



Does Nutrition Education Improved Complementary Feeding Practices in Ondo State, Nigeria? a Cluster Randomized Controlled Trial

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Abstract

This study showed the effect of nutrition education on complementary feeding practices among caregivers in Ondo State, Nigeria. The study was a cluster randomized controlled-trial design. The study participants were in two groups. One was intervention and the other one was the control group in a ratio of 1:1. The sample size was 282; the intervention group was 142 and the control group was 142. Intervention on complementary feeding was carried out in form of nutrition education among the caregivers in the intervention group and the control group received no intervention. The intervention group received four 4 lesson sessions per group. The sessions were based on continued breastfeeding, timely introduction of complementary feeding, minimum meal frequency, minimum dietary diversity, minimum acceptable diet, feeding with iron rich foods, responsive feeding and hygiene. Data were analyzed using SPSS version 22.0. From Kaplan-Meier analysis, continued breastfeeding survival at age 11 months was 94.4% in the intervention group and it was 69.7% in the control group. Adjusted Relative Risk [ARR] was used to determine the effect of nutrition education on the intervention group and control group for variables such as Minimum Acceptable Diet [ARR: 3.13; CI: 2.53-5.16; P<0.001] at the end line. This study concluded that nutrition education based on complementary feeding guidelines improved the feeding practices of the caregivers. Therefore, the study recommends that Ministry of Health in Ondo State should encourage complementary feeding training for caregivers and CHEWs at the various Basic Health Centers in the State.

Abbreviation: ARR: Adjusted Relative Risk; BHC: Basic Health Centre; CFP: Complementary Feeding Practices; CHEW: Community Health Extension Workers; EBF: Exclusive Breastfeeding; FAO: Food and Agriculture Organization; HIV: Human Immunodeficiency Virus; ICF: International Classification of Functions, disability and health; IEC: Information Education Communication; IG: Intervention Group; IYCF: Infant and Young Child Feeding; LGA: Local Government Areas; MDD: Minimum Dietary Diversity; MMF: Minimum Meal Frequency; MAD: Minimum Acceptable Diet; NCP: National Population Commission [Nigeria]; NDHS: Nigeria Demographic and Health Survey; NGOs: Non-governmental organizations; NNHS: National Nutrition and Health Survey; OSHREC: Ondo State Health Research Ethics Committee; OSPHCDB: Ondo State Primary Health Care Development Board; SMART: Standardized Monitor and Assessment of Relief and Transition

Introduction

The UNICEF showed that globally 66% of children aged 6 to 8 months received semi-solid, solid or soft foods, with cases of nutrition deficiencies due to untimely introduction of complementary foods [1]. The timely introduction of complementary feeding among caregivers in sub-Saharan Africa was 71% and 68% for West and Central African countries while it was 67% for Nigeria [1]. Children

receiving MAD was 11% in sub-Saharan Africa, 9% in West and Central African countries and 10% in Nigeria [1]. Infants feeding practices reports available in some other West African nations showed poor practices of MAD by caregivers in Ghana [13%] and in Benin Republic [9%] [1]. The report of the Nigerian National Demographic and Health Survey [2] indicated that only 11% of the breastfed infants received complementary foods from at least

four food groups. Globally, about 45% of infants less than 6 months of age were exclusively breastfed [EBF], with 42% in sub-Saharan Africa and 29% for West and Central African countries. In Nigeria, EBF rate is at 17%, which implies that 83% have had untimely introduction of complementary feeding [1]. The issues of poor infants feeding knowledge and practices among caregivers which result to poor nutrition status among the infants call for action due to the present level of malnutrition in Nigeria.

Standardized Monitory and Assessment of Relief and Transition reported that 21.1% of children less than five years of age in South West Nigeria, the Geo-political Zone of this study were stunted [3]. Malnutrition caused the death of 53% of children less than five years of age in Nigeria [4]. It also showed that 13% of the death could be averted if 90% of mothers in Nigeria practiced exclusive breastfeeding for the first six months. If the same mothers practiced timely introduction of complementary feeding, a further 6% of the death rate could be prevented [5]. Inadequacy in complementary feeding during infancy and childhood has been demonstrated by researchers as a factor that leads to malnutrition, resulting in higher mortality and morbidity rate among the children [6]. In Nigeria, poor infants feeding practices rate is high. Apart from lack of adequate complementary feed being provided to the infants, force-feeding practices rather than responsive feeding is reported among 83.8% respondents in Enugu, Nigeria [7]. Only 10% of infants received minimum acceptable diet in the country [1]. The report of National Demographic and Health Survey showed that only 17.6% of infants in the South West Geo-Political Zone received minimum adequate diet [2].

