

## IMPROVING CAREGIVERS' INFANT AND YOUNG CHILD-FEEDING PRACTICES USING A THREE-GROUP FOOD GUIDE: A RANDOMIZED INTERVENTION STUDY IN CENTRAL UGANDA

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## ABSTRACT

Despite improvements in food production and healthcare services, the burden of malnutrition in Uganda has for the last 30 years remained unacceptably high with rates of stunting (chronic undernutrition) and anemia (proxy for micronutrient deficiency) currently estimated at 29% and 53%, respectively among young children aged 6-59 months. Considering that both undernutrition and over nutrition are greatly attributed to monotonous diets characterized by limited dietary diversity and overdependence on starchy refined grains or roots as staples, there is need to improve the population's awareness of appropriate dietary practices. To improve nutrition education, the Infant and Young Child-feeding national counseling cards for community volunteers (IYCF cards) that were developed by United Nations Children's Fund (UNICEF), are currently the standard package used in Uganda's health sector to educate caregivers on appropriate child-feeding practices. In this study, the effectiveness of a three-group food guide was evaluated against IYCF cards. A randomized, controlled intervention trial engaged three randomly selected distant groups of child-caregiver pairs (n=40) concurrently in one of three treatments namely: (i) nutrition education using a three-food group guide (FG), (ii) nutrition education using age-appropriate IYCF cards, and (iii) negative control group that engaged in hair-plaiting sessions. At baseline, all groups had randomly selected caregivers of children aged 6-14 months and were met once a week for five consecutive weeks during the intervention. Caregivers were interviewed at baseline and 2 months after the interventions to determine changes in child-feeding practices while their children were concurrently measured to determine changes in their nutritional status. At baseline, caregivers in the three treatment arms exhibited inappropriate child-feeding practices indicated by low child-feeding index (CFI) scores, which were also related to poor nutritional status of their children. After the interventions, children in FG group were given more varied animal-source foods than those in IYCF cards group ( $p = 0.02$ ). Compared to controls, caregivers in FG group gave their children significantly more snacks ( $p = 0.01$ ), their child-feeding practices indicated by CFI scores significantly improved ( $p = 0.001$ ) and their children exhibited better growth patterns indicated by weight-for-age ( $p = 0.02$ ) and MUAC-for-age ( $p = 0.03$ ) Z-scores. These findings, therefore, indicate that the three-group food guide is more likely to improve child-feeding practices and growth patterns than IYCF cards. Hence, there is need to integrate the food guide into IYCF materials to foster child-feeding practices and growth.

**Key words:** Dietary guidance, three-group food guide, Infant and Young Child Feeding counseling cards, nutrition education

**Trial Registration:** Pan African Clinical Trial Registry (PACTR202002810799672)



## INTRODUCTION

Globally, malnutrition is a major underlying cause of childhood mortality [1-4] and is associated with impaired physical and mental development [5-7]. Undernutrition manifests as underweight, wasting, and stunting and is partly attributed to poor child-feeding practices that are often characterized by less-diverse diets with inadequate nutrients [8-13]. Hence, nutrition education is one important intervention that is often implemented to improve child-feeding practices in different settings [14-18].

The use of food guides is internationally recognized as an important component of nutrition education because they help individuals to visually conceptualize what constitutes a balanced diet across different cultural contexts [13]. A study in western Uganda that utilized a food guide pictorial as the major nutrition education tool revealed that a simple food guide can facilitate better food selection patterns even among less educated women in a limited-resource rural setting [12]. These findings call for more research to investigate strategies to integrate food guides in the available nutrition education materials to foster adoption of healthier food selection practices among populations in different parts of Uganda.

In Uganda, *Infant and Young Child-feeding national counseling cards for community volunteers* (IYCF cards) [19] has for long been the standard package used by the Ministry of Health to educate caregivers on appropriate child-feeding practices. These counselling cards are used in both health facilities and community settings across the country; however, little is known about their effectiveness. Additionally, the IYCF counseling cards emphasize age-appropriate infant and young child-feeding guidelines but they do not include a food guide to help caregivers to plan a balanced diet for their young children. Hence, this study sought to compare the effectiveness of IYCF cards against nutrition education that uses a three-group food plate guide [20] in enhancing the caregivers child-feeding practices and their children's nutritional status.

In general, diet planning is not a new concept in developing countries like Uganda because many interventions promote a 'balanced diet' to combat undernutrition. What is often challenging is how best to communicate this concept of 'a balanced diet' among groups with limited literacy, little or no exposure to visual media and often with limited food resources. Though different countries have different food guides [21, 22], Uganda lacks a nationally recognized food guide. Hence, a simple three-food group guide in form of a plate was developed and tested in western Uganda to enhance the caregivers' perceptions of a balance diet while improving their self-efficacy to provide nutritious meals for their young children [17, 20, 23]. The three-food group plate was determined to be effective in communicating concepts of food variety, proportionality of food groups in a meal and dietary balance; improving infant and young child-feeding practices [17, 20, 23] as well as reducing children's risk for micronutrient deficiencies and improving their growth [17]. This study was designed to test the effectiveness of this three-food group guide [12] among women from a different cultural group (Baganda) and in a different agro-ecological zone. This study was also designed to compare the effectiveness of the three-group food guide against the *IYCF community*



*counselling cards* which are the standard tool for nutrition education in the health sector.

