Journal of Food Research; Vol. 7, No. 3; 2018
ISSN 1927-0887 E-ISSN 1927-0895
Published by Canadian Center of Science and Education

A Peer-Led Pulse-based Nutrition Education Intervention Improved School-Aged Children's Knowledge, Attitude, Practice (KAP) and Nutritional Status in Southern Ethiopia

Felegush Dargie[1], Carol Jean Henry[2], Hailu Hailemariam[1] & Nigatu Regassa[2]

[1]Hawassa University, School of food science and nutrition, P.O. Box 5, SNNPR, Ethiopia

[2]College of Pharmacy and Nutrition, 3302 Health Science E-wing, University of Saskatchewan, 104 Clinic Place, Saskatoon, SK, S7N 2Z4, Canada

Correspondence: Carol J. Henry, College of Pharmacy and Nutrition, 3302 Health Science E-wing, University of Saskatchewan, 104 Clinic Place, Saskatoon, SK, S7N 2Z4, Canada. E-mail: cj.henry@usask.ca

Received: January 29, 2018 Accepted: February 17, 2018 Online Published: April 1, 2018

doi:10.5539/jfr.v7n3p38 URL: https://doi.org/10.5539/jfr.v7n3p38

Abstract

Background: Peer-led nutrition education intervention on promoting locally available pulses among school-aged children could be one strategy to overcome child malnutrition in poor communities.

Objectives: This study was aimed at assessing the effect of a peer-led pulse nutrition education intervention on knowledge, attitude, practice of pulse consumption and nutritional status among 202 school children.

Methods: School based randomized controlled trial was conducted among 202 (101 control and 101 cases). School age children were selected from the two groups using simple random sampling technique. Baseline data were collected from 1st May to 15th May, 2016. Six month peer led nutrition intervention was provided for the study subjects. Pre-test, post-test and anthropometric measurements (weight and height) were conducted at baseline and end of the intervention. Statistical tests such as independent two samples t-test were employed. World Health Organization (WHO) Anthrop Plus software version 1.0.4 was used to calculate anthropometric indices.

Results: The mean diet diversity score was significantly ($P<0.001$) improved from 2.78 (0.96) to 3.60 (1.10) after a six month intervention in the intervention group. The independent two samples t-test showed significant differences ($p<0.001$) in knowledge, attitude and practice mean scores of school age children about pulse preparation and consumption. There was no significant difference in nutritional status: BAZ ($p=0.774$) and HAZ ($p=0.516$) of school age children between the intervention and control groups at baseline. Post-intervention showed significant ($p=0.01$) differences between intervention and control schools in BAZ mean score of the children which was reflected in significantly ($P<0.001$) decreased prevalence of thinness

Conclusion: The study concluded that peer led education strategy provides an opportunity to reduce malnutrition and its impacts if properly designed, including the use of behavioural change mode.

Keywords: diet diversity**,** KAP, Peer-led education, pulses, nutritional status, school age children

1. Background

School-aged children are one of the most critical and vulnerable segments of the population with regards to food insecurity and nutritional deficiencies. Because they are in their period of growth and development, demands are higher for nutrients, and they are at risk for nutritional deficiencies and diseases (Ling & Jingxu, 2010). Lack of knowledge among mothers, family members and health workers about appropriate foods for school age children is one of the major reasons contributing to malnutrition (Bhutta, et al., 2013). A study conducted by Bhandari *et al.,* 2004 (Bhandari, et al., 2004) showed that nutrition education can be effective in improving the nutritional status of the school age children. Others have indicated that children who learn healthy eating habits have the potential to reduce the likelihood of chronic diseases in adulthood (Negash, et al., 2014). Nutrition education also helped to use locally available foods (Sethi, et al., 2003).

A lack of available foods limits diversified diets and is crucial factor in developing countries, where diets often consist of starchy staples with not enough nutrient-rich sources of food, such as from animal sources, fruits, vegetables, beans and pulses. Legume seeds (also called pulses or grain legumes) have an important role in human nutrition, especially in dietary practices of low-income segments of the population in developing countries because they are generally good sources of many important nutrients and phyto-chemicals; good sources of slow release carbohydrates (starch and dietary fibber), rich in proteins, and contain vitamins (often B-vitamins) and inorganic compounds. Pulse crops are very high in protein and fiber, and are low in fat and also they have high levels of minerals such as iron, zinc, and phosphorous as well as folate and other B-vitamins ([6]) which are vital for proper and healthier growth and development.

Nutrition education and health promotion interventions directed at changing interpersonal, organizational, community, and public policy, help to support and maintain healthy behaviours. Socio-ecological models assume that appropriate changes in the social environment will produce changes in individuals, and that support of individuals is essential for sustained environmental change (Green & Kreuter, 1991). Peer education provides information, training, and resources to peers, who participate in nutrition and health promotion. Peer-led approaches to health promotion are increasing in their popularity because peer interactions exert a powerful social influence on behaviour change.

Schools have the potential to reach a high proportion of school children within the school community, providing opportunities for children to practice healthy eating and for teachers to model healthy eating behaviours since eating is a socially learned behaviour that is influenced by social pressure (FAO, 2014). In schools, peers play an important role in a child's socio-emotional growth. Children act as change agents as they can help change the eating habits of their friends and families by demanding desirable food. In terms of the generational impacts, peers themselves become parents in the future so that they can impart good dietary habits to their children (FAO, 2011). They can also be agents of change by spreading what they have learned in school to their family and community members (Ritchie, 2003).

