Original Research Article||

Sustainability of improved maternal knowledge and practices on pulse inclusion in complementary foods after nutrition education intervention in Southern Ethiopia: A case-control analysis

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Abstract

Nutrition-sensitive program is one among the approaches to improve the nutritional status of children. In households with poor socioeconomic status, improving maternal knowledge of child nutrition has been shown to reduce malnutrition-related morbidity and mortality. However; it is not clear if the effects are long lasting or not. Therefore, the present study was designed with the primary aim of evaluating the sustainability of the knowledge and practices gained from the pulse-related nutrition education intervention. To this end, a community-based case-control study was conducted on 390 mother-child pairs in southern Ethiopia form December 2017 to January 2018. In this study, the cases were those mother-child pairs, previously given pulse-related nutrition education, while the controls were the ones who were not provided a similar intervention. A Chi-square test was used for comparison of categorical variables, and the t-tests for the mean effect. It was found that knowledge was higher in the cases compared with the control group. More specifically, a higher mean difference score was recorded in knowledge in the cases, 8.36 (1.64), than control, 6.82 (2.4). Besides, there was a significant difference in using pulse for complementary food preparation between the cases and control groups. Moreover, there was a higher mean difference in the practice score in the cases, 6.02 (1.22) compared with the control group, 4.88 (1.68), ($p<0.01$). In conclusion, the pulse-related nutrition education intervention has had a lasting effect on maternal knowledge and practices regarding the inclusion of pulses in complementary food preparation for children aged 6-23 months.

Key words: Complementary feeding, food-based approach, knowledge, nutrition education, practice, pulse

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INTRODUCTION

Optimal infant and young child feeding (IYCF) is critical for proper growth and development (UNICEF, 2020). The child suffering from malnourishment may never reach full physical or cognitive potential, which limits his/her ability to learn and overall economic productivity in future life (UNICEF, 2016). Complementary feeding (CF) is the period of dietary adjustment from 6 to 23 months of age of children when exclusive breastfeeding is no longer sufficient to meet the requirements of growing children in quality and quantity of essential nutrients (UNICEF, 2020). The highest burden of child under-nutrition in the world is in Sub-Saharan Africa (SSA); with the pooled prevalence of stunting, underweight and wasting for 32 countries reported as 33.2%, 16.3%, and 7.1% (Akombi et al., 2017).

Ethiopia is also affected by malnutrition. For instance, the mini Ethiopian Demographic and Health Survey (EDHS) 2019 reported 37%, 21% and 7%, stunting, underweight and wasting, respectively in under five years children. Furthermore, the CF practice was suboptimal with only 7% of children aged 6-23 months meeting the minimum acceptable diet, and 14% of children having an adequately diversified diet. Similarly, poor children's nutrition status has been reported in the Southern Nations and Nationalities

Peoples' Region (SNNPR) of Ethiopia (EPHI/CIF, 2019).

Poverty is one of the factors contributing to food insecurity worldwide (Bain et al., 2013). For example, in Ethiopia, children from the richest and richer households were found to be less likely to be stunted compared to those from the poorer and poorest wealth quintiles (Amare et al., 2019). However, in areas of poor socioeconomic status, improving the knowledge of parents, especially of mothers, on nutrition, sanitation and common disease prevention strategies has been shown to reduce the malnutrition induced mortality and morbidity (Bain et al., 2013).

Nutrition-sensitive (NS) programs help to accelerate the progress in improving nutrition by enhancing household and community environment in which children develop and grow (Ruel et al., 2013). Nutrition education (NE) as program and approach improves the nutrition status of under-five children in low and middle income countries (LMICs) (Majamanda et al., 2014). Maternal nutrition knowledge and practice can be improved by effective initiatives that addresses CF practices (Bhutta et al., 2020). Several researchers have applied educational theories and models in the delivery of messages in NE (Guled et al., 2018; Kajjura et al., 2019; Deksiyous et al., 2020). Implementers also applied group-based and community/social mobilization approaches for behavior change communication (BCC) (Kennedy et al., 2018). Use of tools like charts, posters and booklets deliver successful educational interventions (Lassi et al., 2013). Approaches such as intervention group meetings with caregivers and community leaders were used to provide education. Practical application of incorporating cooking demonstrations and home visits, produced highly significant results (Majamanda et al., 2014).