### Hypothesis

It was hypothesized that caregivers who received dietary guidance using the three-group food guide would have significantly higher improvement in complementary feeding practices than their counterparts that were educated using the *IYCF community counselling cards* and those engaged in hair plaiting. It was also hypothesized that the children of caregivers educated using the food guide would be significantly better nourished than children of caregivers in the control groups (IYCF cards and hair plaiting).

## METHODOLOGY

### Study design

This was a randomized controlled intervention trial designed to compare effectiveness of a nutrition education approach that utilized the three-group food guide (FG) with that of utilizing IYCF counselling cards (positive control group). Another group of caregivers was recruited and engaged concurrently in hair-braiding (negative control intervention) to control for changes in behavior that is expected from the mere interpersonal interactions that people experience when they engage in regular group meetings. This negative control group was also expected to help control for external factors such as influence of media, other community programs, and seasonal variations in food availabilities. Using ballot papers, the research team randomly assigned caregivers to one of the three treatment groups. Caregivers in each treatment group met at central locations in each of the study parishes once a week for five consecutive weeks. The three groups of study participants were in the same geographical area to control for cultural differences in IYCF practices; and were about 15 km apart, to limit information flow across the groups. This study was a follow-up of a needs assessment conducted in the same area, which documented gaps in child-feeding practices in Luwero district [9].

Principally, caregivers in the FG and IYCF cards groups received similar messages, notably appropriate feeding of young children of 6 – 18 months. What varied were teaching aids and information packaging. Caregivers were not prohibited from receiving dietary guidance during immunization, de-worming and vitamin A supplementation sessions in health centres. To control for inter-facilitator differences, the FG and IYCF cards groups were taught by a graduate student of Applied Human Nutrition and an enrolled nurse who were trained on facilitating dietary guidance using IYCF cards. The hair-braiding group was facilitated by a local hairdresser supported by one of the facilitators of the nutrition education interventions.

### Participants and study setting

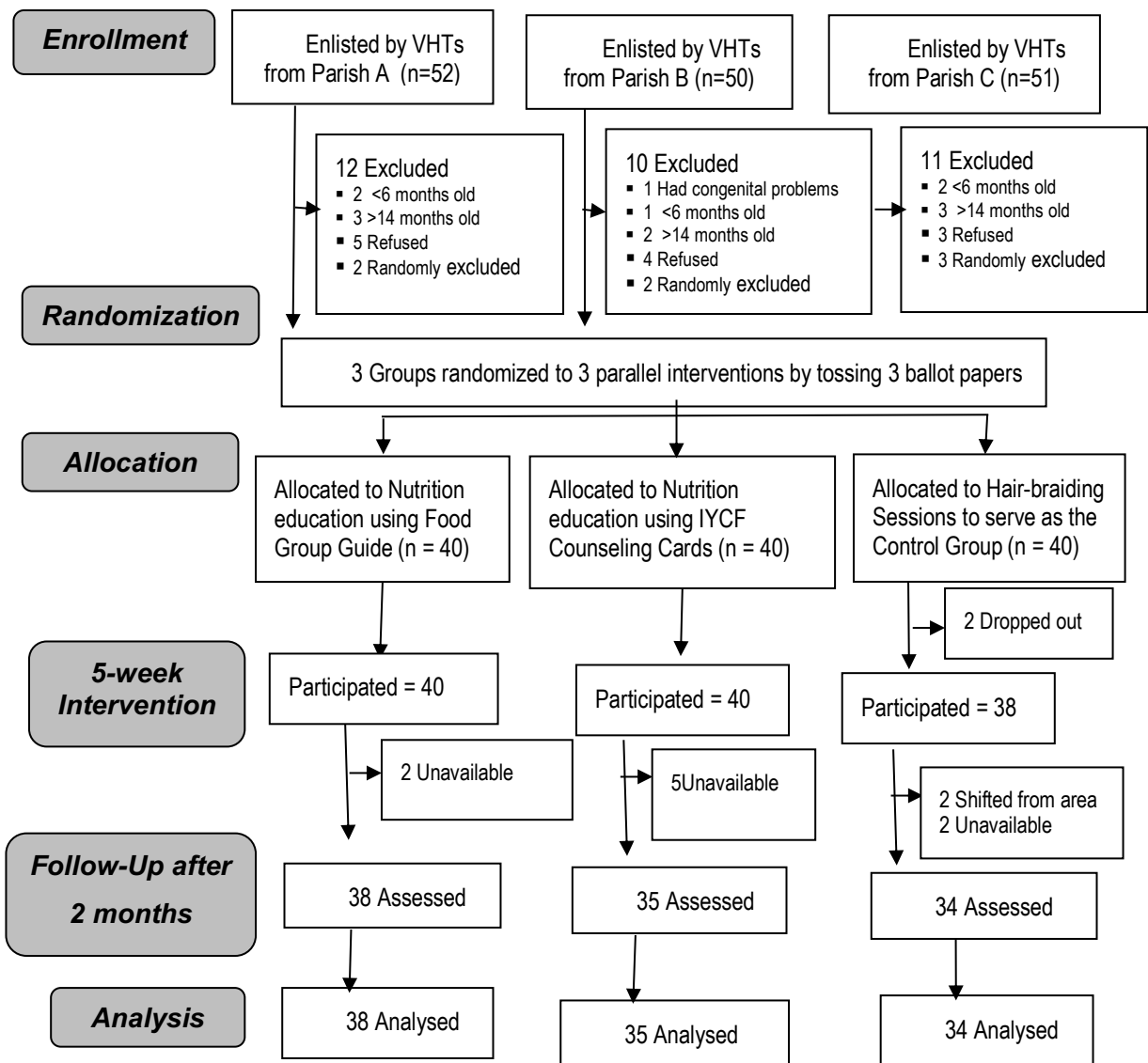
The study was conducted in Sekamuli parish of Bamunanika Sub-County, Kiziba parish of Kikyusa Sub-County and Lunyolya parish of Kalagala Sub-County, all of Luwero district. These intervention sites were purposively selected to obtain participants with comparable socio-demographic characteristics, ethnicity, and access



