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An Integrated Education Intervention Improves the Feeding Frequency of Infants and Young Children in the Upper Manya Krobo District of Ghana

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ABSTRACT

Childhood malnutrition is partly due to inappropriate complementary feeding (CF) practices. The effect of two education interventions on young child feeding practices was evaluated in the Upper Manya Krobo district of Ghana. A total of 32 child growth monitoring centers were randomly assigned to either of two intervention groups [integrated nutrition and agriculture education (IE) or nutrition education (NE)], or the control (CT) group. Over six months, mothers of children 6-24 months old in both intervention groups received monthly nutrition education delivered by community health volunteers; additionally, mothers in the IE group received agricultural education from extension agents. Information on complementary feeding practices and dietary intakes of study children were collected at baseline and at three-month intervals for nine months. Intention-to-treat analysis was complemented by a sub-sample analysis to determine the effect of attendance to education sessions on outcomes. At the end of the study, children in the IE were twice as likely to meet the minimum meal frequency compared to the CT children (aOR = 2.62; 95% CI; 1.11, 6.16), but energy, calcium, and iron intakes from complementary foods did not differ between the three groups. Additionally, children of mothers who attended at least one nutrition education session in the IE group tended to receive the minimum acceptable diet (aOR = 2.30, 95% CI; 0.98, 5.39, $p = 0.055$) compared to children in the CT group at the end of the study. Compliance to the intervention was low, with almost half of intervention mothers (45%) never attending an education session. A combined agriculture and nutrition education led to improved meal frequency among young children in the Upper Manya Krobo district of Ghana. Thus, this is one of the strategies that can be used to address sub-optimal complementary feeding practices in rural areas, where farming is a major source of employment.

Keywords: Complementary Feeding Practices, Nutrition Education, Community Health Volunteers, Ghana

Introduction

The prevalence of childhood malnutrition is high in Ghana, and is partly attributed to inappropriate complementary feeding (CF) practices such as feeding of low diverse meals, and inadequate nutrient intakes among young children (Ghana Statistical Service *et al.*, 2015; Nti & Lartey, 2007). The 2014 Demographic and Health survey indicated that based on a summary indicator using the consumption of breast milk, other

milks or milk products, minimum feeding frequency, and minimum diet diversity, only 13% of Ghanaian children aged 6-23 months met the minimum standard of being appropriately fed (Ghana Statistical Service *et al.*, 2015). The above-mentioned report also indicated that the Eastern region recorded the least proportion of children (29.6%) who met the minimum meal frequency.

Nutrition education interventions have been used to address sub-optimal practices such as inadequate feeding frequency and malnutrition in some developing countries. In environments where food availability is not a limiting factor, educational interventions have reportedly improved CF practices and young child growth (Dewey & Adu-Afarwaha, 2008; Guldán *et al.*, 2000; Penny *et al.*, 2005), suggesting that poor feeding practices and malnutrition may be the result of caregivers' lack of knowledge of recommended practices or beliefs about certain foods, and not the lack of food. However, in environments where food accessibility is scarce, approaches to reduce childhood malnutrition may need to include also strategies that are aimed at improving caregivers' ability to access foods at the household level. Improving household food production can lead to food availability and consumption by increasing the quantity and quality of food and/or increase income through the sale of agricultural products, thus increasing the ability of household to purchase food. A review of the effectiveness of agriculture interventions in improving nutrition outcomes concluded that interventions that were combined with other strategies such as nutrition education were likely to have positive effects on the nutritional status of young children (Berti, *et al.*, 2004). Thus, in communities where the economy is agricultural-based, combining strategies that aim at improving both agricultural production and caregivers' nutrition knowledge could lead to improved CF practices and infants and young children's nutrient intakes.

Health care providers have been used extensively in recent studies as channels of nutrition education (Bhandari *et al.*, 2004; Penny *et al.*, 2005; Santos *et al.*, 2001). In most of these studies, health services were easily available to caregivers of young children. Studies that have looked at the effects of educational interventions in areas where accessibility to health care was poor are few, and the researchers generally used specially trained fieldworkers to deliver the intervention (Kilaru *et al.*, 2005; Roy *et al.*, 2005). One consequence of this particular approach is that more financial input is needed to sustain the intervention after the project period. The use of existing health and agricultural services may be a sustainable way

of addressing childhood malnutrition, particularly in areas where agriculture forms the basis of the economy.