Pulses belong to the leguminous family crops (FAO, 2016) and have important attributes including high nutritional value, long storage times and relatively low cost in comparison to animal products (Dilis and Trichopoulou, 2009). Pulses provide dietary protein, energy and micronutrients that play essential role in human nutrition, especially in combination with cereals (Dilis and Trichopoulou, 2009). For illustration, a research study showed (Kebebu et al., 2013), a significant increment in protein content of cereal based complementary food (CBCF) after household processing and the addition of 30% broad beans. In a similar fashion, a significantly higher intakes of protein, carbohydrate, folate, magnesium, iron, and zinc was reported in those consuming pulses (Mitchell et al., 2009).

In Ethiopia, pulse agriculture is the second most important crop and a key source of income for smallholder farmers, supporting household food security. Pulses also serve as alternative sources of plant based-proteins and other essential nutrients (Bishaw et al., 2018). However, consumption of pulse for CBCF preparation is very low. A nationally representative study in Ethiopia (CSA, 2017) reported that only 15.5% of breast fed and 19% non-breast fed children under two years of age consumed pulse incorporated foods. In addition a research review from southern Ethiopia reported 12.4% to 43.7% pulse incorporation in CBCF (Henry et al., 2015). Additional study from Sidama (Dafursa and Gebremedhin, 2019) confirmed that only 17.1% children consume pulse incorporated CBCF. Nutrition education interventions have shown positive effects on knowledge, and lasting changes in community practices (Guled et al., 2018; Kajjura et al., 2019; Deksiyous et al., 2020).

Sustainability of intervention is the ability of a project to function effectively, for the foreseeable future, with high treatment coverage, integrated into available health care services, with strong community ownership and resources mobilized by the community as well as the government (Gruen et al., 2008; Bodkin and Hakimi, 2020; Shoesmith et al., 2021). Most interventions are assessed with parameters such as feasibility, strategic planning, process, and outcomes. However, few studies consider the sustainability aspect as part of the evaluation indicators of successful interventions (Harvey and Hurworth, 2006). The sustainability of interventions depend on interactions between multiple stakeholder groups including institutions, health services, communities and households. Sustainability of interventions benefit to the policy makers, funders, programs, managers, and the community and the households (Gruen et al., 2008). A review of literature showed that only 60% of all new programs were found being sustained beyond the first few years after the termination of initial project funding (Savaya et al., 2009). Accordingly, the present study was conducted three and five years after the successful nutritional interventions (2013 and 2015) on the utilization of pulses in CBCF in southern Ethiopia.

The aim of the present research was to determine if the focused nutrition education interventions that successfully improved knowledge and practice on

utilization of pulse in CBCF (Mulualem et al., 2016; Berhanu et al., 2020) were sustainable in the setting of project areas, and to assess the degree of information flow to the control communities.

MATERIALS AND METHODS

Study Area and Design

The present study was conducted in Sidama and SNNPR, Ethiopia. Sidama region is one of the newly established regional states of Ethiopia. According to population projection of Central Statistical Agency (CSA) Ethiopia, 2022, Sidama has a population of around 4.06 million with area of 6.5 million square kilometers. Sidama is one of the leading coffee producing regions in Ethiopia. It is generally a fertile area, varying from flat land (warm to hot) to highland (warm to cold). Economically, most are subsistence farmers (CSA, 2022). Wolayta is an administrative zone in southern Ethiopia. Based on the 2022 population projection conducted by the CSA Ethiopia, the zone has a total population of 2.19 million with an area of 4.2 million square kilometers. Agriculture is the livelihood for more than 90% of the population in the rural areas. Maize, haricot bean, taro, sweet potato, *enset*, banana, avocado, mango and coffee are the major crops with tremendous benefits to smallholder farmers'(CSA, 2022).

The study included two districts from Sidama region (Boricha and Hawassa Zuria), and one district from Wolayta zone of SNNPR (Damot Gale). For this research a case-control design was employed. The respondents were drawn from a list of NE participants who had been selected for the case/control arm of two studies, one from 2013 (Mulualem et al., 2016), and the other from 2015/16 (Berhanu et al., 2020). The researchers followed quasi-experimental study design (Mulualem et al., 2016) and cluster randomized control trial (Berhanu et al., 2020). The participant mothers and children from those earlier nutrition interventions in selected districts were traced back and followed. The comparison between the outcomes of interest in the cases and control groups created the basis for determining whether the beneficial effects of the intervention could be detected after 3 to 5 years. Data collection for the present study was carried out from December 2017 to January 2018.