to food. Using Fisher *et al.* [24] formula a sample size of 32 child-caregiver pairs was needed to achieve a medium effect given that 6% of caregivers were reported to practice appropriate infant and young child-feeding practices [25]. This sample size was adjusted to allow a 20% expected drop-out rate; hence, 40 child-caregiver pairs were needed for each study arm.

A Village Health Team member (VHT) selected from each study arm was requested to enlist 50 women with children aged 6 -14 months within a radius of 5 kilometers from each intervention site. Within each selected household, all healthy children aged 6-14 months were eligible for the study. A total of 153 households were enlisted.

From the lists provided by VHTs, investigators screened out children whose caregivers refused to take part in the study and those that had congenital problems that affect food intake. Children's birth dates were then used to screen out children that were either below 6 months or above 14 months of age. So, a total of 26 child-caregiver pairs were excluded from the study because one child was disabled (with special feeding needs), 5 were <6 months old, 8 were >14 months old, and 12 caregivers declined to participate. This left a pool of 127 eligible child-caregiver pairs. Investigators then randomly selected 40 child-caregiver pairs from each list of caregivers from the three study sites (see Figure 1). Thus, a total of 120 child-caregiver pairs were engaged in the study. This study adheres to CONSORT guidelines for reporting clinical trials. Figure 1 shows the flow of the research activities.



**Figure 1: Consort diagram for the study**

### Description of the nutrition education interventions

The three-group food guide graphic (**Figure 2**) and the curriculum outline presented in **Table 1** were adapted from Kabahenda *et al.* [17]. The key messages adapted to support the food guide were designed to address information gaps identified in a needs assessment study reported by Nankumbi *et al.* [7]. Age appropriate IYCF cards [19], which are the standard tool for educating caregivers of young children in Uganda, were used as the reference in developing the nutrition education messages.



**Figure 2: A food guide graphic used during training of primary caregivers in the**

### **FG group**

**Table 2** provides an outline of key messages communicated using the cards. As shown in Tables 1 and 2, the major difference in the nutrition education provided to the Food Guide and IYCF cards groups was what was emphasized, and how the training sessions were structured. Caregivers in the Food Guide group were coached on how to identify and select foods from each of the three food groups; while caregivers in the IYCF cards group were coached on age-appropriate feeding practices for young children. The focus on the food groups was needed in this study population because earlier research had revealed monotonous diets constituted of porridges and limited dietary diversity [7].

### **Data collection and processing**

At baseline and two months after the interventions, each selected primary caregiver was interviewed face-to-face at her home using a structured questionnaire to generate data on household socio-demographic characteristics, breastfeeding and complementary feeding practices plus children's dietary intake as elaborated below. Anthropometric

assessments were also conducted on all children 6-18 months before the intervention and two months after the intervention.