Pulse-based nutrition education is considered essential in raising awareness, promoting compliance, or guiding dietary choices such as making pulses a part of healthy dietary options. Recent studies have documented that pulses can make important contributions in terms of macro-and micro-nutrients, and when combined with grains; they form a complete protein (Ofuya & Akhidue, 2005). Pulses are often called "the poor people's meat," and they might be better known as the "healthy people's meat" as they do have many impressive nutritional and health benefits (Dilis & Antonia, 2009). In developing countries, pulses are the most important protein source compared to industrialized countries where meat and other animal products are commonly eaten (Tamil Nadu Agricultural University, 2000). Thus, a nutritional intervention in poor societies that integrates pulses as part of healthy option can be an important strategy to improve nutritional status (Fikru, 2014; Tariku, et al., 2015).

In Ethiopia, lack of awareness and knowledge about feeding amount, frequency and type of food contribute significantly to poor nutritional status among school age children even in families where adults meet their daily requirements. Although poverty is the main reason for under nutrition, lack of knowledge about how to use locally available foods, negative attitudes towards using pulse products (Kebebu, et al., 2013) are some of the reason for under nutrition. Fortified food commodities, protein enriched and factory processed foods are either not available in local market and/or are not affordable to low-income families. Consequently, majority of the food stuffs consumed by these population segments are poor in protein and micronutrients (Abebe, et al., 2006). The health implication of poor nutritional quality and inadequate quantity of foods is well documented (Kalanda, et al., 2006).

To the best of the authors' knowledge, there are limited researches conducted on strategies to improve dietary behaviour focusing on peer led nutrition education at school level in Ethiopia. The scantly available evidences suggest that peer-led nutrition education approaches are practical, feasible and well accepted in schools (Best, et al., 2010; Guldan, et al., 2000).The main objective of this study is, therefore, to assess the effect of peer-led pulse nutrition education on KAP and nutritional status of school age children in four village schools in Misrak Badiwacho district, Hadya zone, Southern Ethiopia.

2. Theoretical Framework

During the last few decades, researchers have used different models to explore the factors influencing human behaviour. Some of the most influential and commonly cited perspectives, theories and models includes: Hines *et al.*'s (Hines, et al., 1987) model of responsible environmental behaviour; Ajzen's theory of planned behaviour (Ajzen, 1991); Stern *et al.*'s (Stern, et al., 1999) value-belief-norm (VBN) theory; Blake's theory of reasoned action (Blake, 1999).

The theory of Planned Behaviour (TPB) is a well-known and validated model used to predict maternal behaviour in children feeding practices. Originally the theory was developed by Ajzen in 1991 (Ajzen, 1991). Theory of planned behaviour has three constructs that helps to predict intentions to a given behaviour. It distinguishes between three types of beliefs - behavioural, normative, and control. The TPB is comprised of six constructs that collectively represent a person's actual control over the behaviour. 1) Attitudes 2) Behavioural intention 3) Subjective norms 4) Social norms 5) Perceived power and 6) Perceived behavioural control. In the TPB, the most immediate predictor of behaviour is an intention (i.e. a motivation or plan) to engage in the behaviour (such as consumption of proper diet). The TPB proposes intention to be determined by the additive effects of attitude, subjective norm and perceived behavioural control.The theory of planned behaviour states that 'people's behaviours are determined by their intentions, which in turn are influenced by attitudes, social norms, and perception of control over the behaviour" (Contento, 2011).

As shown in fig 1, beliefs and evaluation of behavioural outcomes influence attitudes, normative beliefs and motivation influence subjective norms and control beliefs and perceived power influence perceived behavioural control (Zoellner, et al., 2012; Fila & Smith, 2006). The theory helps nutrition educators understand the motivational factors for certain behaviour (Contento, 2011). This theory helps to examine a person's attitude towards certain behaviours, cultural and environmental influences (U.S., 2005). The Theory of Planned Behaviour (TPB) has been used successfully to predict and explain a wide range of social and economic behaviors (Fila & Smith, 2006; Temesgen, et al., 2013).

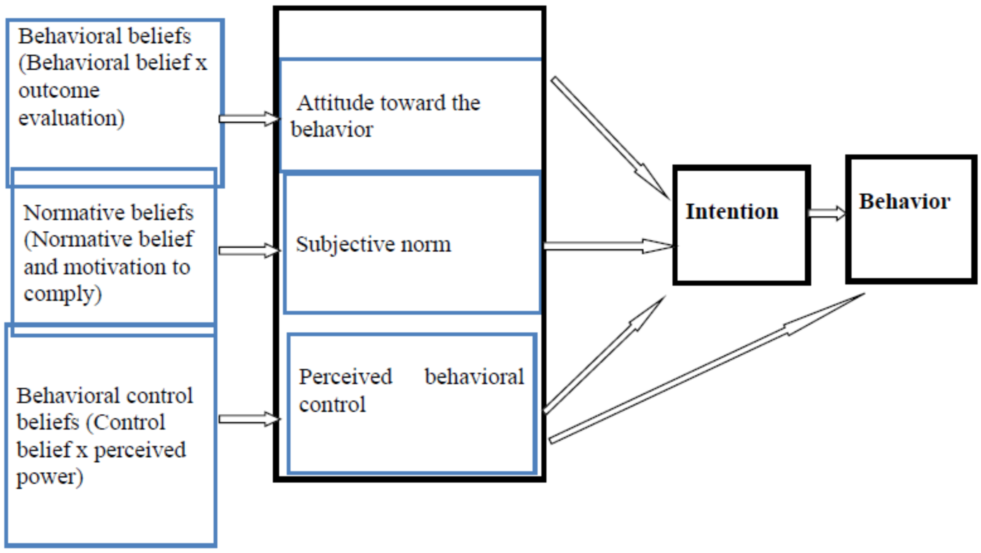

Figure 1. Theory of Planned Behavior Model (Source: ([21])

3. Methods and Materials

The Study Area

The study was conducted in *Misrak Badiwacho district (Woreda), Hadiya* zone, Southern Nations Nationalities and People's Regional State (SNNPRS), Ethiopia. SNNPR is the third largest administrative region of Ethiopia. The region is the most diverse region in the country in terms of language, culture and ethnic background. About 93% of the population is rural and 50% is within productive age range indicating that about half of the population is economically dependent (CSA, 2007).