The nutritional intervention studies were conducted in total of 14 kebeles; 12 from Sidama (Berhanu et al., 2020) and 2 kebeles from Wolayta (Mulualem et al., 2016). The study areas were places where nutrition-sensitive agriculture had been implemented for about ten years. For the present study, eight kebeles were selected: six from Sidama (four from Boricha and two from Hawassa Zuria) and two kebeles from Damot Gale of Wolayta zone.

Source and Study Population

The source populations for the present study were those mother-child pairs who participated in previous specific nutrition intervention studies on utilization of pulses (Mulualem et al., 2016; Berhanu et al., 2020). The study population was those mother-child pairs residing in the intervention (cases) and non-intervention (control) areas. The mothers/care givers who received the NE, and completed the baseline and end-line information were included. However, individuals engaged in other similar long-term nutrition intervention training were excluded from this study.

Sample Size and Sampling Techniques

The present study employed the sample size estimation formula used in case control studies where there is a one-to-one matching between the cases and controls (r=1). Based on the previous studies the proportion exposed to NE in the control group, on an average, was assumed to be 20% (0.2); while the proportion of cases exposed to the NE in intervention group was estimated at 33% (0.33) (Mulualem et al., 2016; Berhanu et al., 2017). The average proportion exposed for the two groups combined was 0.265, (0.33+0.20)/2. The sample size of 200 was computed for each arm considering the 95% confidence interval (Z_1=1.96), 80% sampling power (1- β) (Z_2=0.84), and 10% compensation for nonresponse, n1= 182+18; n2 = 182+18, making the total 400.

The rural districts in Sidama region and Wolayta zone were purposely selected based on the availability of project related data. Two districts (Boricha and Hawassa Zuria) from Sidama were selected by lottery method from the list of intervention districts. Then, the cases and controls were identified based on their exposure to previous NE interventions. Accordingly, two kebeles from Hawassa Zuria, and four from Boricha districts were selected as case and control pairs. In addition, two kebeles were sampled from Damot Gale in Wolayta and matched based on the selected socio-demographic characteristics of the respondents (age, education, household size), and equal number of cases and controls was allocated.