### **Assessment of children's dietary intake and child-feeding practices**

Data on children's dietary intake was collected by interviewing primary caregivers using an interactive 24-hour recall [26] and a qualitative food frequency questionnaire. Data from 24-hour recalls were used to compute individual dietary diversity (IDD) scores [27] and food variety scores [28]. These data were combined with those on caregivers' breastfeeding practices, use of baby bottles, dietary diversity, frequency use of foods from the different food groups and meal frequency to generate a comprehensive measure of children's feeding practices, which is hitherto referred to as the "child feeding index" or CFI [29]. The child feeding index (CFI) data were further desegregated by age category to quantify children's intake in reference to recommended intakes for ages 6-9, 9-12 and 12-18 months [29] so as to evaluate the age-appropriateness of the diets availed to young children.

### **Assessment of changes in children's nutritional status**

Children's weights were measured in triplicate to the nearest 0.1kg using a 150 kg capacity digital *Seca* scale (Model 874) when children were naked. Children that were too young to stand on the scale were held and measured with their caregivers using the tared weighing method. Children's mid-upper arm circumferences (MUAC) were measured in triplicate to the nearest 0.1 cm using color coded non-stretch MUAC tapes supplied by UNICEF, while head-circumferences (HC) were measured using a tailors tape to the nearest 0.1 cm following procedures detailed by Magon [30]. Mean measurements for weight, MUAC, and HC were then exported into WHO Anthro software (version 3.2.2) to compute weight-for-age, MUAC-for-age, and Head-circumference-for-age Z-scores. Absolute z-scores were imported into a statistical package (SPSS) and analyses of variance were used to determine the significance of changes in means of these anthropometric indices across the three treatment groups.

### **Data analysis**

Analysis of variance (ANOVA) and Tukey's *post-hoc* test were used to test the significance of differences in mean changes in complementary feeding practices and nutritional status of children across the three intervention groups. Pearson correlation coefficient and Chi-square test were used to test for associations between changes in food selection practices and nutritional status of the children. For all analyses, p-value of < 0.05 was considered statistically significant.

## **RESULTS AND DISCUSSION**

### **Socio-demographic characteristics of the participants**

The mean age of the primary caregivers was 26.75±0.67 years while that of the children was 10.53±0.237 months of which 28.1% were aged 6-8 months, 29.8% aged 9-11 months and 42.1% aged 12-18 months (Table 3). Majority of primary caregivers in the three study groups were biological mothers of the children (97.1%), had not studied beyond primary school (78.4%), were subsistence farmers (85.6%), lived in households headed by their spouses (88.9%), and were subsistence farmers (70.3%).





These findings are similar to those reported in the Uganda Demographic and Health Survey [31].

### **Changes in caregiver food selection and child-feeding practices**

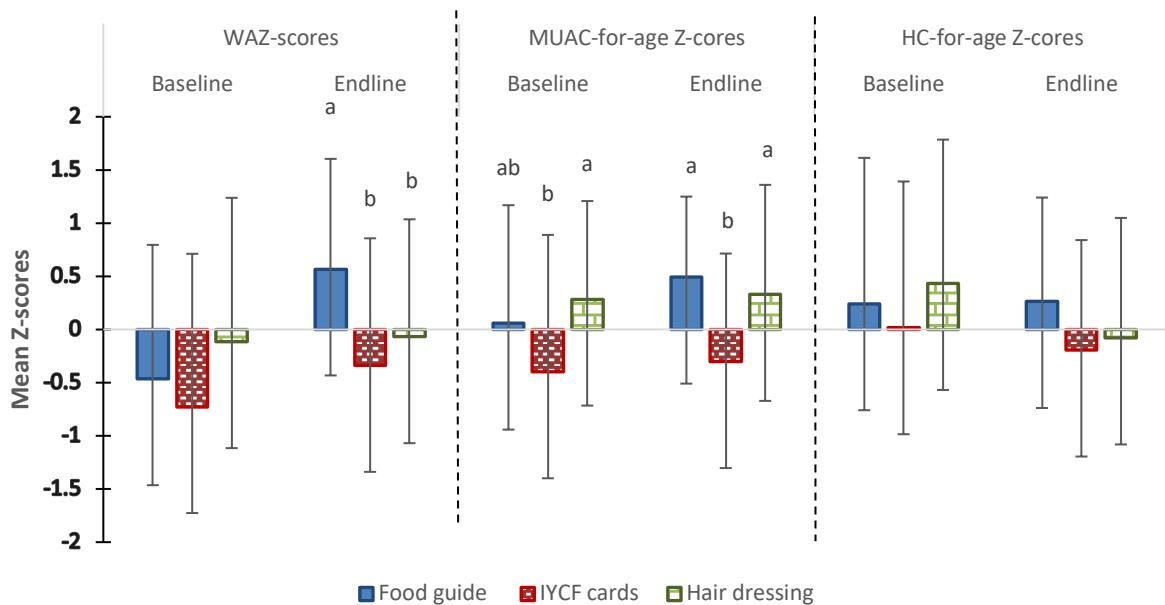
Overall, caregivers in all three study groups had poor child-feeding practices at baseline. However, significant changes in children's diet quality (indicated by child-feeding index scores) were noted among caregivers that participated in nutrition education sessions that emphasized incorporating foods from all food groups in children's diets (the Food Guide group). As shown in Table 4, the mean Child Feeding Index (CFI) scores of caregivers in the Food Guide group was  $5.20 \pm 0.25$  and was significantly higher than the mean CFI scores of caregivers trained using the IYCF cards ( $4.80 \pm 0.24$ ) and the control group ( $4.50 \pm 0.27$ ). This indicates that the Food Guide group adapted better child-feeding practices than caregivers in the IYCF group and the control. The similarity between the IYCF group and the control may be attributed to the likely use of IYCF counselling cards during the well-child visits (mainly immunization days) in public health facilities to educate caregivers on appropriate child-feeding practices in both the IYCF cards and control group since use of IYCF cards is the standard practice [19]. This indicates that community level nutrition education that utilizes the current IYCF counselling cards is likely not to have added much advantage in improving overall child-feeding practices compared to ongoing IYCF education efforts in public health facilities. Notably, changes in caregivers' child-feeding practices were not related to socio-demographic characteristics though some previous studies have found significant associations between socio-demographic characteristics and maternal child-feeding practices [32-34].