Objectives

- To implement a nutrition education program using World Health Organization guidelines on complementary feeding for caregivers in Ondo State, based on complementary feeding practices, knowledge and attitudes.
- Establish the effects of nutrition education on complementary feeding, knowledge, attitudes and practices among caregivers in Ondo State.

The recruitment of study participants into the study

Materials and Methods

Research Design

This was a cluster-randomized controlled trial. A randomized controlled trial reduces bias in interventional studies by controlling for known and unknown confounders. It also provides evidence of a causal-effect relationship between the intervention and the outcomes [8,9]. The Basic Health Centres were randomized and not the caregivers to enhance participation by caregivers, by reducing loss to follow-up.

The study had two phases: the needs assessment phase and the intervention phase.

Sample Size

Sample size was determined using [10] for continuous assessment. A total of 290 caregivers were achieved. During the study 6 caregivers were lost to follow-up which resulted to 284 caregivers that completed the study. They were distributed as follows; This resulted into 70 caregivers in the first Basic Health Center for intervention group, 72 in the second BHC for intervention group, 69 in the first BHC for control group and 73 in the second BHC at the end of the study depending on eligibility criteria and willingness of the caregivers to participate in the different communities.

Sampling Techniques

Multi-stage sampling method was adopted for this study. Purposive sampling method was used for the selection of Ondo North Senatorial District out of the three Senatorial Districts in the State. Owo Local Government Area [LGA] due to existing literature [11]. Simple random sampling method was used for the selection of the 4 Basic Health Centres [BHC] out of ten [10] BHCs in the LGA. Randomization was then conducted to assign the BHCs into intervention groups and control group by a biostatistician using MS EXCEL at a ratio of 1:1, with each study group having two BHCs. Caregivers were allocated to study group based on the BHCs they attend for post-natal care.