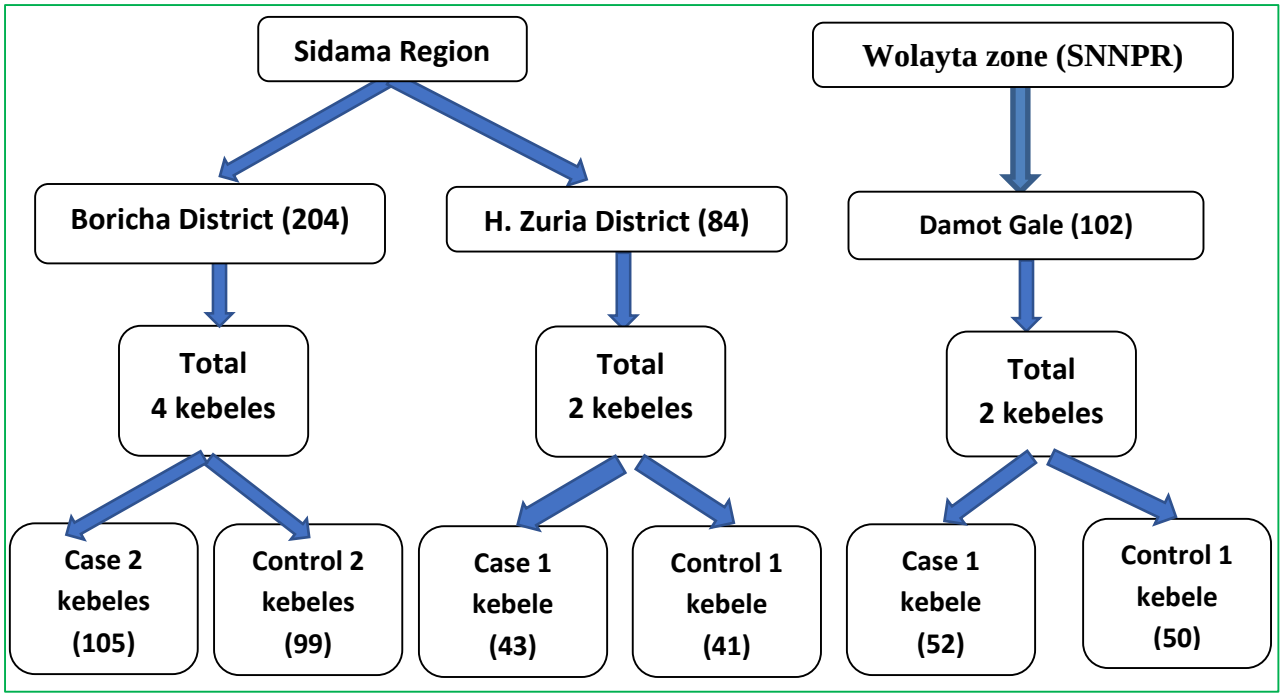

Figure 1. Flow chart describing selection of study areas. Sample sizes are shown in brackets.
Key: IG = intervention group; CG = control group

Ethical Considerations

Ethical approval for the study was obtained from the Institution Review Board of Hawassa University (Ref. No: IRB/023/10). The local authorities were informed about the study objectives for their permission and support. The authorities were supportive throughout the data collection period. Informed consent was obtained from each participant through a written form. Confidentiality of the data obtained from participants was strictly maintained and used solely for the purpose of the research.

Data Collection Tools

Structured and semi-structured questionnaires were used to assess the socio-demographic, economic, dietary and related household characteristics. Parts of questionnaires which dealt with socio-demographic and economic information were taken from standard surveys (CSA, 2012). The tools to assess maternal knowledge and practice on processing, preparation and utilization of pulse incorporated CBCF were adopted from the previous NE researches (Negash et al., 2014; Mulualem et al., 2016). Ten questions were used to assess maternal knowledge and another ten questions for practical application (Negash et al., 2014; Mulualem et al., 2016). The knowledge and practice level of mothers was categorized into knowledgeable/practicing (those who scored ≥70%), fairly knowledgeable/fairly practicing (those who scored 50 to 69%) and poorly knowledgeable/poorly practicing (those who scored <50%) based on the 10 questions employed for each. Besides, questions on maternal recall knowledge on nutritional advantage of pulse and pulse incorporated CBCF were asked for case groups in order to assess sustainability. The content validity of the tool was assessed against the conceptual framework of the study. Two days intensive training was given to the data collectors by the PI using a checklist. In order to customize and adapt the tool to the local situation pretesting of the questionnaires was conducted in similar population group at different areas. In accordance with the findings of the pretest, modifications were made to the questionnaire. Data were collected in private setting within the compound nearby to the client's home. The questionnaires were prepared in English and translated into "*Sidamu Afo*" and "*Wolitigna*" languages by professionals fluent in the language and English accordingly. Questionnaires were administered in "*Sidamu Afo*" in Sidama region, and "*Wolitigna*" in Wolayta zone.

Data Management and Analysis

Data entry, cleaning, editing and analysis were carried out using SPSS version 20 for Windows (IBM Corporation, Armonk, NY, USA). After data entry

was completed, its accuracy was checked. Prior to analysis, the data was screened for missing, out of range and outlier values by examining the frequency distribution of the variables. The presence of outliers in the pertinent continuous variables was diagnosed using Box and Whiskers plot. Data description was made using mean, median, standard deviation (SD), frequency, percentage and presented in tables. Estimates of population parameters were presented with a 95% Confidence Interval (CI). All continuous variables were checked for normality using the Kolmogorov-Smirnov test. Chi-square test was conducted to see the association between nutrition education intervention and selected categorical variables in the case and control communities. The mean difference in knowledge and practice between case and control groups was assessed using independent two samples t-test ($p < 0.05$).

RESULTS

Socio-demographic Characteristics

In the present study, 390 mother-child pairs participated; 200 (100%) cases and 190 (95%) controls (Figure 1). The mean (SD) maternal age was 30.04 (4.74) years for cases and 29.45 (5.25) years for controls (Table 1). There was no significant difference in the mean (SD) age of participants in the cases and controls. Close to two-thirds of the mothers in each group were in the age range of 25-34 years. In the study, about 58.5% of the case and 49.5% of the control had 5 to 9 family size implying that there was no statistically significant differences in socio-demographics between the case and the control groups.