### **Changes in children's feeding frequency**

Based on caregivers' self-reports, all children aged 6-8 months met the WHO recommendation [19] of at least 2 meals per day at baseline; only 34.4% of those aged 9-12 months were reported to consume the recommended 3 or more meals per day, while none of those aged 12-18 months met the recommendation of at least 4 meals per day. There were no significant changes in meal frequency across all study groups (see Table 4). In addition, the meal frequency scores were lower than 2 for all child age group categories (6-8, 9-11, and 12-23 months) across the three treatments. This indicates sub-optimal meal frequency. Although there were no significant changes in children's meal frequency after the interventions; children of caregivers trained using the food guide and IYCF cards had significant increase in average number of snacks. After the intervention, the mean number of snacks given to children per day in the FG group was  $1.33 \pm 0.10$ ,  $1.09 \pm 0.10$  among children in the IYCF cards group, and  $0.58 \pm 0.15$  among the controls. The changes in snack frequency among children whose caregivers received nutrition education indicates improved meal planning skills. Though Hassen *et al.* [35] found associations between snacking behavior and socio-demographic characteristics, in this study, the number of snacks given to children was not related to any of the household socio-demographic characteristics, which indicates that most rural caregivers can change their feeding schedules.

### Changes in children's nutritional status

Overall, compared to the control children whose caregivers were educated using IYCF cards, the children whose caregivers were educated using the food guide (FG group) had improved nutritional status indicated by weight-for-age (WAZ) Z-scores and MUAC-for-age Z-scores (see Figure 3). There were no significant differences in head circumference-for-age Z-scores of children in the Food Guide and those in IYCF cards groups.



Mean values with different superscripts are significantly different from each other at  $p < 0.05$ .

**Figure 3: Changes in nutritional status of children across the three treatment groups**

A significantly higher proportion of children with increased weight-for-age Z-scores in the Food Guide group had increased child-feeding index (CFI) scores ( $\chi^2 = 13.327$ ;  $p < 0.05$ ). This shows that children whose caregivers were trained using the three-group food guide improved adherence to child-feeding guidelines (indicated by CFI scores) and this consequently improved their weight status. There were no significant associations between child-feeding indicators and children's nutritional status among children whose caregivers were trained using the IYCF counselling cards and among those of the control caregivers.

Overall, this study shows that nutrition education in Uganda can be strengthened by using a food guide graphic based on three food groups to effectively communicate concepts of dietary diversity and proportionality [36]. The superiority of the food guide graphic over IYCF cards was demonstrated by the significant improvement of the child-feeding index scores for children whose caregivers were trained using the food guide graphic. The higher CFI among children in FG group indicates that their caregivers adhered better to the recommended breastfeeding and complementary feeding practices than caregivers in the control group. The limited differences in CFI

scores of children in the FG group and IYCF group can be attributed to the similarities in the content they were taught, compared to the control group.

### **Limitations of the study**

Much as pre-prepared curricula were used and scripted messages were passed on to participants verbatim, the same pair of facilitators trained both the caregivers in the intervention (FG) and control (IYCF cards) groups. Hence, there may have been instances when facilitators inadvertently passed on information that was meant for one group to another. The other limitation is that the study was not designed to enable the three intervention groups to be met simultaneously, hence the meeting time was not controlled for. Finally, the likely use of *IYCF counselling cards* during the well-child visits (mainly immunization days) in public health facilities to educate caregivers on appropriate child-feeding practices was not controlled for in all the study groups.