Misrak Badiwacho district is one of the 11districts of Hadiya Zone which is administratively subdivided into 39 villages (called *kebeles:* i.e the smallest administration unit) of which the four kebeles: AburseAnjilo, AndegnaAburse, Lalo Gerbe and Woiyra Gere are identified as potential pulses (grain legumes) growing areas. The major crops grown in the Woreda include Irish potato, maize, pulses (like haricot bean, Chick pea), teff, enset (false banana) and sweet potato (Sintayehu & Worku 2011; Mulalem, et al., 2016). There are 19,690 estimated school age children in Misrak Badiwacho district.

Data sources and study design

School based randomized controlled trail was conducted and data were collected at two different points in time (at baseline and after intervention). The source populations were all school age children who lived in the study area for more than six months. The study population was considered healthy and able to communicate school aged children (age 10-14), attending their education in the kebele's school, and were randomly selected to participate in the study. Since the study dealt with KAP, which requires a certain level of understanding, older ages than younger ones were preferred.

Sampling design

The sample size was determined based on previous studies using the mean (μ) + standard deviation (SD) of pulse consumption practice score (out of ten pulse consumption practices) 7.6+1.36 in a study conducted in Damot Gale woreda, Wolayita zone (Mulalem, et al., 2016). The expected change (Δ) from the intervention is taken to be ≈ 0.4, which ranges from 0.2 to 0.5 (for this calculation, effect size of 0.3 was taken), at 95% level of confidence (z_1=1.96) and the power (1- β) 100% is taken to be 80% (z_2=0.84). 10% contingency for loss to follow-up was used. Finally, sample size of 101 for control and intervention group was determined as the minimum size by using a population based formula (Cocharan, 1977).

Once the sample size was determined, both purposive and random sampling technique was used to select the study subjects. Misrak Badiwacho woreda has 39 kebeles, of which four kebeles were purposively selected based on their potential of pulse crops like beans, chickpeas and lentils (Sintayehu & Worku 2011). As each village has elementary level school, the four schools were purposefully selected followed by random assignment of these schools either the intervention or control group (two Kebele for intervention and two Kebeles for control group). Sampling frame was prepared using the students' roster/list provided by each school. Then using the sampling frame, children ifrom each class were selected using simple random sampling technique and proportional allocation to size of school age children in each school.

Data collection

Data were collected using pre and post tested structured questionnaires. Twenty four hour recall method was used to assess diet diversity. Weight and height scales for anthropometric measurements were measured. We used two different groups of well-trained data collectors (at baseline and at end line) to collect the data on KAP and Diet Diversity Score (DDS). Anthropometric measurements were taken by the principal investigator to control inter personal measurement errors.

Food and agriculture organization (FAO, 2014) tool was used to assess the dietary diversity of the participating children which includes the food group and specific food type consumed in the last 24-hr preceding the survey. The 12 food groups were cereals, vitamin A rich vegetables, other vegetables, vitamin A rich fruits, meats, eggs, fish, legumes, nuts and seeds, milk and dairy products, oils and fat, sweets. KAP assessments were conducted using face to face interview at the school setting at baseline and end line (after six months). Standardized techniques and calibrated equipment were used for anthropometric measurements (Cogill, 2003) and following the standard procedures (Gibson, 2005). Weight was measured using WHO weight scale (seca digital weight scale). The instruments were checked and adjusted to zero for each measurement. Height was measured shoes off using standing height board and WHO heights scale to the nearest 0.1cm.

During the six months intervention period, pulse nutrition education messages were conveyed to the sampled children in the intervention by 20 already assigned older peers from school club, who were trained for two days on nutrition education by the principal investigator and nutrition professionals. The trained peers were used as a vehicle to deliver nutrition education (but were not considered as study participants) to all selected school age children using various strategies: lesson education (including giving short pulse nutrition education), peer group discussion, pamphlets, posters& demonstration.

The key pulse nutrition messages included, but not limited to, food groups and diet diversification, benefits of pulses, pulse processing and preparation techniques (demonstration), cooking variety of pulse based dishes/recipes, proper hand washing and food handling and storage were given to participating children based on quick reference (IDRC, 2015). The TPB constructs were used to predict intentions to a given behaviour. These constructs are attitudes, subjective norm, and perceived behavioural control (as described in fig 1 above). The TPB constructs were used for the peer-led nutrition education sessions to gain knowledge and skills and bring behavioural changes on: susceptibility to malnutrition (macro-and micro-nutrient deficiencies), consequences of malnutrition (on health, growth & development), benefits of pulse consumption, nutritional and health benefit of pulses, benefits of pulse processing and preparation and increased requirement of nutrients, determinants of pulse consumption, processing and preparation and how (strategies, activities,) to use pulses, pulse-based food preparations/recipes, techniques to enhance the nutritional value of pulses. In addition, personal hygiene, proper hand washing during food preparation and handling were provided to enhance the knowledge, skills and self-efficacy of the subjects on appropriate pulse-based foods/recipes preparation and feeding practices.

