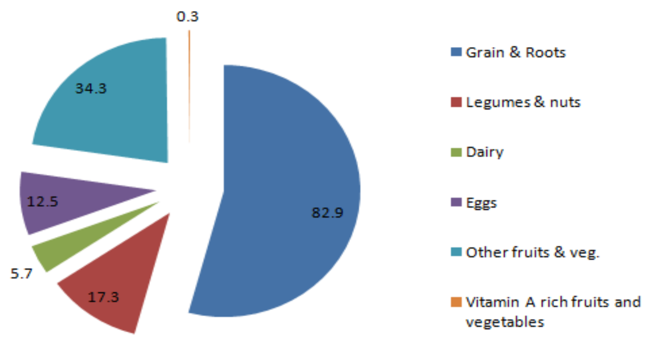

Figure 1: Percent of diet diversity of young children based on 7 food groups (N=771).

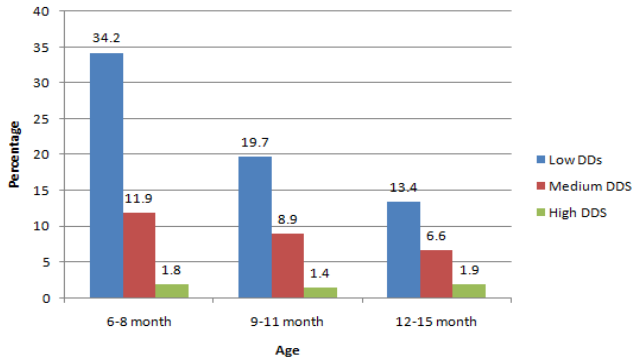

Figure 2: Diet diversity score by age group (N=771). Low DDS- consume<2 food groups; Medium DDS - consume 3 food groups; High DDS - consume >4 food groups per day.

a small percentage that consumed kale (2.2%) and flesh or organ meat in 24 hour period. The mean Dietary Diversity Score (DDS) + SD were 2.2+1 which is below the recommended diet diversity for young children by WHO i.e., 4 per day. Figure 1 summarizes food groups consumed by young children.

In general, 518(67.2%) young children had low diet diversity score which they consume 0-2 food groups in the past 24 hour prior to the data collection; 213(27.6%) had medium diet diversity score which they consume 3 food groups and 40(5.2%) had high diet diversity group which they consume more than 4 food groups. The diet diversity classification based on children's age categories presented on Figure 2. Minimum meal frequency is one of the indicator for minimum acceptable diet in children, 41% (n=316) of young children aged 6-8 month met the minimum meal frequency i.e., 2 times per day with additional 1 or 2 snacks; 27% (n=210) young children aged 9-15 months had a minimum meal frequency i.e., 3 times per day with additional 1 or 2 snacks. Only 4.4% and 6.7% of young children aged 6-8 month and 9-15 month had minimum acceptable diet respectively.

Monthly pulse consumption by young children who participated in this study was assessed. Most (99.4%, 99.2%, 98.6%, 97.5%, & 43.7%) mothers reported that they have never given pea, chickpea, lentil, faba bean and haricot bean respectively for their children. Only 2.6% children consumed haricot bean more than once per day; 5.4% consumed 3-6 times per week; 23.2% consumed 1 or 2 times per week and 15% consumed 2 or more per month. The consumption of other pulses such as chickpea, faba bean, pea and lentil was very low.

Two-thirds (65.1%) of mothers said that they grow pulse crops in the last year (2015) and almost half of them (49.9%) grow pulse in both belg and kiremt which are a rainy season in the country. Around 98% of mothers said that they use the harvested pulse crops for own consumption and 87% said that the main pulse crop grown in the area is haricot bean.