### **CONCLUSION**

This study demonstrates that the food guide graphic improved food selection practices of child-caregivers than giving them age-specific recommendations on infant and young child-feeding. Furthermore, these improvements were linked to improved child growth in only a period of 3 months. Findings from this study demonstrate that nutrition education can positively improve caregivers' ability to make better food choices, provide their children with better quality meals and increase children's eating occasions by increasing the number of snacks. These findings also highlight the need for a validated and widely acceptable food guide for harmoniously communicating concepts of variety and proportionality in children's diets in different contexts. There is need for more research to investigate best strategies for integration of the food guide and concepts of food variety, proportionality and balance in IYCF counseling materials.

### **LIST OF ABBREVIATIONS**

WHO - World Health Organisation; CFI - Child-feeding Index; HIV - Human Immunodeficiency Virus; MUAC - Mid Upper Arm Circumference; GoU - Government of Uganda; UNICEF - United Nations Children's Education Fund; IYCF - Infant and Young Child-feeding; FG - Food guide; FV - Food variety; DDS - Dietary diversity scores; HC - Head circumference

### **DECLARATIONS**

#### **Ethics approval and consent to participate**

The study protocol was approved by the Institutional Review Board of the School of Public Health, Makerere University (Ref# HDREC 228) and the Uganda National Council for Science and Technology (Ref# SS 3465). The study protocol was explained to each caregiver and written informed consent (in local language) was also obtained from each caregiver at recruitment, before the education sessions (interventions), and each data collection point. Also the primary child-caregiver consent to collect dietary intake data and to conduct anthropometric assessment of children 6-18 months was



obtained at recruitment and at each data collection point. Special identification numbers for participants were used during data processing to ensure confidentiality

### **Consent for publication**

This manuscript does not contain data that identify individuals from whom it was collected.

### **Availability of data and materials**

The dataset used to generate findings reported in this paper and training materials used are available from the corresponding author at reasonable request.

### **Competing interests**

The authors and funding agencies declare that they have no competing interests.

### **Funding**

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### **Authors' contributions**

All authors conceptualized and designed the study. EK implemented the interventions and collected data under the guidance of MKK. EK and MKK contributed to analysis, interpretation of the data and manuscript writing, ensuring that it has important intellectual content. EK, MKK, and EB read and approved the final version of this manuscript.

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**Table 1: Outline of key messages to caregivers trained using the Food Guide (FG group)**

| Session and topic   | Key Messages  |
|---|---|
| <b>Session 1:</b> Introduction  | <ul style="list-style-type: none"> <li>• Importance of continued breastfeeding during complementary feeding</li> <li>• What, when and why introduce complementary foods</li> <li>• Grouping complementary foods into Energy-giving, Body-building, and Protective food groups.</li> </ul>   |
| <b>Session 2:</b> Choosing and preparing energy-giving foods for children aged 6 to 18 months                     | <ul style="list-style-type: none"> <li>• Variety in energy giving foods</li> <li>• Number of servings and serving sizes of different types of energy-giving foods</li> <li>• Boosting energy content of common energy-giving foods</li> <li>• Preparing nutrient-dense energy-giving foods.</li> </ul>  |
| <b>Session 3:</b> Choosing and preparing protective foods for children aged 6 to 18 months                        | <ul style="list-style-type: none"> <li>• Variety in vegetables and fruits</li> <li>• Appropriate incorporation of vegetables in young children's meals</li> <li>• Serving children fruits at meal time and as snacks.</li> </ul>  |
| <b>Session 4:</b> Choosing and preparing body-building foods from plant sources for children aged 6 to 18 months  | <ul style="list-style-type: none"> <li>• Variety in plant-source body-building foods</li> <li>• Number of servings of plant-source body-building foods to give children daily</li> <li>• How to increase absorption of non-haem iron in children's diets</li> <li>• Why and how to combine legumes and cereals in children's meals</li> </ul> |
| <b>Session 5:</b> Choosing and preparing body-building foods from animal sources for children aged 6 to 18 months | <ul style="list-style-type: none"> <li>• Variety in animal-source body-building foods</li> <li>• Minimum number of servings of ASF to give to children daily</li> <li>• How to prepare various ASF for children.</li> </ul>   |

Adapted from Kabahenda *et al.* [17]