Data analysis

Anthropometric indices of school age children: HAZ and BMI-for-age (BAZ) were computed using WHO Anthro Plus version 1.0.4 software. Body mass index (BMI) was calculated using the formula weight in kilogram divided by height in meter square. Nutritional status of school age children, stunting and wasting, was defined by Z-scores for HAZ and BAZ less than -2 standard deviations below median values. All other data were entered, cleaned and analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Continuous data were checked for normality using the Kolmogorov-Smirnov test. Comparison of outcome variables between the intervention and control groups was done using independent two samples t-test. Paired t-test was employed to see the difference between the pre and post-intervention effects. P-value of less than 0.05 was taken as significant. Descriptive statistics such as mean (SD), Z-score, percentage and graphs were used to display the findings of study.

KAP of pulse consumption and nutritional status of school aged children (BMI-for age Z-score (BAZ) and Height for age Z-score (HAZ) were considered as dependent variable, while the independent variables included in the study were age, sex, educational status, nutrition education, household pulses availability, pulses consumption and dietary diversity of school age children.

Ethical consideration

The Institution Review Board of Hawassa University approved the study. Ethical clearance was also found from local authorities after the study design and objectives were explained to officials of health and education department, and administration of Misrak Badiwacho woreda and other local authorities (schools) were informed about the study objectives for their permission and support. Explanation about anthropometric measurement procedures, the intervention (nutrition education) purpose and description of the benefits of the study were explained in order to obtain their verbal assent from study participants and consent from their parents. Confidentiality of the data obtained from participants were also strictly secured and maintained. And finally verbal assent obtained from school age children and consent was signed by their parents to confirm their children’s permission to be participant in the study.

4. Results

4.1 Socio-demographic Characteristics of the Study Subjects

A total of 202 school age children (101 in each group) participated in the study with response rate of 100%. At baseline, the mean (SD) age of subjects in completed years were 12.31(1.26) 12.32 (1.27) in the intervention and control schools respectively. There was a balanced representation of male and female participants in both groups. The distribution of the participants by grade level indicates that participants from grade 7 made up higher proportion (about 43 percent) compared to 35 and 22 percent for grade 5 and 6 respectively. More than 90 percent of the participants were Protestant Christians. The distribution of the participants by grade level, birth order and educational status indicates that there is no significant variation between the control and study participants (Table 1).

Table 1. Characteristics of the participants at elementary schools in Misrak Badiwacho Woreda, Hadiya zone, southern Ethiopia, 2016.

Characteristics		**IG (n=101)**		**CG (n=101)**		**X^2**	**P-Value**
		No	**%**	**No**	**%**		
Sex	Male	48	47.5	49	48.5	0.00	0.888
	Female	53	52.5	52	51.5		
Current highest grade (educational status)	Grade 5	22	21.8	23	22.8	0.00	1.00
	Grade 6	35	34.7	35	34.7		
	Grade 7	44	43.6	43	42.6		

IG = Intervention Group; CG = Control Group $X^{2=}$chi square

4.2 Effect of Nutrition Education Intervention on KAP of School Aged Children

Table 2 shows that at base line participants had relatively poor knowledge, attitude and practice, but after 6 month nutrition education, there was significant improvement in the intervention groups compared to the control groups.

Table 2. Percentage distribution of school aged children by KAP on pulse consumption at base line and end line in the intervention and control group, M*israk Badiwacho Woreda* schools ,2016

KAP		**Base line**		**End line**		**P-value**
		N	%	N	%	
Intervention group=101	Knowledgeable >70%	20	19.8	94	93.1	0.001
	Fairly knowledgeable50-70%	30	29.7	3	3	
	Note Knowledgeable<50%	51	50.5	4	4	
	Positives Attitude >70% of agreed	24	23.8	79	78.2	0.001
	Neutral Attitude >70 of neutral	32	31.7	15	14.9	
	Negative attitude>70% of Disagreed	45	44.6	7	6.9	
	Practicable	17	16.8	71	70.3	0.001
	Fairly Practicable	37	36.6	21	20.8	
	Not fairly Practicable	47	46.5	9	8.9	
	Knowledgeable >70%	22	21.8	24	3.8	0.854
Control Group n=101	Fairly knowledgeable 50-70%	32	31.7	30	29.7	
	Note Knowledgeable <50%	48	47.5	47	46.5	
	Positives Attitude >70% of agreed	24	23.8	26	25.7	0.854
	Neutral Attitude >70 of neutral	32	31.7	32	31.7	
	Negative attitude>70% of Dis agreed	45	44.6	45	44.6	
	Practicable	17	16.9	18	17.5	0.854
	Fairly Practicable	32	31.7	33	32.7	
	Not Practicable	52	51.5	50	49.5	

*Statistical significant at p<0.05

Further, the independent t-test confirmed that (Table 3) no significant differences were observed in mean scores of knowledge *(p=0.617)*, attitude *(p=0.730*) and practice *(p=0.371)* about pulse preparation and consumption between the intervention and control schools at the baseline assessment. In the post-intervention, the independent two samples t-test showed significant differences *(p<0.001) in* mean KAP scores of the children (Table 3).