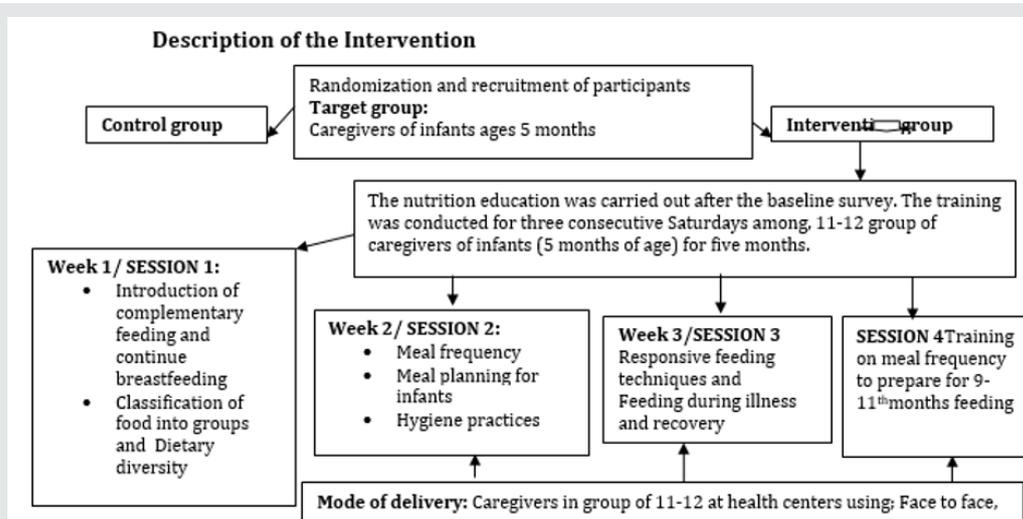
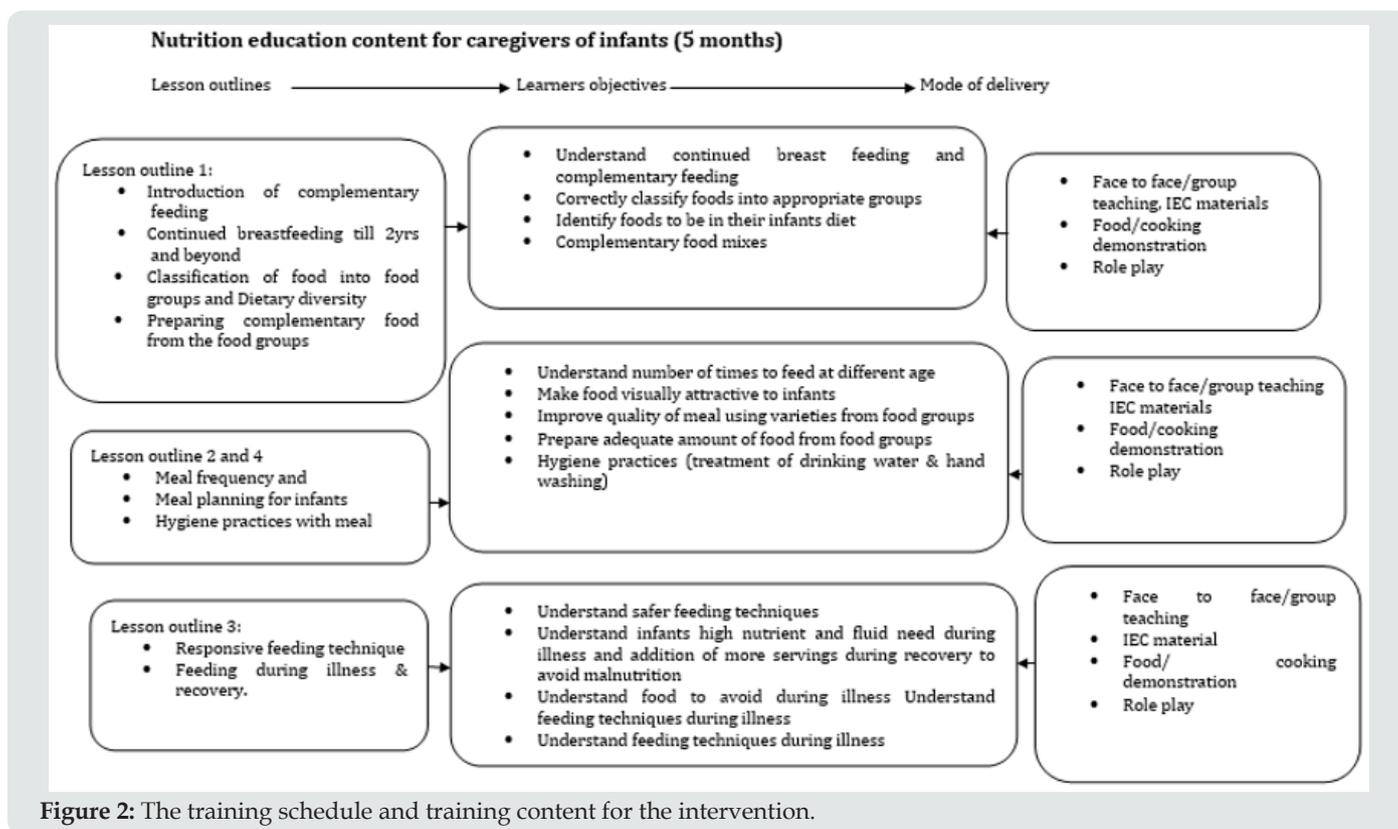


Figure 1: The description of the intervention.

The study participants were recruited by the researcher, assisted by the Community Health Extension Workers [CHEWs]. The researcher together with the CHEWs in the selected BHCs recruited and registered eligible participants [caregivers with infants] into the study at the weekly routine meetings in the BHCs. Daily recruitment was carried out when the caregivers visited the health

centres for routine meetings for immunization, appointments and check-ups. Eligible caregivers were recruited in 13, 11 and 10 in numbers in each Basic Health Centres, until the required sample size was achieved. The screening was conducted by the researcher and the Community Health Extension Workers (Figures 1 & 2).



The Training

Caregivers in the control group were selected from 2 BHCs and did not receive any intervention from the research team. Meanwhile, the caregivers in the intervention group which were also selected from 2 BHCs received the complementary feeding nutrition education from the research team. The education session began with creating rapport between the researcher [assisted by CHEWs in the research group] and the participants. The training was conducted in the local Yoruba language for better understanding. The content of the nutrition education on complementary feeding was based on the guidelines [12] as well as the knowledge, attitude and practices gaps identified during the need's assessment. The caregivers received training on continued breastfeeding, dietary diversity, meal frequency, responsive feeding techniques, meal planning for infants, infants' meal planning during illness and recovery and hygiene [water treatment]. This training was carried out in three consecutive weekends as the caregivers were recruited per group in the respective health centers weekly. After the recruitment and training, the caregivers were followed up during the program. The phone numbers of the caregivers and the CHEW in that zone, where the caregivers resided were also written down by the researchers in case of questions or if need arises to attend to some unclear area of the training pertaining to the study. Two days to and on the eve

of visitation day, the enumerator allocated to the area would call to remind the caregivers about the visitation day.