**Table 2: Outline of key nutrition messages to caregivers trained using IYCF cards**

| Key Message  | What was emphasized for specific age groups (months) |                         |                          |
|--|--|-------------------------|--------------------------|
|  | 6-8  | 9-11                    | 12-18                    |
| 1. At 6 months baby is developmentally ready and needs other foods in addition to breast milk  | ++   | +                       | –                        |
| 2. Introduce complementary feeds stepwise e.g. 2-3 heaped tablespoons per feed and gradually increase amount to 1/3 of Nice cup (about 100 ml)                                     | ++   | +                       | –                        |
| 3. Using the <i>Nice</i> cup to gauge adequate amounts of complementary feeds for children at different stages   | 1/3 cup (100 ml)                                     | 1/3 cup (~100 ml)       | 1/2 cup (~150 ml)        |
| 4. Continued breastfeeding on demand (day and night).  | ++   | ++                      | ++                       |
| 5. HIV positive mothers who are not breastfeeding to give baby a <i>Nice</i> <sup>‡</sup> cup of milk (~ 300mls) per day   | ++   | ++                      | ++                       |
| 6. Appropriate feeding frequency in a day  | 3  | 4<br>(3 meals+ 1 snack) | 5<br>(3 meals+ 2 snacks) |
| 7. Appropriate procedures to soften baby foods for easy swallowing without choking. Thicken mash as baby grows   | ++   | ++                      | ++                       |
| 8. Diversifying baby's diet by including at least a small bit of a food from each food group (staples, legumes & nuts, meats/fish/poultry/eggs, vegetables, fruits, and oils/fats) | ++   | ++                      | ++                       |
| 9. Responsive feeding to ensure that baby eats its entire meal   | ++   | ++                      | ++                       |
| 10. Giving children water and any liquid foods using clean open cups and avoiding bottles, teats and spouted cups.   | ++   | ++                      | ++                       |
| 11. Practicing good personal hygiene when handling baby food   | ++   | ++                      | ++                       |
| 12. Discussed examples of balanced baby feeds placing emphasis on dietary diversity and consistency of mash  | ++   | ++                      | ++                       |

++ means more emphasis, + means moderate emphasis, while – means no mention.

<sup>‡</sup>*Nice* cup is a common household plastic cup with a fluid capacity of about 250 ml or 300 ml when filled to the brim.

Adapted from the *Uganda IYCF Counselling cards for Community Volunteers* [8]



**Table 3: Socio-demographic characteristics of the study participants**

| Characteristic                             | FG group<br>(n = 38) | IYCF cards group<br>(n =35) | Control group<br>(n = 34) |
|--|----------------------|-----------------------------|---------------------------|
| <b>Children</b>                            |                      |                             |                           |
| Mean age (months)                          | 10.90±0.46           | 10.52±0.41                  | 10.15±0.36                |
| <b>Household head</b>                      |                      |                             |                           |
| Primary caregiver                          | 7.7                  | 5.9                         | 2.9                       |
| Spouse to Primary caregiver                | 87.2                 | 88.2                        | 91.2                      |
| Caregivers' parents                        | 5.1                  | 5.9                         | 5.9                       |
| <b>Occupation of household head</b>        |                      |                             |                           |
| Subsistence farmer                         | 66.7                 | 76.5                        | 67.6                      |
| Casual laborer                             | 2.6                  | 8.8                         | 14.7                      |
| Small scale business off farm              | 30.8                 | 14.7                        | 17.6                      |
| <b>Primary caregiver</b>                   |                      |                             |                           |
| Mean age (years)                           | 27.05±1.00           | 26.50±1.32                  | 26.65±1.20                |
| <b>Highest level of education attended</b> |                      |                             |                           |
| No formal Education                        | 5.1                  | 5.9                         | 17.6                      |
| Primary level                              | 74.4                 | 58.8                        | 73.5                      |
| Ordinary secondary level                   | 12.8                 | 35.3                        | 2.9                       |
| Advanced secondary level                   | 7.7                  | 0                           | 0                         |
| Vocational and tertiary level              | 0                    | 0                           | 5.9                       |
| <b>Main occupation</b>                     |                      |                             |                           |
| Subsistence farmer                         | 74.4                 | 88.2                        | 94.1                      |
| Small scale business off farm              | 10.3                 | 11.8                        | 0                         |
| Casual laborer                             | 0                    | 0                           | 2.9                       |
| Teacher                                    | 10.3                 | 0                           | 0                         |
| Nurse                                      | 0                    | 0                           | 2.9                       |
| None                                       | 5.1                  | 0                           |                           |
| <b>Relationship to the children</b>        |                      |                             |                           |
| Biological mother                          | 100                  | 97.1                        | 94.1                      |
| Aunt                                       | 0                    | 0                           | 5.9                       |
| Grandmother                                | 0                    | 2.9                         | 0                         |