Knowledge, Attitude and Practice (KAP) of mothers towards pulse and pulse incorporated complementary food

Mothers KAP about benefit of pulse, using pulse in complementary food preparation and processing of pulse for complementary foods were assessed using questionnaire. Mean + SD of knowledge, attitude and practice were 2.6+1.3, 3.9+2.8, and 0.7+0.9 respectively. About one-fourth of mothers (30.9%) said that they knew pulses are rich in macro- and micronutrients; 38.3% knew that giving pulse incorporated complementary food improves the health of the child. Only 1.3% and 4.4% knew that giving germinated pulse-cereal mix complementary food improves the health of the child and if pulse based foods are prepared without soaking and eaten the child will have abdominal cramps and excessive flatulence respectively. About one-fourth of mothers (30.2%) said that they knew incorporating pulse in complementary food improves the quality of the food and 0.9% said that they knew soaking and germinating of pulse enhance the nutrient content. About one-third of mothers (37.5%) believed that pulse should be used in the preparation of complementary foods; many (63.4%) believed that pulse based complementary foods are not tasty and are unsuitable to be eaten by young children; most (93.1%) said that preparing germinated pulse-cereal mix complementary food is difficult. No one said that they soaked or germinated pulse products and only 10% mentioned the right proportion of cereal and pulse to prepare complementary foods. Many (86.1%) said that they have no good knowledge about preparation of pulse incorporated complementary food and 86.3% were not confident in preparing germinated pulse-cereal mix complementary foods (see Table 4).

On knowledge questions 99% of mothers scored less than 70% which indicated the lack of maternal knowledge on pulse incorporated complementary foods; 85.3% of mothers scored less than 70% regarding attitude questions which indicate negative attitude towards soaking and germination and use in complementary foods and 94% of mothers scored less than 70% on practice questions which also indicated poor practice of household processing techniques for pulse crops and use in complementary foods.

Association of KAP of mothers, anthropometric indices and mean diet diversity of their children

Association of mean KAP of mothers with anthropometric indices of their children was performed using Pearson's chi square and found no association. Knowledge: Wasting (p=0.687), stunting (p=0.319), underweight (p=0.296) and MUAC (p=0.212). Attitude: Wasting (p =0.856), stunting (p =0.979), underweight (p =0.918) and MUAC (p=0.268). Practice: Wasting (p =0.471), stunting (p =0.263), underweight (p =0.548) and MUAC (p =0.744).

Association of mean KAP with mean diet diversity and minimum

Table 5: Prevalence of household hunger by diet diversity, N=771.

Diet Diversity Score	Household Hunger N (%)			
	Food Secure	Mild hunger	Moderate hunger	Severe hunger
Low (0-2 food group)	336 (43.6)	38 (4.9)	132 (17.1)	12 (1.6)
Medium (3 food group)	149 (19.3)	19 (2.5)	41 (5.3)	4 (0.5)
High (>4 food group)	33 (4.3)	3 (0.4)	3 (0.4)	1 (0.1)

meal frequency performed using Pearson's chi square and found a significant association: Knowledge p=0.001, Attitude p=0.002 and Practice p=0.001. Minimum meal frequency also significantly associated with KAP of mothers': Knowledge p =0.001, Attitude p=0.001 and Practice p =0.001. Some of the KAP variables were also significantly associated with diet diversity using Pearson's chi square, however, when Bonferonni correction was performed to minimize type I error, significant association found only in Practice variables. Table 4 presented the association of KAP variables and mean diet diversity. In this study, when Multiple Classification Analysis (MCA) was performed, mean diet diversity did not associate with mean knowledge (r=0.10, p=0.1) and mean attitude (r=0.10, p=0.3) but associate with mean practice (r=0.10, p=0.01) of mothers. Table 5 summarize the prevalence of household hunger by diet diversify. In addition to KAP and household hunger, other factors such as wealth index, mothers' source of income, age of mothers, household family size, and age of child, on diet diversity and meal frequency for young children were evaluated with Mean Classification Analysis. Thus, in addition to feding practice of mothers household family size was strongly associated (r=0.10, p=0.05) with diet diversity. Meal frequency, was strongly associated with maternal mean knowledge (r=0.15, p=0.001). There was an inverse relation with poor maternal knowledge and meal frequency of the child. Mean practice was strongly associated with meal frequency and an inverse relation was observed with negative attitude and meal frequency (r=0.15, p=0.003). Household family size strongly associated (r=015, p=0.05) with meal frequency with an inverse relation with large and medium family size and age of the child was also associated (r=0.15, p=0.02) with meal frequency which younger children 6-8 months had low meal frequency than older children.