Studies that explored the use of education to address the feeding of children aged 6 to 24 months are limited in Ghana. In this study, an integrated approach involving nutrition and agricultural education delivered by community health volunteers and agricultural extension agents was used to address sub-optimal CF in rural Ghana. The objective of this study was to determine the effect of the intervention on CF practices and nutrient intakes of children 6-23 months. A second intervention group was included to assess the effects of the integrated education compared to having only nutrition education.

Methods

Study design and participants

The cluster-randomized controlled trial took place in three sub-districts of the Upper Manya Krobo district of Ghana, where 85% of the communities are rural (Nubians Renewal Organization, 2010). The three sub-districts were served by the staff of two Community-based Health Planning and Services (CHPS) compounds and two sub-district health clinics. Monthly community-based child welfare clinics (CWC) were organised by the community health nurses who were assisted by community health volunteers (CHV). Child welfare clinic centers were included in the study if there was an active CHV. Thirty-two CWC were stratified by average monthly attendance, and then a simple random sampling method was used to assign them to two intervention groups [integrated education (IE) or nutrition education (NE)] or the control (CT) group. All infants aged 6 to 11 months old with no major birth defects, living in the study area, and attending child monthly welfare clinics were eligible for the study.

Preliminary data analysis of an earlier study in the district showed that iron was the least adequate micronutrient among infants in the area (RIING Project, unpublished results). Therefore, dietary iron intake was used in determining the sample size for this study. Assuming an effect

size of 1.2 mg (Hotz & Gibson, 2005) in the mean intake of infants between the intervention and control groups and a standard deviation of 2.4 mg (Santos *et al.*, 2001), 63 mother-infant pairs were needed per group at statistical power of 80% and significance level of 0.05 (Hulley *et al.*, 2007) for two-sided hypothesis. Adjusting for cluster effect by multiplying by 1.5 (Roy *et al.*, 2005) and then accounting for a drop-out rate of 20% for follow up, the sample size needed per group was 120 mother-child pairs, making a total of 360 mother-child pairs.

Procedures

To develop the intervention, formative research was conducted in the study area to assess existing CF practices and challenges to CF education. This included interviewing community health workers and staff of the Ministry of Food and Agriculture (MOFA), focus group discussions involving mothers and grandmothers of young children, and testing potential education messages among target mothers using the trials of improved practices (TIPS) method. Based on the results of the formative research, a nutrition education training manual (Colecraft, 2008) was modified and used by community health volunteers to educate caregivers of children 6 to 24 months of age at the intervention centers. Three agricultural topics were selected in consultation with the local agricultural workers for the agricultural education component of the intervention, and delivered by two agricultural extension agents at the IE centers. Group education sessions took place monthly during CWC sessions and were delivered to all mothers who attended the clinic. Each intervention center received nutrition education for at least six months, and IE centers received additional education sessions in agriculture (six sessions). Three project education evaluators assessed the education sessions and attributed scores for recording attendance, style of teaching (interactive or not), mothers' level of interest and content of lessons. Caregivers in the control group received the standard GHS care. This involved education delivered by the community health nurses on malaria prevention, family planning, and child feeding. These topics were addressed

alternatively, so that caregivers on the average received information on child feeding at three-month intervals.

Each mother-child pair was visited by fieldworkers at baseline, then at three, six, and nine months after recruitment. The primary outcome variables that were measured during the study period were children's nutrient intakes (energy, iron, vitamin A, and calcium) and feeding practices (diet diversity and feeding frequency) using a single 24-hour recall and a food frequency questionnaire. Other forms of data collected using structured questionnaires were child morbidity (maternal recall of symptoms seven days prior to interview), and household characteristics. All questionnaires were translated into the local languages and translations were agreed upon for consistency. Seven local young women with secondary level of education were recruited and trained to administer the questionnaires.

Dietary data were converted to energy and nutrients using a database which was prepared from a combination of nutrient database (RIING Project, unpublished results). Information collected using the food frequency questionnaire was used to develop a dietary diversity score based on the seven food groups used in the WHO indicators for assessing infant and young child feeding practices (WHO, 2008; 2010).