**Table 4: Mean changes in child-feeding practices across the three intervention groups**

| Child-feeding practice scored                    | Mean Child-feeding Index (CFI) scores across treatment groups (95%CI) |                               |                                     |                               |                               |                                      |                               |                               |                                     |
|--|---|-------------------------------|-------------------------------------|-------------------------------|-------------------------------|--------------------------------------|-------------------------------|-------------------------------|-------------------------------------|
|  | Food guide  |                               |                                     | IYCF cards                    |                               |                                      | Control                       |                               |                                     |
|  | Baseline<br>n = 40  | Post intervention<br>n = 38   | Change<br>n = 38                    | Baseline<br>n = 40            | Post intervention<br>n = 35   | Change<br>n = 35                     | Baseline<br>n = 40            | Post intervention<br>n = 34   | Change<br>n = 34                    |
| Breastfeeding                                    | 0.73 (0.17-1.63)  | 0.67 (0.07-1.44)              | -0.03 (-1.32-1.26)                  | 0.83 (0.01-1.67)              | 0.54 (0.2-1.28)               | -0.2 (-1.41-1.01)                    | 0.6 (0.18-1.38)               | 0.76 (0.09-1.61)              | 0.29 (0.83-1.41)                    |
| Use of baby bottles                              | 0.44 (0.06-0.94)  | 0.23 (0.2-0.66)               | -0.23 (0.86-0.40)                   | 0.60 (0.1-1.1)                | 0.17 (0.21-0.55)              | -0.4 (0.95-0.15)                     | 0.63 (0.14-1.12)              | 0.15 (-0.19-0.49)             | -0.53 (-1.14-0.08)                  |
| Meal frequency (past 24 hours)                   | 1.07 (0.72-1.42)  | 1.03 (0.87-1.19)              | -0.08 (-0.35-0.19)                  | 1.03 (0.67-1.19)              | 1.03 (0.86-1.2)               | 0.00 (-0.49-0.49)                    | 1.13 (0.67-1.59)              | 0.97 (0.8-1.14)               | -0.18 (0.64-0.28)                   |
| Dietary diversity                                | 1.00 (0.61- 1.39)   | 1.36 <sup>a</sup> (0.82-1.9)  | 0.33 <sup>a</sup> (-0.25-0.91)      | 1.05 (0.66-1.44)              | 1.2 <sup>ab</sup> (0.79-1.61) | 0.11 <sup>ab</sup> (0.36-0.58)       | 1.18 (0.68-1.68)              | 1.06 <sup>b</sup> (0.72-1.4)  | -0.15 <sup>b</sup> (-0.81-0.51)     |
| <b>Food group frequency of use (past 7 days)</b> |   |                               |                                     |                               |                               |                                      |                               |                               |                                     |
| Staples (grains or tubers)                       | 0.45 (0.05-0.95)  | 0.72 (0.26-1.18)              | 0.28 (0.28-0.84)                    | 0.35 (0.13-0.83)              | 0.60 (0.1-1.1)                | 0.26 (0.40-0.92)                     | 0.58 (0.08-1.08)              | 0.71 (0.25-1.17)              | 0.15 (0.35-0.65)                    |
| Egg/fish/poultry                                 | 0.29 (0.22-0.8)   | 0.72 <sup>a</sup> (0.01-1.45) | 0.44 <sup>a</sup> (-0.58-1.46)      | 0.25 (0.29-0.79)              | 0.83 <sup>a</sup> (0.21-1.45) | 0.63 <sup>a</sup> (0.25-1.51)        | 0.40 (0.15-0.95)              | 0.35 <sup>b</sup> (0.14-0.84) | -0.03 <sup>b</sup> (0.75-0.69)      |
| Meat   | 0.37 (0.25-0.99)  | 0.51 (0.21-1.23)              | 0.18 (0.67-1.03)                    | 0.08 (0.19-0.35)              | 0.42 (0.27-1.11)              | 0.34 (0.42-1.10)                     | 0.25 (0.19-0.69)              | 0.75 (0.04-1.46)              | 0.24 (-0.58-1.06)                   |
| Total frequency                                  | 1.10 <sup>ab</sup> (0.18-2.38)  | 1.95 (0.98-2.92)              | 0.9 <sup>ab</sup> (-0.53-2.33)      | 0.67 <sup>b</sup> (0.21-1.55) | 1.86 (0.98-2.74)              | 1.23 <sup>a</sup> (0.14-2.60)        | 1.23 <sup>a</sup> (0.28-2.18) | 1.59 (0.59-2.59)              | 0.35 <sup>b</sup> (0.72-1.42)       |
| <b>Total CFI scores</b>                          | <b>4.34 (4.14-4.54)</b>   | <b>5.20 (4.95-5.45)</b>       | <b>0.90<sup>a</sup> (0.69-1.11)</b> | <b>4.18 (3.98-4.38)</b>       | <b>4.80 (4.56-5.04)</b>       | <b>0.74<sup>ab</sup> (0.39-1.09)</b> | <b>4.75 (4.53-4.97)</b>       | <b>4.50 (4.23-4.77)</b>       | <b>0.21<sup>b</sup> (0.41-0.01)</b> |

Baseline = 1 week before the intervention; Endline is 9-10 weeks after the intervention; CFI = Child-feeding Index. All values are Means (95%CI). Child-feeding practices scored as detailed by Ruel and Menon [29]. Mean values with different superscripts (in same row) are significantly different across treatment groups at p < 0.05





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