Table 3. Independent two samples t-test for school age children's KAP on pulse preparation and consumption in elementary schools of *Misrak Badiwacho district*, *Hadiya* zone, Southern Ethiopia, 2016

Intervention period	**KAP**	**Mean (SD)**				
		IG	**CG**	***t (df)***	***p-value***	***95% CI***
Pre-intervention	Knowledge	4.03 (1.49)	4.18 (2.58)	-0.50 (200)	.617	(-0.73, 0.44)
	Attitude	4.06 (2.43)	4.14 (2.53)	-0.35 (200)	.730	(-0.81, 0.57)
	Practice	3.68 (2.64)	4.02 (1.19)	-0.90 (200)	.371	(-1.08, 0.40)
Post-intervention	Knowledge	9.04 (1.41)	4.30 (2.19)	18.36 (200)	<0.001	(4.20, 5.21)
	Attitude	7.87 (1.43)	4.10 (1.73)	16.92 (200)	<0.001	(3.30, 4.17)
	Practice	7.79 (2.07)	3.69 (2.54)	12.40 (200)	<0.001	(3.37, 4.65)

*Statistical significant at p<0.0

4.3 Anthropometric Measurements and Indices of School Age Children

The mean (SD) of weight (kg) and height (cm) of the children in the intervention schools were 45.28 kg (4.04) and 153.39 cm (4.60) at baseline and 47.48kg (3.87) and 154.40cm (4.67) at post-intervention respectively **(Figure 2**).The mean (SD) of anthropometric indices (BAZ and HAZ scores) of school age children in the intervention schools at baseline measurement were -0.46 (0.88) and -1.28 (0.68) respectively and -0.25 (0.81) and -1.20 (0.65)after six months of intervention, respectively.

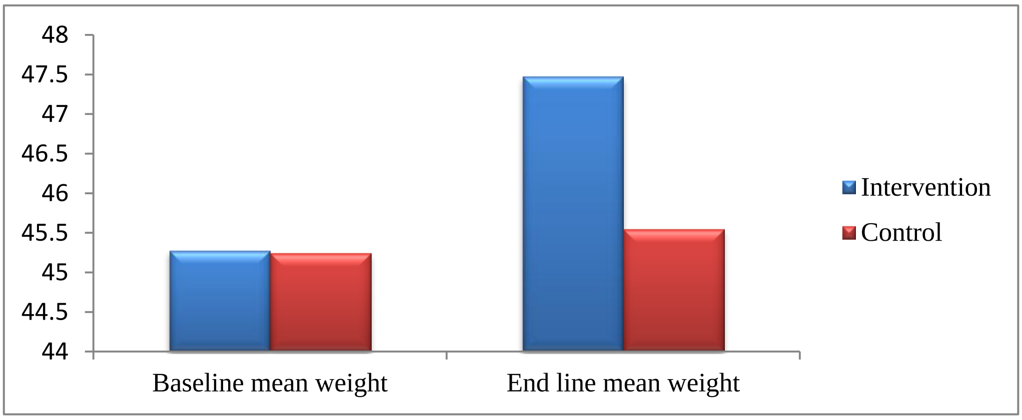

Figure 2. Comparison of mean weight gain of school age children between the schools

4.4 School Age Children's Nutritional Status

Nutritional status of the two groups was compared using BMI (Table 4). At baseline the prevalence of thinness/wasting (body mass index for age z-score, BAZ), was 16.8% and 11.9% in the intervention and control schools respectively. After six months of intervention, the prevalence of thinness was significantly (P<0.001) reduced to 5.0% in the intervention but not in the control schools. The prevalence of stunting (height for age z-score, HAZ) in the intervention and control schools was 22.8% and 20.8% respectively. In the post intervention, there was no significant difference (p>0.05) in prevalence of stunting in both schools (Table 4).

Table 4. Frequency distribution of school age children's nutritional status in the intervention and control schools prior and after the intervention in *Misrak BadiwachoWoreda, Hadiya zone*, southern Ethiopia, 2016

Indices	**Indicator***	**Study period**	**Study group**	
			Intervention (n=101) N (%)	**Control (n=101) N (%)**
BAZ	**> -2SD &< +2SD**	Baseline	84 (83.2)	89 (88.1)
		End line	96 (95.0)	91 (90.1)
	< -2SD	Baseline	17 (16.8)	12 (11.9)
		End line	5 (5.0)	10 (9.9)
	> -2SD &< +2SD	Baseline	78 (77.2)	80 (79.2)
HAZ		End line	83 (82.2)	78 (72.2)
	< -2SD	Baseline	23 (22.8)	21 (20.8)
		End line	18 (17.8)	23 (27.8)

BAZ= Body Mass Index for Age Z-score; HAZ = Height for Age Z-score.

*The classifications are based on WHO growth charts for boys and girls (WHO, 2007).

4.5 Comparison of Nutritional Status of School Age Children between the Groups

There was no significant differences in nutritional status; BAZ (*p=0.774*) and HAZ (*p=0.516*) of school age children between the intervention and control schools at the baseline assessment. In the post-intervention the independent two samples t-test showed significant (*p=0.01*) differences only in BAZ mean score of school age children between intervention and control schools .But there was no significant difference in mean HAZ score of the children after intervention as shown in Table 5.