Research Instruments

WHO [2010a] IYCF indicators [13]

WHO [2010b] 24hr. dietary recall on complementary feeding practices [14]

WHO [2004] Complementary feeding guidelines [12]

Data analysis

Pilot study was carried out. During the pilot study, training was conducted for caregivers in the intervention group and there was standardization of data collection procedures. Each questionnaire was administered twice on the same group of participants at an interval of two days. A correlation co-efficient of more than 0.7 was considered adequate [Mukaka, 2012]. They are as follows:

a) Baseline questionnaire for the caregivers: 0.89[0.82-0.92].

b) Second questionnaire for all the caregivers: 0.77[0.61-0.84].

c) Third questionnaire for all the caregivers: 0.88[0.71-0.91].

Complementary feeding practices were determined based on the [13] IYCF indicators. Early initiation of breastfeeding was determined thus; proportion of infants who were put to breast within one hour of birth; for exclusive breastfeeding; [proportion of infants 0-5 months who were fed exclusively with breast milk]. For continued breastfeeding, [proportion of infants fed with breast milk in the previous day], For meal frequency [a frequency of 2 times for ages 6-8 months and 3 times for 9-11 months was considered adequate and milk feeding frequency for non-breastfed infants [proportion of infants 6-11 months who received at least 2 milk feedings during the previous day] was considered adequate]. For dietary diversity, a daily intake of 4 or more out of 7 food groups was considered adequate [15]. For consumption of iron rich and iron fortified foods, proportion of infants who received iron rich food or iron fortified food that is designed for infants or that is fortified at home. For responsive feeding, caregivers were expected to encourage the infant to eat the food served. Also, for hygiene, treatment of water by boiling water to boiling point and allow it to cool in a clean container was the acceptable practice.

Feeding practices was determined using the feeding practices variable for the questionnaire according to 24hr. dietary recall on complementary feeding practices [14]. The caregivers that answered yes to right practices was awarded 1 while the caregivers that answered no to right complementary feeding practices was awarded 0. The proportion of each variable was subjected to regression analysis. In addition, adjustment/controlling for the covariates such as caregivers age and parity was done during the analysis to cater for the design effect because it was the BHCs that were randomized into study groups and not the caregivers.

Logistical and ethical considerations

Ethical clearance was obtained from Ondo State Health Research Ethics Committee [OSHREC]. Letter of introduction to the coordinator of Owo LGA, BHCs was obtained from Ondo State Primary Health Care Development Board [OSPHCDB], Nigeria.

Results

The influence of nutrition education on complementary feeding practices of the caregivers

A regression analysis using Adjusted Relative Risk was carried out to determine the effect of the nutrition education on the feeding practices of the caregivers. The caregivers in the intervention group were 8 times more likely to feed the infant with minimum meal frequency than the caregivers in the control group at the midline [ARR: 8.13; CI: 3.12-21.19; $p < 0.001$] and 3.4 times at the end line [ARR: 3.41; CI: 2.36-5.22; $p < 0.001$]. The result showed that caregivers in the intervention group were 7 times more likely to feed their infants with diversified diet in terms of the complementary foods at midline [ARR: 7.89; CI: [4.47-13.92; $p < 0.001$] and 6.7 times at the end line [ARR: 6.66; CI: 4.43-8.84; $p < 0.001$]. Feeding the infants with minimum acceptable diet was 6.4 times more likely among the caregivers in the intervention group [ARR: 6.42; CI: 2.42-18.33; $p < 0.001$] at the midline and 3 times more likely at the end line [ARR: 3.13; CI: 2.53-5.16; $p < 0.001$] compared to the control group. This shows that the infants in the intervention group were more like to meet the minimum acceptable diet requirement compared to the infants in the control group, both at the midline and at the end line of the study.