Ethics approval

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the McGill University Research Ethics Board, the Noguchi Memorial Institute for Medical Research Institutional Review Board, and Ghana Health Service Review Board before the fieldwork began. Informed consent by signature or thumb-print was obtained from all mothers who gave consent also for the participation of their children.

Statistical analyses

The time points reported in the results (baseline, 6 months, 9 months) do not correspond to the age of the study children, but rather reflect the period (months) of being in the study. Analysis was by intention-to-treat. Analysis of variance (ANOVA) or Kruskal Wallis tests were used to compare continuous variables of the three groups, and the Pearson's chi square test was used for categorical variables (time point analysis). Generalized estimating equations (GEE) were used to investigate changes over time. To determine the effect of the intervention on CF practices and nutrient intakes, STATA software (StataCorp, 2009) was used to conduct multiple linear and logistic regressions, controlling for biological (child's sex and age, maternal age) and socio-demographic characteristics (maternal education, house ownership, type of settlement, possession of basic amenities), baseline values, and intra-cluster correlation.

Results

A total of 367 mother-child pairs, consisting of 123 IE, 122 NE, and 122 CT were recruited at baseline. Of these, 210 participants completed the nine months follow up (Figure 1). The main reasons for loss to follow up were families moving out of the study area, not locating participants at visit time points and ending the study before participants completed nine months. Study children in the three groups did not differ in age, but a greater proportion of the children in the integrated education group were males compared to the control group at baseline (Table 1). Attendance to education sessions was very low among participants, with 45% of mothers never attending an education session. Additionally, attendance to nutrition education sessions in the IE group was higher compared to the NE group (% attendance¹: IE = 70%, NE = 40%; $p < 0.0001$).

¹ Percentage of mothers who attended at least one nutrition education session.