Table 5. Independent t-test two samples t-test for anthropometric indices of school aged children, Misrak Badiwacho Woreda, Hadiya zone, southern Ethiopia, 2016

		Mean (SD)				
Period	**Anthro-indices**	**Intervention**	**Control**	***t* (df)**	***P-value***	**95%CI**
At baseline	**BAZ**	-0.46 (0.88)	-0.48 (0.93)	0.29 (200)	.774	(-0.21, 0.29)
	HAZ	-1.28 (0.68)	-1.22 (0.71)	-0.65 (200)	.516	(-0.26, 0.13)
At six months	**BAZ**	-0.25 (0.81)	-0.55 (0.86)	2.61 (200)	0.001*	(0.75, 0.54)
	HAZ	-1.20 (0.65)	-1.26 (0.67)	0.75 (200)	.520	(-0.12, 0.24)

*Statistical significant difference at P<0.05

5. Discussion

The current study demonstrated significant changes in mean knowledge, attitude and practices scores of school age children about household pulse preparation and consumption, DDS, mean weight gain and BAZ score of children after the six months peer-led pulse nutrition education intervention. The mean KAP scores in the intervention group are consistent with a study reported from southern Ethiopia which indicated that after six months of pulse nutrition education, the mean knowledge, attitude and practice score of mothers on pulse-incorporated complementary feeding was significantly (p<0.05) improved from 1.09 to 9.46, 2.09 to 9.41 and 1.31 to 7.60 respectively (Mulalem, et al., 2016). In another study, fruit and vegetable consumption, created positive attitude toward healthy foods and may improve academic outcome (Silveira, et al., 2011; Wall, et al., 2012).

A local study conducted in a district in southern Ethiopia indicated that pulse nutrition education was effective in bringing positive changes on the KAP of women at reproductive age towards household preparation and consumption of pulses (Yetnayet, 2015). Though there was significant increment in mean KAP scores, these figures were lower than the findings of the current study. One of the reasons may be due to unequal KAP questions responded by study participants, differences in study subject's age and difference in some socio demographic profiles. The improvement in mean KAP scores of school age children in this study is also comparable with the study conducted by Walsh and his colleagues in the Free State and Northern Cape which indicated that in contrast to control areas, knowledge of what to eat significantly improved by between 42.2% and 52.6% in rural intervention areas (Walsh, et al., 2003). Other studies (Fikru, 2014) conducted in South East Oromiya, Ethiopia on randomly selected adolescents reported that mean pulse consumption was significantly improved from 5.29 (4.3) at baseline to 12.44 (4.8) after six months of pulse nutrition education in the intervention group. Other studies such as Shahid*et.al* (Shahid, et al., 2009) also reported the same results.

It was also observed that the mean DDS was significantly (p<0.001) improved in the intervention school following the six months education intervention. But change in mean body weight of control school's children after six month was not statistically significant. In addition, the change in mean height after six months of intervention was not statistically significant in both study groups mainly because of the short term observation period. These findings are not different from previous studies as none of these similar studies demonstrated significant improvement in mean height gain at the end of the pulse nutrition education intervention. Had the nutrition education interventions been conducted for a longer period of time, the effects on the mean height would have been different. For instance, a study in Peru documented significant differences in both mean weight and height gain between the intervention and control group after 18-month of nutrition education (Penny, et al., 2005). Another study done by Shi *et al* (Shi, et al., 2009) also showed significant differences in both mean weight and height gain between the intervention and control group at the end of the intervention.

This interventional study demonstrated significant reduction in the prevalence of wasting/thinness in the intervention schools, but the improvement was not significant in control schools. However, the prevalence of stunting did not show any statistically significant change in both study schools. The result of the present study is consistent with the findings of the study conducted in southern Ethiopia which concluded that provision of pulse based nutrition education to mothers could improve the weight for height and weight for age z-scores of their children (Tariku, et al., 2015). Another study conducted in *Wolayita* zone, southern Ethiopia, the mean (SD) weight for age and weight for height Z-scores of young children were significantly higher in the intervention group compared to those in the control group. The study did not find significant difference in mean (SD) height for age Z-score between the two groups at the end of the pulse nutrition education intervention (Mulalem, et al., 2016).

The current result for body mass index for age (BAZ, wasting) was consistent with nutrition education conducted on Iranian nomadic children. The study showed significant differences between the intervention and control group on WAZ, WHZ and HAZ after 12-month nutrition education (Salehi, et al., 2004). A study conducted in Pakistan documented that the mean (SD) weight for age and weight for height Z-scores of children were significantly higher in the intervention group compared to those in the control group. There was no significant difference in mean (SD) height for age Z-score between the two groups at the end of the nutrition education intervention (Liaqat, et al., 2007). This might be stunting (height for age Z-score) is a linear growth which is a consequence of long-term nutritional deficiencies in the early life of children. Therefore, stunting might not be improved by such short-term pulse nutrition education intervention.

Finally, some of the limitations of this study need to be considered when interpreting the results discussed above. Ideally, the sample sizes per study group (project and country) would have been larger, to increase precision and generalization to a larger population. As the study has mainly focused on pulse based education, its generalizability to other crops may be limited. It’s cross sectional nature and presence of some omission and commission errors might also be other limitations of the current study.

5. Conclusion

This study examined the effects of peer led nutrition education on consumption of pulses, DDS and nutritional status based on theory of planned behavior among school age children. The findings suggest that a well-designed peer education provides substantial impact and opportunities to influence pulse consumption, dietary diversification and improve dietary intake at individual levels. This implies that schools can become a very promising venture to change KAP of children with regards to adoption of nutrient-enriched food varieties (such as pulse), and subsequent improvements in nutritional and health status over the generations.

Authors Contributions

CH, HH and FD designed the study. FD implemented field data collection, analysed and interpreted results and prepared draft manuscript. CH and HH supervised implementation of the field work, and critically reviewed manuscript. NR assisted in data analysis and reviewed the manuscript. All authors approved the final draft.

Acknowledgement

The authors would like to thank the Canadian International Food security Research Fund through the International Development Research Centre (IDRC) and the Global Affairs Canada, Government of Canada, for the financial support for the project.