Table 1. Socio-demographic characteristics of study participants from six rural kebeles, southern Ethiopia (January, 2018)

Variable	Cases N (%)	Controls N (%)	p value *
Mothers age in completed years			
<24	26 (13)	26 (13.7)	0.72
25-34	127 (63.5)	124 (65.3)	
>35	47 (23.5)	40 (21.1)	
Mean (SD) maternal age	30.04 (4.74)	29.45 (5.25)	0.85
Mean (SD) husband age	35.00 (5.89)	34.57 (6.33)	0.35
Household Size			
Low (≤ 4)	81 (40.5)	89 (46.8)	0.57
Medium (5-9)	117 (58.5)	94 (49.5)	
High (≥10)	2 (1.0)	7 (3.7)	
Mean family size (SD)	5.17 (1.63)	5.07 (2.1)	0.44
Husband has other wife (wives)			
No	153 (76.5)	157 (82.6)	0.11
Yes	47 (23.5)	33 (17.4)	
Mothers educational status			
Illiterate	74 (37.0)	66 (34.7)	0.37
Read and write	46 (23.0)	35 (18.4)	
Primary level	70 (35.0)	73 (38.5)	
Secondary and above	10 (5.0)	16 (8.4)	
Husband educational status			
Illiterate	52 (26.0)	49 (25.8)	0.96
Read and write	34 (17.0)	31 (16.3)	
Primary level	89 (44.5)	83 (43.7)	
Secondary and above	25 (12.5)	27 (14.2)	
Husband occupation			
Farmer	152 (76.0)	158 (83.2)	0.12
Employee	6 (3.0)	1 (0.5)	
Petty trader	41 (20.5)	29 (15.3)	
Others	1 (0.5)	2 (1.0)	

*****p value for the chi-square test

Mothers' Knowledge

The result showed high knowledge score in the case and some improvements in the controls (Table 2). Regarding the nutritional advantage of pulse, 98% cases scored more than controls, 89.9%. Overall, the score for the knowledge of cases was significantly higher ($p<0.01$) than that of controls. However, controls also showed improvement in knowledge on the benefit of pulse for child growth and development, and importance of mixing pulse with cereals. The mothers who participated in the present study had knowledge about the importance of pulse processing at household level such as soaking, germination and dehulling. Compared to the controls, mothers in the case group had a greater knowledge about household processing of pulses ($p<0.05$).

Table 2. Knowledge of mothers in case and control groups on nutritional advantages of pulse incorporated complementary foods in Sidama region and Wolayta zone, Ethiopia (January, 2018)

Variable	Cases	Control	P value*
Know nutritional advantage of pulse crop			
Yes	196 (98)	170 (89.9)	0.01
No	4 (2)	20 (10.1)	
Major advantage of providing good health			
Yes	179 (89.5)	149 (78.4)	0.003
No	21 (10.5)	41 (21.6)	
Major advantage for child mental and physical development			
Yes	159 (79.5)	128 (67.4)	0.007
No	41 (20.5)	62 (32.6)	
Major advantage make the child more strong (strengthen the child)			
Yes	160 (80.0)	121 (63.7)	0.01
No	40 (20.0)	69 (36.3)	
Know the advantage of mixing pulse with cereals in CoF/ foods			
Yes	195 (97.5)	165 (86.8)	0.001
No	5 (2.5)	25 (13.2)	
Mother know nutritional advantages of pulses for CoF			
Yes	196 (98)	161 (84.7)	0.01
No	4 (2)	29 (15.3)	
Germination decreases anti nutrients and improves quality of CoF			
Yes	191 (95.5)	139 (73.2)	0.01
No	9 (4.5)	51 (26.8)	
Soaking decreases abdominal discomfort and gas formation			
Yes	191 (95.5)	134 (70.5)	0.01
No	9 (4.5)	56 (29.5)	
Mother know dehulling decrease nutrient content of pulses			
Yes	171 (85.5)	126 (66.3)	0.01
No	29 (14.5)	64 (33.7)	