Responsive feeding was more likely to be practiced among the caregivers in the intervention group than the caregivers in the control group [ARR: 2.12; CI: 1.72-2.65; $p < 0.001$] at the midline and 6 times more likely at the end line [ARR: 6.60; CI: 4.43-8.84; $p < 0.001$]. The responsive feeding practices were also established by caregivers during the FGDs. This was what a caregiver from the intervention group had to say; I did not believe that the different ways of encouraging the infants to accept complementary food could be achievable because of my experience with my first daughter, but this training helped me. Since the time we were taught on responsive feeding which was demonstrated to us in the health centre, I practiced responsive feeding on my infant and it was achievable." [CAREGIVER3, FGD2 2017] (Table 1).

Table 1: The influence of nutrition education on complementary feeding practices of the caregivers.

CBF practices	Baseline	p-value	Midline	p-value	End line	p-value
Timely introduction of CF						
ARR (CI) Soft/thick complementary foods	0.97(0.89-1.03)	0.289	2.23(2.64-3.43)	<0.001*	1.12(0.71-2.64)	<0.001*
ARR (CI) Meal Frequency 6-8 Months 9-11 Months	0.95(0.86-1.05)	0.689	8.18 (4.64-14.43)	<0.001*	2.13(1.71-2.64)	<0.001*
ARR (CI) Dietary Diversity (≥ 4)	0.97(0.94-1.01)	0.857	8.13 (3.12-21.19)	<0.001*	3.41(2.36-5.22)	<0.001*
ARR (CI) Minimum Acceptable Diet	1.00(0.81-1.25)	1	7.89 (4.47-13.92)	<0.001*	6.60(4.43-8.84)	<0.001*
ARR (CI) Iron Consumption	0.96 (0.75-1.25)	1	6.42 (2.42-18.33)	<0.001*	3.13 (2.53-5.16)	<0.001*
ARR (CI) Feeding during illness	1.01 (0.82-1.25)	1	2.59 (0.45-0.78)	<0.001*	2.77 (0.57-1.04)	<0.001*

ARR (CI) Responsive Feeding	0.91 (0.73-1.07)	0.44	2.48 (0.48-1.23)	<0.001*	2.83 (1.81-4.42)	<0.001*
ARR (CI) Treat water	1.00(0.54-1.78)	0.699	2.12 (1.72-2.65)	<0.001*	6.60 (4.43-8.84)	<0.001*
ARR (CI)	0.95 (0.91-0.99)	1	7.02 (4.18-11.80)	<0.001*	3.11(2.46-4.12)	<0.001*

Continued breastfeeding survival analysis

Adjusted Relative Risk analysis showed that 30% of the caregivers in the control group were less likely to continue breastfeeding, compared to the intervention group at the end line [ARR 0.30; CI: 0.16-0.56; p<0.001]. Additionally, survival analysis was performed on the continued breastfeeding practices of the caregivers in both groups to determine the probability of continued breastfeeding along with complementary feeding among the caregivers. From Kaplan-meire analysis, 69.7% of the caregivers in the control group continued with breastfeeding at age 11 months, compared to 94.4% of the caregivers in the intervention group [p<0.001].

Discussion

Despite research-based evidence on association of adequate complementary feeding practices and child survival. In Nigeria,

70% of caregivers did not have good adequate complementary feeding practices [16,17]. Only 17.5% of Nigerian infants received minimum acceptable diet during complementary feeding by the caregivers [18]. In South western Nigeria, the geopolitical zone where this study was carried out, only 17.8% of infants received minimum acceptable diet [MAD] while in Ondo State, only 11.4% received MAD [2]. This study showed the effect of nutrition education which improved the caregivers' complementary feeding practices. Prior to the commencement of complementary feeding practices at the baseline, there was no significant difference in the complementary feeding practices in the two groups. Some of the caregivers that introduced complementary feeding earlier than six months were among caregivers that participated in this study. Whether they introduced complementary feeding earlier or at appropriate time there was a significant improvement in the feeding practices among the caregivers that received nutrition education (Figure 3 & 4).