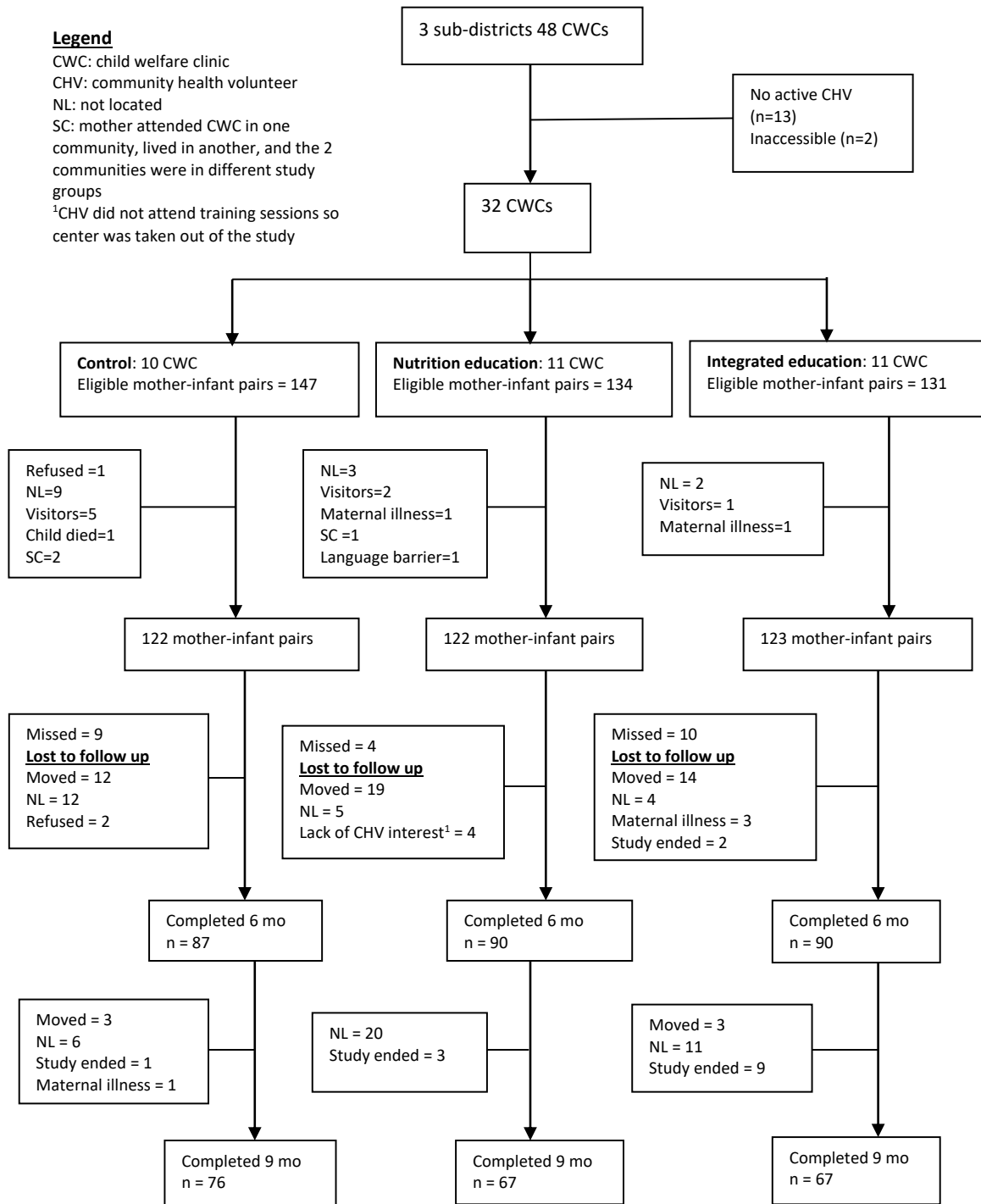


Fig. 1: Flow chart of study participants

Table 1: Baseline characteristics of study children and their households in the Eastern region of Ghana^{1,2}

	Treatment ³						p-value
	Integrated education n = 123		Nutrition education n = 122		Control n = 122		
Child							
Sex (% male)	75	(61.0) ^a	64	(52.5) ^{a,b}	55	(45.1) ^b	0.045
Age (months)	7.5 ±	1.5	7.5 ±	1.6	7.7 ±	1.5	0.303
Maternal							
Age (y)	26.2 ±	6.6	27.3 ±	7.3	27.0 ±	6.4	0.463
Formal education (y)	4.6 ±	3.4 ^a	4.8 ±	3.6 ^{a,b}	5.7 ±	4.1 ^b	0.038
Main economic activity							
Unemployed	9	(7.3)	13	(10.7)	9	(7.4)	0.175
Farming	52	(42.3)	61	(50.0)	50	(41.0)	
Trading	51	(41.5)	41	(33.6)	44	(36.1)	
Hairdressing/seamstress	9	(7.3)	7	(5.7)	14	(11.5)	
Other ⁵	2	(2.4)	0	(0)	5	(4.1)	
BMI (kg/m ²)	22.1 ±	3.6	22.2 ±	2.9	22.8 ±	3.7	0.308
Household							
Home ownership	40	(34.2) ^a	50	(41.0) ^a	33	(27.1) ^b	<0.0001
Amenities score⁶							
High	9	(7.3) ^a	29	(23.8) ^b	68	(55.7) ^c	<0.0001
Low	114	(92.7)	93	(76.2)	54	(44.3)	

¹Results presented as mean ± standard deviation or n (%). Groups were compared using analysis of variance, Kruskal-Wallis or Pearson's chi square test; ²Mean ± SD or n (%) on the same row with different superscript letters are significantly different, p < 0.017 (pair-wise Mann-Whitney or chi square test with Bonferroni correction); ³Integrated education received monthly nutrition and agricultural education; Nutrition education received monthly nutrition education. all groups received standard care by Ghana Health Service; ⁴Sample for analyses: control (117), nutrition education (120) and integrated education (122); ⁵Includes teachers (n = 3), police (n = 1), banker (n = 1), cook (n = 1) and student (n = 1); ⁶A proxy indicator of household's possession, based on housing materials (wall and roof), source of drinking water, light and type of toilet facility. Scores 0 – 3 = low amenities, 4 – 5 = high amenities.