*****p value for the chi-square test

Mothers' Practices

Mothers in the case and control groups were asked about practical skills on complementary food preparation and feeding to their young children (Table 3). Most of the mothers from both the case (95%) and control (90%) groups provided pulse-incorporated food to their children in the form of thick porridge. However, significantly higher number of controls provided the food in the form of cereal gruel to the young children ($p<0.05$). Mothers from the cases were more likely to add pulses while preparing complementary foods than the controls groups ($p<0.01$). Haricot bean and chickpea were the commonly utilized pulses for child food in the study area. Mothers in the case groups (51.5%) were more likely to correctly mix pulses with cereals than those in the control sets (42.1%) while preparing complementary foods, although the difference is not significant ($p=0.06$). The results also revealed that a significant number of cases were practicing pulse soaking, germination and dehulling, ($p<0.01$) during food preparation compared to the controls.

Table 3. Practical skills of the case and control groups on pulse incorporated food preparation and feeding in Sidama region and Wolayta zone, Ethiopia (January, 2018)

Variable	Cases	Control	P value*
Utilization of pulses while preparing complementary food			
Yes	193 (96.5)	154 (81.1)	0.01
No	7 (3.5)	36 (18.9)	
Using correct pulses: cereal ratio/ mixture			
Yes	103 (51.5)	80 (42.1)	0.06
No	97 (48.5)	110 (57.9)	
Removes seed cover while preparing pulse incorporated CF			
Yes	119 (59.5)	76 (40)	0.01
No	81 (40.5)	114 (60)	
Soaking and germination of pulse for CF preparation			
Yes	186 (93.0)	102 (53.7)	0.01
No	14 (7.0)	88 (46.3)	

*****p value for the chi-square test

Knowledge and Practice Score Sum

Overall, 299 (76.7%) of respondents were found to be knowledgeable and 30 (7.60%) were poorly knowledgeable (Table 4). Those knowledgeable by cases [178 (89.0%)] were greater (p=0.01) than the controls [121 (63.6%)].

A total of 233 (59.7%) study participants (Table 4) were found correctly practicing the necessary pulses processing and additions to complementary foods. There was a higher mean (SD) practice score [6.02 (1.22)] for the case group (p=0.01) than the control counterpart [4.88 (1.68)]. The mean practice score is lower than mean knowledge score in both group.

Table 4. Knowledge and practice score of cases and control mothers in Sidama region and Wolayta zone, Ethiopia (January, 2018)

Variable	Frequency	Cases	Controls	P value (95% CI)
	Total N (%)	N (%)	N (%)	
Knowledge categories*				
Knowledgeable	299 (76.7%)	178 (89.0 %)	121 (63.6%)	0.01
Fairly knowledgeable	61 (15.6%)	17 (8.5%)	44 (23.2%)	
Poorly knowledgeable	30 (7.7%)	5 (2.5%)	25 (13.2%)	
Mean (SD) Knowledge score		8.36 (1.65)	6.82 (2.63)	0.01(1.10, 1.97)
Practice categories				
Correctly Practicing	233 (59.7%)	147 (73.5%)	86 (45.3%)	0.01
Fairly practicing	108 (27.7%)	45 (22.5%)	63 (33.2%)	
Poorly practicing	49 (12.6%)	8 (4.0%)	41 (21.6%)	
Mean (SD) Practice score		6.03 (1.23)	4.88 (1.68)	0.001 (8.54, 1.43)

*Knowledgeable those with >=70%; fairly knowledgeable those with 50 to 69%; and poorly knowledgeable are those with <50% in knowledge sum scores; *correctly practicing are those having >=70%; fairly practicing those with 50 to 69; and poorly practicing those with <50% in practice score.

DISCUSSIONS

Almost all studies evaluating nutrition intervention outcomes are conducted immediately after completion of the intervention, i.e., at the end line. The present study was conducted after 3 to 5 years of the successful nutritional intervention and evaluated

the degree of sustainability of the knowledge and practices of incorporating pulses into CBCF. The cases in pulse-focused interventions achieved higher sustainability scores in knowledge and practical application after the project's termination.