Discussion

The findings of this study provide insight of maternal knowledge, attitude, and practices on pulse incorporated complementary foods and their potential association with diet diversity and nutritional status of young children. Nutrient dense foods are important for complementary feeding to support proper growth and development particularly during rapid growth such as during 6-24 months. Low diet diversity due to food insecurity, lack of nutrient dense foods in traditional home prepared complementary foods, and lack of knowledge, attitude and practice among mothers were reasons provided in the literatures for poor complementary feeding practices [22,30,31]. Maternal knowledge about using pulses in young children diet was found to be low in SNNPR, where mothers reported that they do not know the benefit of pulse and its preparation for complementary foods [11,32,33].

In the present study maternal knowledge, attitude and practice of mothers about pulse incorporated complementary food and household pulse crop processing was low, and suggested a lack of proper nutrition education of mothers in the study areas. Previous nutrition education interventional studies done in rural communities of Ethiopia showed that when there was a significant improvement in maternal KAP, then both child growth and dietary diversity improved [22,31].

The results observed in this study regarding mean diet diversity score is not different from those reported in the Ethiopian Demographic and Health Survey and other study [3] and as we previously reported [11]. In the present study 94.8% of young children had poor dietary diversity score. Pulses are known for having nutritional and health benefits due to protein and micronutrient content [34]. The frequency of pulse consumption was low in most pulse crops, however haricot bean was the most pulse crop consumed by the children: 12.6% consumed it once or more per day. This finding was similar with a study done in Wolaita Zone [32]. Maternal KAP about pulse usage in complementary showed the majority of mothers did not have good knowledge, attitude and practice. A study done in rural Ethiopia also found that only 3% of mothers said that they soaked or germinated pulses for preparation of complementary food [22], similar to our findings of no one soaking or germinating pulses. Mothers' said pulse incorporated complementary foods are not tasty and are unsuitable for young children; further, mothers had no knowledge on how to prepare pulses for use complementary foods.

In most low income countries, poor diet diversity is expected where main complementary foods are prepared from cereal grains and consumption of animal source is low [9,30]. In this study KAP of mothers regarding child feeding practice and pulse incorporated complementary foods was significantly associated with diet diversity of children. However, food insecurity also associated with diet diversity (p=0.028). Table 5 shows children from food secure households/no household hunger had no difference from households who had hunger in diet diversity score. Data also show that the majority of hunger free households had low diet diversity score. Thus, poor maternal feeding practice could be one of the reasons for poor diet diversity in these children. The finding of this study also indicated a high undernutrition rate in the study areas. Although nutritional status was not significantly associated with maternal KAP, the high rate of undernutriton indicated the need of appropriate intervention in these areas. Anemia was also prevalent in this study population of young children of 68%. The prevalence of anemia found in this study was a bit higher than a study done in Northeast Ethiopia i.e., 66.6% [35] and EDHS [3] i.e., 60.9% in under two children. Among these groups 4.8% had iron deficiency and 16.9% had iron deficiency anemia. Zinc was also a problem which 10.7% young children affected by low serum zinc concentration. In the present study, 85.6% mothers had no a source of income generating activities which made them dependent on their husband's income for food and other necessities. In addition, more than half of them (60.1%) were not in charge of food purchase.

Conclusion

Maternal KAP was low regarding pulse incorporating complementary food and household techniques of pulse processing such as soaking and germination. Low diet diversity and low meal frequency as well as low minimum acceptable diet were a problem in the study population and significantly associated with maternal KAP. In addition, there were high undernutriton rates where 52% of children were stunted and 68% of children were anemic. Our result also demonstrated a high level of iron and zinc deficiencies that cannot be ignored. These strong associations between maternal KAP on nutrition and undernutriton, as well as low diet diversity score in the study participants; indicates a gap in nutrition interventions. To implement nutrition education in consistent manner and to be cost effective, the government should strength the nutrition package, with emphasis on child feeding practice, food preparation from locally available foods with demonstrations. As education and counselling is given by Health Extension Workers, thus, training of HEWs intensively in nutrition is very important. In this study, diet diversity was not significantly associated with household hunger, however, 33% of household had hunger based on the FANTA HHS, thus there is a need to link nutrition with agriculture. This suggests the government and other non-government organizations should start working with HEWs and Development Agents in agriculture and nutrition; to introduce and provide quality seeds and appropriate training in agriculture and nutrition for farmers. Furthermore, empowering mothers by focusing on their KAP for pulse foods should be taken into consideration while planning any of the interventions.

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