Children in the IE group were four times more likely to consume flesh foods (fish, meat, poultry, sausage) compared to the NE group (aOR = 4.14, 95% CI: 1.35, 12.75) at the end of the study, but the odds of consuming flesh foods did not differ between children of the IE and CT groups (aOR = 1.85, 95% CI: 0.42, 8.21). The complementary feeding practices of the study participants over the study period are shown in Figures 2, 3, and 4. In the bivariate analysis, CF practices did not differ between the interventions and control groups. After controlling for amenities, demographic factors, and cluster effect, IE children were twice as likely to have met the minimum meal frequency² compared to the CT children (aOR =

2.62; 95% CI; 1.11, 6.16) at the end of the study. The diversity of the children's diet increased over the study period (effect of time: p = 0.006). At nine months, IE and CT children were about six (aOR = 6.46, 95% CI: 1.71, 23.39) and three (aOR = 3.19; 95% CI; 1.05, 9.71) times respectively, more likely to have received foods from at least four food groups the previous seven days compared to children in the NE group. However, the likelihood of meeting the minimum diet diversity did not differ between the IE and CT groups (aOR = 2.02, 95% CI: 0.40, 10.16). Less than half of the children (40%) received minimum acceptable diet³ at baseline. The proportion of IE children who received minimum acceptable diet

² This refers to the proportion of children 6-23 months of age who received solids, semi-solids or soft foods the minimum number of times or more during the previous day.

³ This is the proportion of children 6-23 month of age who had at least minimum diet diversity and minimum meal frequency the previous day.

increased over the study period (time*group effect: $p = 0.034$) compared to NE and CT children. Additionally, children of mothers who attended at least one nutrition education session in the IE group tended to receive the

minimum acceptable diet (aOR = 2.30, 95% CI; 0.98, 5.39, $p = 0.055$) compared to children in the CT group at the end of the study.

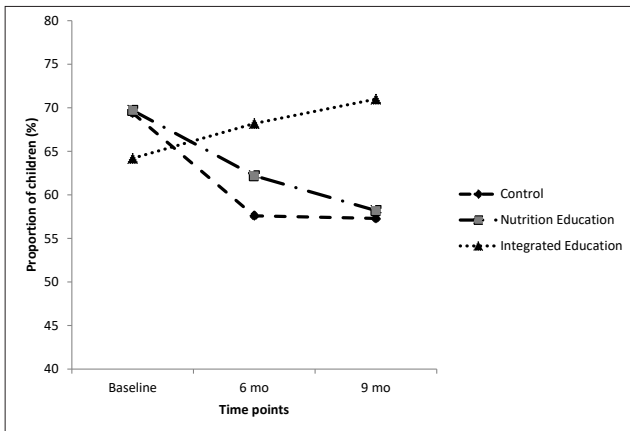


Fig. 2: The proportion of children aged 6-24 months in Upper Manya Krobo district who received the minimum meal frequency over the study period

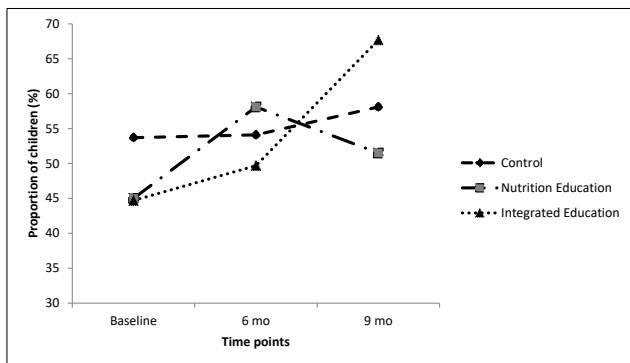


Fig. 3: The proportion of children aged 6-24 months in Upper Manya Krobo district who received the minimum diet diversity over the study period

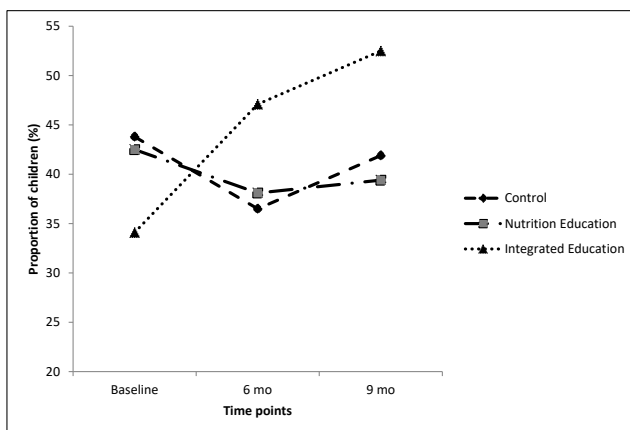


Fig. 4: The proportion of children aged 6-24 months in Upper Manya Krobo district who received the minimum acceptable diet over the study period