Sustainability is one of the major concerns in nutrition interventions. Factors like organizational setting, and community environment affect sustainability (Savaya et al., 2009), this may include engaging the local community in the original locations of the interventions. In addition, the internal and external political environment also affects the sustainability of successful interventions. Thus, it is important to pay attention and understand the local enabling political climate for both positive and negative program drivers (Bodkin and Hakimi, 2020). Ethiopian government showed strong commitment to tackle malnutrition and its effects through preparation of doable national food and nutrition policy (FDRE/MH, 2018) in a multi-sectoral approach with clear roles and accountability of sectors to the governing body. The food based nutrition intervention approach covered more than 70% of the roles (FDRE/MH, 2018) where nutrition sensitive agriculture was mandated for about 63% of all efforts.

The present study revealed that maternal practices are significantly ($p<0.01$) higher in the case than control. However, the control also exhibited higher practice scores than that during the baseline. Review on NE interventions showed significant increase in compliance with the imparted messages in the intervention group (Lassi et al., 2013). Improvements also noted in increasing food diversity and frequency of feeding after intervention (Kuchenbecker et al., 2017). One of the reasons for sustainability could be the positive change in the nutritional status of children.

Our result showed maternal knowledge on advantages of pulse on providing good health, and child growth/development has increased. Comparable trend was reported in Bangladesh (Nguyen et al., 2019), where most of the CF messages were retained after termination of the intervention. In addition, it was reported that mothers receiving non-intensive messages also gained knowledge (Nguyen et al., 2019). This study also demonstrated positive effect of education on participants and the neighborhood with those who received a BCC intervention (Hoddinott et al., 2017). The nature of the education, and simplicity of the messages with demonstration helped mothers retain knowledge in the case groups. The gain of knowledge in the control suggests possibility of information diffusion to the control area.

Pulse and other foods processing at household level is essential to enhance bioavailability of nutrients (Kebebu et al., 2013; Whiting et al., 2019). Prior to receiving nutrition education (Mulualem et al., 2016), none of the mothers applied processing during complementary food preparation. The study also reported at the base line that almost no mother practiced recommended processing techniques in the preparation of CBCF (Hailu et al., 2020). Further research showed that those in the intervention kebeles increased processing knowledge and practices at the end of intervention however, there was no change in the control communities (Negash et al., 2014; Mulualem et al., 2016; Berhanu et al., 2020). Over time, as shown in the present study, most of cases and many of the control group were found applying processing during CBCF preparation.

Food viscosity is one of the factors which affect the nutritional status of young children. WHO (WHO, 2009) recommends that CBCFs should be thick enough and more solid to be energy and nutrient-dense to better fulfill the nutritional needs of young children. When a child eats thick, solid foods, it is easier to give more kilocalories (WHO, 2009). In the present study more mothers from control reported giving CBCF made in the form of thin gruel for their young children. This has negative effect on the child health and growth performances. As the stomach capacity is very small and fills up fast with foods in the form of gruel and always fall short of the required amounts of nutrients and energy per feeding (Mengistu et al., 2017). Children in Ethiopia having the culture of consuming thin cereal-based gruels are affected by high rate of malnutrition (Endris et al., 2017). Mothers require further demonstration-based interventions on the practical application of food density for CBCF, in addition to other variables such as amount and frequency.

The present research showed no major differences in the socio-demographic status of the case and control community. However, respondents in the case groups showed better knowledge and practical application on CF. The knowledge and practices were sustained in the case communities and there was improvement from previously low end line measurements seen several years back in the controls. The engagement of the health extension workers (HEW) during the intervention period might be among the reasons for retention of knowledge in the study areas (Hailu et al.,

2020). In the Ethiopian health care system HEW had frequent contact with the local community (Assefa et al., 2019). Focused and long-term, hands-on education involving the local community and its leaders leads to improved knowledge and practical application.

CONCLUSIONS

This study revealed that there was retention of knowledge in those who had received the intervention, i.e., the cases after three to five years (for different locations) of intervention compared to those who have not been given any. Practice of including pulses in the complementary foods was higher in cases than in the controls. It was also found that the controls showed higher scores in knowledge and practices than they did at the end line of the original trials. It can be concluded that the BCC strategies including appropriate information augmented with hands on training on pulse food preparation have positive effect in retaining knowledge and improving practices. Other simple yet efficient methods, such as peer practical demonstrations of the teaching activity, might enhance knowledge retention and practices.

Data Availability

The dataset is available from the corresponding author upon email request

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this paper.

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