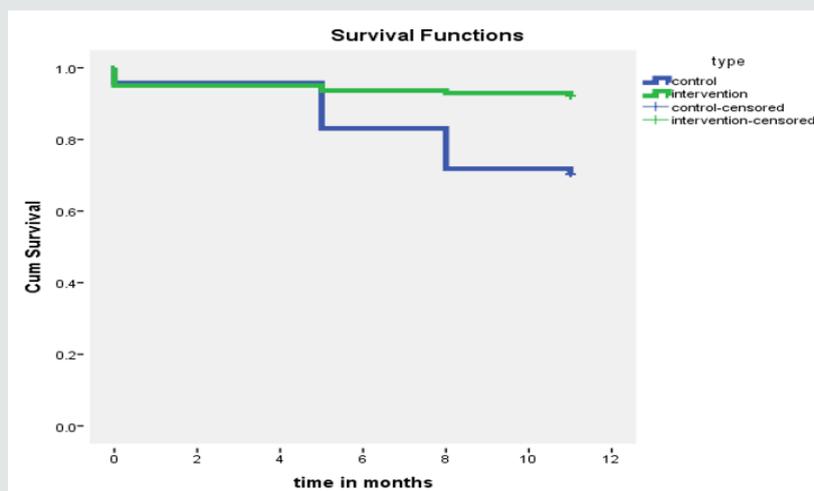


Figure 3: Survival function of caregivers continued breastfeeding.

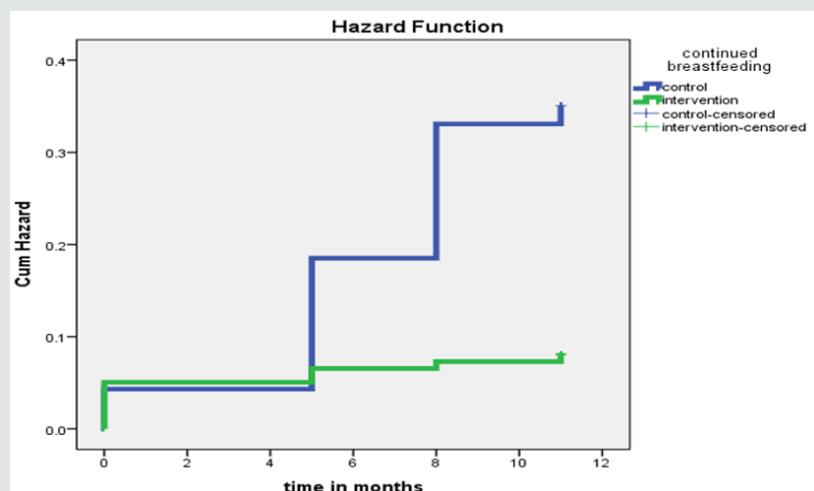


Figure 4: Hazard function of caregivers continued breastfeeding.

Force feeding ways of introducing complementary feeding among the caregivers in the control group showed poor feeding practices of the caregivers. There was lack of knowledge on responsive feeding which made the caregivers in the control group lack confidence to feed the infants. This resulted to force feeding as determined in this study, which could affect the timely introduction of the complementary feeding practices. Majority of the caregivers in the control group started force feeding due to the refusal of the complementary foods by the infants. The issue of early intolerance of the complementary foods by the infants was handled during the nutrition education using different techniques of responsive feeding through posters and food demonstrations. This study is in line with guiding principle of complementary feeding stated by the National Policy on infant and young child feeding in Nigeria [19], which declared that responsive feeding using psycho-social care should be adopted by mothers in Nigeria. To foster a reciprocal relationship between the parent or caregiver and the child, and thus practicing responsive feeding, was hypothesized to be beneficial to both parties [20]. Accelerated rate of death and pneumonia as a result of force feeding was a concern [21]. They further stated that force feeding leads to infections, collapsed lungs, digestive and pancreatic problems. Acceptable ways of introducing complementary feeding that will be acceptable by the infants and will not frustrate the effort of the caregivers which could lead to introduction of force feeding, was learnt by the caregivers in the intervention group during the nutrition education on complementary feeding. Lack of responsive feeding practices caused growth flatterer among the infants in low- and middle-income countries [22].