Table 2: Energy and nutrient intakes of children aged 6-24 months in the Upper Manya Krobo district of Ghana at the end of study¹

	Treatment ²			p-value ³
	Control	Nutrition education	Integrated education	
Mean intakes				
Energy	679 ± 39	650 ± 40	691 ± 50	0.794
Calcium	374 ± 29	372 ± 40	440 ± 36	0.305
Iron	9.1 ± 0.5	8.4 ± 0.6	9.0 ± 0.7	0.696
Proportion meeting recommendations ¹				
Energy	45 (59.2)	35 (53.8)	33 (53.2)	0.732
Calcium	57 (75.0)	41 (63.1)	48 (77.4)	0.149
Iron	59 (77.6)	40 (61.5)	43 (69.4)	0.115

¹Intakes are based on a single 24-hour dietary recall and intakes were compared to WHO recommended energy and nutrient intakes from complementary foods, assuming average breast milk intake. Results are presented as mean ± standard error of mean or n (%); ²Integrated education centers received monthly nutrition and agricultural education; nutrition education centers received monthly nutrition education. All groups received standard care by Ghana Health Service; ³Based on analysis of variance (ANOVA) test or Pearson's Chi Square test

Energy, calcium, and iron intakes from complementary foods were similar in the three groups at the end of the study period (Table 2). The proportion of children who met age-specific recommended energy intake from complementary foods decreased over the study period (time effect: $p < 0.0001$), while proportion of those who met iron and calcium increased over the same period.

Discussion

In this study, an educational approach that involved two existing government agencies (GHS and MOFA) was used to address complementary feeding in rural areas. Delivering the intervention through existing services was to ensure that the program could be sustained after the completion of the study at a minimum cost. The study thus increased the use of community health volunteers, who were already involved in infants and young child growth monitoring activities in the district.

The combined agriculture and nutrition education intervention led to slight improvement in some recommended feeding practices. Studies that have looked at the effect of educational interventions on WHO's recently developed infant and young child feeding indicators (WHO,

2008) are scarce. One non-randomised study in India that used locally trained counsellors to deliver monthly nutrition education to caregivers reported improved diet diversity (received at least 5 food groups: 42% vs 19%; $p = 0.01$) among intervention infants aged 11 months (Kilaru *et al.*, 2005). A higher proportion of intervention infants 7-11 months old were fed at least four times daily (78% vs 51%; $p < 0.001$), similar to findings of the current study. Our findings are also similar to the results of the Credit with Education program developed by Freedom from Hunger intervention (MkNelly & Dunford, 1998). An evaluation of that program in the Western region of Ghana reported significant improvement of feeding frequency of the children from baseline among participants compared to controls (change 0.8 vs -0.1, $p = 0.03$). The program however, required participants to be engaged in non-farming income generating activities, and thus did not include a large percentage of rural caregivers, whose only economic activity was farming. The present study collected information and examined feeding frequency and diet diversity as described by WHO (WHO, 2010), and therefore provides information on the effect of an education intervention on infant and young child feeding practices, as defined by the new international indicators. Similarly, an integrated agriculture and nutrition

and health behaviour change communication intervention marginally increased the number of children (6-12 mo) who received foods from at least four food groups (minimum diet diversity) in Burkina Faso (Olney *et al.*, 2015), as well as decrease the prevalence of anemia among younger children. Our intervention however, did not affect energy and nutrient intakes of young children. This lack of effect on nutrient intakes are inconsistent with results of other nutrition education interventions that were implemented through existing health care systems in Brazil, India, Pakistan, and Peru (Bhandari *et al.*, 2004; Penny *et al.*, 2005; Santos *et al.*, 2001; Zaman *et al.*, 2008).