Conflict of interest

The authors declare no conflict of interest.

References

Abebe, Y, Barbara, J. S., Margaret, J. H., & Gail, G. E. (2006). Nutritive value and sensory acceptability of corn- and Kocho-based foods supplemented with legumes for infant feeding in southern Ethiopia. *AJFAND, 6*, 1-19.

Ajzen, I. (1991). Theory of planned behavior. *Organizational Behavior and Social Human Decision Processes, 50*, 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Best, C., Neufingerl, N., Van Geel, L., Van Den Briel, T., & Osendarp, S. (2010). The nutritional status of school-aged children: why should we care? *Pub Med., 3*, 400-417. https://doi.org/10.1177/156482651003100303

Bhandari, N., Mazumder, S., Bahl, R., Martines, J., Black, R. E., & Bhan, M. K. (2004). An Educational Intervention to Promote Appropriate Complementary Feeding Practices and Physical Growth in Infants and Young Children in Rural Haryana, *India. Journal of Nutrition*, 2342-2348.

Bhutta, A. Z., Das, K. D., Rizvi, A., Gaffey, F. M., Walker, N., Horton, S., ... Black, E. R. (2013). Evidence-based interventions for improvment of maternal and child nutrition: what can be done and at what cost? http://dx.doi.org/10.1016

Blake, J. (1999). Overcoming the ‘value-action gap’ in environmental policy: Tensions between national policy and local experience. *Int. J. Justice Sustain, 4*, 257-278. https://doi.org/10.1080/13549839908725599

Cocharan, W. G. (1977). Sampling techniques. New York: Wiley Publishing.

Cogill, B. (2003). Anthropometric Indicators Measurement Guide.Food and Nutrition Technical Assistance

Project, Academy for Educational Development, Washington.

Contento, I. R. (2011). Nutrition education: linking research, theory and practice. 2nd ed. Sudbury, MA, USA: Jones and Bartlett.

CSA (Central Statistical Agency) (2007). Population and Census of Ethiopia. Addis Ababa, Ethiopia.

Dilis Vardis & Antonia Trichopoulou (2009). Nutritional and health properties of pulses *Mediterr J NutrMetab, 1*, 149-157. https://doi.org/10.1007/s12349-008-0023-2

FAO (Food and Agriculture Organization) of the United Nations 2014 Guidelines for assessing nutrition-related Knowledge, Attitudes and Practices manual. Rome.

FAO. (2011). Guidelines for measuring household and individual dietary diversity, by G. Kennedy, T. Ballard & M.C. Dop. Rome.

Fikru, S. (2014). Effect of nutrition education on perceived barriers of pulse processing and Consumption by Households. Msc.Thesis HawassaUniveristy, College of Agriculture, Hawassa.

Fila, S., & Smith, C. (2006). Applying the theory of planned behavior to healthy eating behaviors in urban native American youth. *International journal of behavioral nutrition and physical activity, 3*(11).

Gibson, R. S. (2005). *Principles of Nutritional Assessment 2ed.* Oxford University press. 273-293.

Green, L. W., & Kreuter, M. W. (1991). *Health Promotion Planning: Educational and Environmental Approach*. (2nd Edition). Mountain View, Calif.: Mayfield.

Guldan, G. S., Fan, H., Ma, X., Ni, Z., Xiang, X., & Tang, M. (2000). Culturally appropriate nutrition education improves infant feeding and growth in rural Sichuan, *China. Journal of Nutrition, 130*, 1204-1211. https://doi.org/10.1093/jn/130.5.1204

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *J. Environ. Educ.*, *18*, 1-8. https://doi.org/10.1080/00958964.1987.9943482

International Development research center (IDRC) (2015). “Pulse consumption for improved nutrition” Manual for training community leaders, Hawassa University and University of Saskatchewan. Canada.

Kalanda, B. F., Verhoeff, F. H., & Brabin, B. J. (2006). Breast and complementary feeding practices in relation to morbidity and growth in Malawian infants. *Eur. J. Clin. Nutr., 60*, 401-407. https://doi.org/10.1038/sj.ejcn.1602330

Kebebu, A., Whiting, J, S., & Henry, J., C. (2013). Formulation of a complementary food fortified with broad beans (vicia faba) in Southern Ethiopia. *African Journal of Food, Agriculture, Nutrition and Development, 13*(3), 7789-7803.

Liaqat, P., Rizvi, M. A., Qayyum, A., & Ahmed, H. (2007). Association between complementary feeding practice and mothers’ education status in Islamabad.*J Hum Nutr diet, 20*, 340-344. https://doi.org/10.1111/j.1365-277X.2007.00791.x

Ling, S., & Jingxu, Z. (2010). Recent evidence of the effectiveness of educational interventions for improving complementary feeding practices in developing countries. Journal of *Trop Pediatr*.

Mulalem, D., Henry C., Berhanu G., & Whiting, J, S. (2016). The Effectiveness of Nutrition Education: Applying the Health Belief Model in Child-Feeding Practices to Use Pulses for Complementary Feeding in Southern Ethiopia. *Ecology of Food and Nutrition.*

Negash, C., Belachew, T., Henry, C., Kebebu, A., Abegaz, K., & Whiting, S. (2014). Nutrition education and introduction of broad bean-based complementary food improves knowledge and dietary practices of caregivers and nutritional status of their young children in Hula, Ethiopia. *Food and Nutrition Bulletin, 35*(4), 480-486. https://doi.org/10.1177/156482651403500409

Ofuya, Z. M., & Akhidue, V. (2005). The Role of Pulses in Human Nutrition: A Review. *J. Appl. Sci. Environ. Mgt., 9*(3), 99-104.