Therefore, responsive feeding techniques should be among the package for complementary feeding guidelines. To corroborate the effectiveness of nutrition education on responsive feeding, it was revealed that there was an improvement in the complementary feeding practices of caregivers in the intervention group as the caregivers in Kosovo were able to see more reasons to have patience and encourage the infants to eat complementary foods [23]. Consumption of iron rich foods was high among the infants in both groups and this agrees with the reports on consumption of iron rich foods in South-West Nigeria by [19]. The report revealed that 60.1% of infants in this geo-political zone consumed iron rich foods. Despite the high rate of consumption of iron rich foods in both groups, there was a wide margin of iron rich foods intake between the infants in the intervention group and control group in the present study. Increase in the intake of iron rich foods was due to the nutrition education that the caregivers in the intervention group received. Intakes of iron were lower by 16% among infants of 6-12 months than children of 13-36 months in an observational study in Brazilian Well Child Clinic [24]. There was an association between complementary foods and haemoglobin concentration among Indian infants [25]. The author stated that there was a positive association between the infants' haemoglobin concentration and fortified baby foods, breast milk and infant formula as well as fruits and vegetables to a lesser extent on the contrary to porridge or gruel. Iron deficiency [ID] is the most common micronutrient deficiency world-wide and young children are the special risk group because their rapid growth leads to high iron requirements [26].

Early initiation of complementary food using semi-solid, solid/soft food consistency and food diversification was improved among the caregivers in the intervention group. The knowledge acquired during the nutrition education was put into practice during the period of complementary feeding before the first birthday of the infants [age 12 months]. It was recommended that nutrition education is needed in West African countries to improve the knowledge of caregivers on complementary foods consistency as majority of mothers in West African countries feed the infants with thin gruel during complementary feeding [27]. Poor timing of initiation of complementary feeding led to 70% malnutrition among infants in Konaseema region of India therefore recommended nutrition intervention on complementary feeding [28]. Untimely initiation of complementary feeding was prevalent among caregivers in North eastern part of Ethiopia and that nutrition education on timely introduction of complementary feeding could improve the practices among mothers [29]. The infants in the intervention group had higher minimum meal frequency rates than the infants in the control group. This was similar to the findings which revealed that meal frequency increased according to the age of children study in South eastern of Ethiopia [30]. The increase in the percentage of the infants who were fed with minimum meal frequency was higher in the intervention group than the control group due to the effect of the nutrition education on the intervention group. This is in line with the findings which showed that there was an increase in meal frequency of infants whose mothers were in intervention group than the infants whose mothers were in the control group in Ethiopia [31]. The intervention group caregivers increased the meal frequency during illness of the infants during the study compared to the caregivers in the control group. Children poor appetite induced by illness can contribute to perpetuate vicious cycle of infectious diseases [32].

Dietary diversity during complementary feeding was achieved among the caregivers in the intervention earlier at midline of the study than the caregivers in the control group. The effect of the knowledge of the caregivers in the intervention group was noticeable in the minimum dietary diversity achieved during the feeding practices. There was higher number of infants who were fed on minimum dietary diversity in the intervention group than the control group. This study was in line with the study which showed significant difference between dietary diversity, meal frequency and feeding infants with iron containing foods among caregivers the intervention group and those in the control group in Uganda [33]. However, literature on intervention to improve the feeding practices of caregivers prior the commencement of the complementary feeding practices, and at different age of the infants' months was limited. Nutrition education improved dietary diversity among caregivers of infants between 6-23 months in Malawi [34]. Also, UNICEF showed that nutrition education is a catalyst for improving dietary diversity among caregivers in Lilongwe, Malawi [35]. Treatment of drinking water by the caregivers showed that the caregivers in the intervention group practiced good hygiene as compared to the caregivers in the control group. This could be the effect of the nutrition education received by the intervention group. The underlying determinants of undernutrition include food insecurity, inappropriate care practices, poor access to health care,

and an unhealthy environment, including access to portable water, sanitation, and hygiene [36] in [37]. In 2018 UNICEF declared that 88% of diarrhea deaths were due to lack of access to safe drinking water, poor sanitation and hygiene [38]. World Health Organization stated that nutrition outcome could be improved with better intervention on water, sanitation and hygiene [39].

The improvement in complementary feeding practices in the intervention group could be linked to the knowledge acquired during nutrition education. The intended feeding practices as noted at the baseline study as well as during FGDs and KIIs was to feed the infants with thin consistency. However, nutrition education was able to change the understanding of the caregivers on food consistency which in turn improved the feeding practices among the caregivers in the intervention group. Several studies have proved the need for nutrition education to improve complementary feeding practices of caregivers. Nutrition education was recommended as a viable tool to improve complementary feeding practices among mothers in Cross River State, Nigeria [18]. Nutrition education on complementary feeding is needed by caregivers in Sagamu, Nigeria to improve the infant feeding practices among mothers [40]. It was 30% of infants in Nigeria were adequately fed and therefore recommended nutrition education for the improvement of caregivers feeding practices [41].

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