The lack of effect observed in the present study may be due to various factors including the relatively short duration and issues that affected the implementation of the intervention. Mothers in the intervention groups received education monthly instead of the originally planned bi-weekly schedule. Additionally, attendance rate was low among mothers and the intervention did not occur for almost half of the participants. As such, exposure to the intervention was lower than expected. Frequent exposure of caregivers of young children to nutrition education has the potential to improve feeding practices and subsequently, the energy and nutrient status of young children. In Indonesia, caregivers of mildly wasted children who received weekly nutrition education on infant and young child feeding showed significant improvement in knowledge and practices, compared to those who received monthly education on the same topics (Inayati *et al.*, 2012).

Exposure to the intervention in the present study was a major challenge. The low level of attendance to the education sessions was a reflection of low attendance to child welfare clinics in the district. The number of children seen within the first half of 2011 decreased to 4790 compared to 6084 during the same period in the previous year (Upper Manya Krobo District Health Directorate, 2011). There has been no study to investigate the possible causes of this decline in coverage. However, a decrease in health volunteer activities, which included home visits during which mothers were reminded of

the next CWC, could have been a contributing factor. The low level of commitment among CHV could be attributed, at least in part, to a general dissatisfaction as a result of lack of remuneration from the GHS⁴. At the time of the present study, CHV worked strictly on volunteerism basis. A nutrition education intervention in India that had the *Anganwadi* workers as educators, was successful in improving energy intakes (difference = 1230 kJ; $p < 0.001$) (Bhandari *et al.*, 2004). The *Anganwadi* workers are not professional health workers, but form part of the Integrated Child development Scheme of India and receive monthly remunerations (Ishrath, 2011). In addition, their activities are regularly monitored by a supervisor, who then reports to a Child Development Project officer. Having a system which provides regular remuneration to the volunteers may help enhance their willingness to participate in activities that aim at improving young child well-being and growth in their communities.

One factor that contributed to the lack of mothers' commitment to the intervention was a limited involvement of the target audience at the design phase of the intervention. Participants' commitment to change is essential in the success of nutrition education programs that aim to change behaviour (Kayman, 1989; Olson & Kelly, 1989), and this needs to be recognized during the development phase. This was partly explored during the TIPS phase, when mothers' willingness to perform potential feeding recommendations was tested. However, the formative research did not explore caregivers' willingness to receive frequent education on child feeding in their communities, including how much of their time they were ready to commit to it. The consideration of these factors during the formative phase would have led to the identification of potential problems which could have been resolved before the implementation stage.

The results indicated that the integrated nutrition and agriculture education improved feeding practices, but not nutrition education alone. This significant result was observed in both the intention-to-treat and sub-sample

⁴Comments from volunteers to the doctoral student during the training workshops of the study.

analyses (data not shown). The lack of improvement in the nutrition education group could partly be due to the low attendance to education sessions among mothers, and reinforcement of nutrition messages by agricultural extension agents in the integrated group. Similarly, a study in China that used multiple methods such as group discussions, food demonstrations, and home visits to reinforce messages reported improved feeding frequency among intervention children compared to control children at 12 months (4.2 vs 2.9; $p < 0.001$) (Shi *et al.*, 2010). Using innovative ways of bringing caregivers together which then serve as a platform for nutrition education may improve participants' interest in education interventions. In the present study, the agricultural education sessions were used to discuss topics to which the mothers could easily relate. These sessions might have provided a forum which was of interest to women in the area, serving as motivation for mothers of young children to attend CWC, where they were also exposed to nutrition education. Nutritionists and health workers need to find platforms that interest caregivers to expose caregivers to appropriate nutrition education.

Lack of information on some potential sources of bias such as geographical location of CWC, better ways of assessing compliance, and effect of educators on study outcomes are limitations acknowledged by the researchers of the present study. Information on the above-mentioned factors might have provided a clearer understanding of the results. Additionally, an in-depth qualitative study to investigate the implementation process of the present study is needed to provide better insight into the low rate of participation in the intervention.

Conclusion

The intervention resulted in improvement in feeding practices but failed to improve the nutrient intakes of young children. Implementation of the intervention was hampered and this may possibly be due to inadequate involvement of participants during the planning stage. A combined agriculture and nutrition education can be applied as one of the means of improving complementary feeding practices in the rural areas, where farming is

a major source of employment. However, using the community health volunteer system, as it currently operates, may not be an effective way to address infant and young child malnutrition in rural Ghana.

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