Penny, M. E., Creed-Kanashiro, H. M., Robert, R. C., Narro, M. R., Caulfield, L. E., & Black, R. E. (2005). Effectiveness of an educational intervention delivered through the health services to improve nutrition in young children: a cluster-randomized control trial. *Lancet, 365*(9474), 1863-72. https://doi.org/10.1016/S0140-6736(05)66426-4

Ritchie, J. R. (2003). Bicultural Development within an Early Childhood Teacher Education Programme. *International Journal of Early Years Education*, *11*(1), 43-5. https://doi.org/10.1080/0966976032000066082

Salehi, M., Kimiagar, S. M., Shahbazi, M., Mehrabi, Y., & Kolahi, A. A. (2004). Assessing the impact of nutrition education on growth indices of Iranian nomadic children: an application of a modified beliefs, attitudes, subjective-norms and enabling-factors model. *Br. J. Nutr., 91*, 779-787. https://doi.org/10.1079/BJN20041099

Sethi, V., Kashyap, S., & Seth, V. (2003). Effect of nutrition education of mothers on infant feeding practices.*Indian Journal of Pediatric, 70*(6), 463-466. https://doi.org/10.1007/BF02723133

Shahid, A., Siddiqui, F. R., Bhatti, M. A., Ahmed, M., & Khan, M. W. (2009). Assessment of Nutritional Status of Adolescent College Girls at Rawalpindi. *ANNALS*, *15*(1).

Shi, L., Zhang, J., Wang, Y., Caulfield, L. E., &Guyer, B. (2009). Effectiveness of an educational intervention on complementary feeding practices and growth in rural China: a cluster randomised controlled trial. *Public Health Nutr.*, *13*(4), 556-565. https://doi.org/10.1017/S1368980009991364

Silveira, J., Taddei, J., Guerra, P., & Nobre, M. (2011). Effectiveness of school based nutrition education interventions to prevent and reduce excessive weight gain in children and adolescents: a systematic review. *Jornal De Pediatria [serialonline]*. *September, 87*(5), 382-392.

Sintayehu, D., & Worku, T. (2011). A baseline survey report of selected rural kebeles in the SNNPR, Improving food security in highlands of Ethiopia through improved and sustainable agricultural productivity and human nutrition: 13-16.

Stern, P., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Hum. Ecol. Rev.*, *6*, 81-97.

Tamil Nadu Agricultural University. (2000). Pulses production strategy in Tamil Nadu.

Tariku, B., Whiting, S. J., Mulualem, D., & Sing, P. (2015). Application of the health belief model to teach complementary feeding messages in Ethiopia. *Ecology of food and nutrition, 54*(5), 572-582. https://doi.org/10.1080/03670244.2015.1049344

Temesgen, B., Birhanu, Z., Astale, T., & Dejene, T. (2013). Predictors of intended infant feeding options among HIV positive pregnant women in Addis Ababa: The perspective of theory of planned behavior. *Journal of AIDS and HIV Research, 5*(7), 260-268.

U.S. (2005). Department of Health and Human Services & National Institute of Health. Theory at a Glance: A guide for health promotion practice, 2nd ed. NIH publication.

Wall, D. E., Least, C., Gromis, J., & Lohse, B. (2012). Nutrition education intervention improves vegetable-related attitude, self-efficacy, preference, and knowledge of fourth-grade students. *J Sch Health, 82*, 37-43. https://doi.org/10.1111/j.1746-1561.2011.00665.x

Walsh, C. M., Dannhauser, A., & Joubert, G. (2003). Impact of a nutrition education program me on nutrition knowledge and dietary practices of lower socioeconomic communities in the Free State and Northern Cape. *SAJCN, 16*(3), 89-95

Yetnayet, M. (2015). Effects of Nutrition Education for Promoting House Hold Utilization of Pulses among Women of Reproductive Age. Msc. Thesis, Msc. Thesis Hawassa Univeristy, College of Agriculture, Hawassa, Ethiopia.

Zoellner, J., Estabrooks, P., Davy, B., Chen, Y., & You, W. (2012). Exploring the theory of planned behavior to explain sugar-sweetened beverage consumption.*Journal of nutrition education and behavior, 44*(2), 172-177. https://doi.org/10.1016/j.jneb.2011.06.010

Annex: Sample size determination formula

$$n = \left[\left(\frac{\sigma}{\Delta}\right)^2 \left(Z_{\alpha/2} + Z_{\beta}\right)^2\right] + 0.25\left(Z_{\alpha/2}\right)^2$$

$$Where; \quad \begin{array}{l} n = Sample\ size\ in\ each\ group \\ Z_{\alpha/2} = 1.96\ for\ 95\%\ confidence\ level \\ Z_{\beta} = 0.84\ for\ 80\%\ power \\ \sigma = SD\ for\ pulse\ consumption\ (1.36) \\ \Delta = Expected\ change\ (0.4) => effect\ size = \frac{\Delta}{SD} \end{array}$$

Sample size calculation for each group using the above formula:

$$\boldsymbol{n} = \left[\left(\frac{1.36}{0.4}\right)^2 (1.96 + 0.84)^2\right] + 0.25(1.96)^2 = \mathbf{91.6}$$

$$10\%\ \text{loss to follow up};\ n = 91.6 * 10\% = 9.16$$

$$n = 91.6 + 9.16 \approx \mathbf{101}$$

The final sample size for both the study and control group is 101 each (total sample size= 202)