



# **Effectiveness of Behaviour Change Communication for Mothers on Complementary Feeding Practices and Infants' Nutritional Status in Nigeria**

**Kolade Afolayan Afolabi<sup>1\*</sup> and Adebukunola Olajumoke Afolabi<sup>2</sup>**

<sup>1</sup>*Medical and Health Services, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria.*

<sup>2</sup>*Clinical Nursing Services, Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Osun State, Nigeria.*

## **Authors' contributions**

*This work was carried out in collaboration between both authors. Author KAF undertook the initial conceptualization of this study, the original draft, design, methodology, data curation, data analysis and final manuscript editing. Author AOA was responsible for supervision of data collection procedure, procurement of ethical clearance and final approval of this study draft and validation of research instruments. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

**Introduction:** The quality of feeding in early childhood depends on nutritional knowledge of mothers. Improving maternal nutrition knowledge is therefore pivotal towards promoting effective infants' feeding behaviour.

**Objective:** Study assessed mothers' knowledge about complementary feeding and complementary feeding practices. Study also assessed effectiveness of Behaviour Change Communication on mothers' knowledge and complementary feeding practices, compared the nutritional status of infants whose mothers received intervention to infants of mothers in the control group.

**Materials and Methods:** A quasi-experimental study conducted among 204 mothers in rural and urban local government areas, South-west Nigeria between March and September, 2019. Sample size was estimated using formula for comparison of two proportions, eligible mothers were

\*Corresponding author: Email: [doctorafolabi2@yahoo.com](mailto:doctorafolabi2@yahoo.com);

selected through multistage sampling technique. Study was conducted in three phases: pre-intervention phase, intervention and post intervention phases.

**Intervention:** Selected mothers were randomly assigned into intervention and control groups. Mothers in the intervention group received Behavior Change Communication on complementary feeding and were followed up for six months.

**Data Analysis:** Data was analyzed using SPSS software version 25, Chi-square and repeated analysis of variance evaluated effectiveness of intervention, level of significance was  $< 0.05$ .

**Results:** BCC improved mothers' knowledge about complementary feeding by 31.9% ( $\chi^2 = 21.62$ ;  $p = 0.001$ ), meal frequency by 16% ( $\chi^2 = 5.88$ ,  $p = 0.01$ ), dietary diversity by 19.6% ( $\chi^2 = 7.44$ ,  $p = 0.01$ ), minimum acceptable diet by 20.6% ( $\chi^2 = 13.09$ ;  $p = 0.01$ ). Intervention also reduced underweight by 14% ( $\chi^2 = 0.69$ ,  $p = 0.01$ ); ( $F(1,191) = 275.34$ ;  $p = 0.04$ ) among intervention group.

**Conclusion:** Effective nutritional intervention for mothers towards improving nutritional status of children should incorporate appropriate behaviour change approach. This approach is capable of improving nutritional status of infants and children and consequently reduce malnutrition and related complications in early childhood.

*Keywords: Behaviour Change Communication (BCC); complementary feeding Practices; infants' nutritional status; Nigeria.*

## 1. INTRODUCTION

Appropriate nutrition during infancy and early childhood is vital towards safeguarding overall healthy growth and development of children [1]. Nearly half of all deaths among under-five children worldwide are attributed to nutrition related matters and majority of these deaths occurred in Asia and Africa [2]. Global estimate showed that about 22.9% of under-five children are stunted in the developed countries while in Africa; Central Africa accounted for 32.5%, Southern Africa 28.1%, Northern Africa 17.6% and West Africa 31.4% [2]. In addition, approximately 45% of all deaths among under five children were related to under nutrition which often occur in middle and low income countries of the world particularly in Africa and Asia [3].

In Nigeria, the National Nutrition and Health Survey, NNHS [4] revealed that acute malnutrition among children under five in Nigeria was between 5% and 9.9%, the prevalence of underweight was 19.9%. This was close to 22% obtained in the Central and West Africa. In addition, the prevalence of stunting was 32% which was considered the highest in Nigeria since 2014 with some states in the North-West and North-Eastern part of Nigeria recording significantly high prevalence of 40% and higher.

Studies have however investigated predisposing factors to the observed high incidence of morbidity and mortality among under five children especially in Nigeria; for instance, the Nigeria National Bureau of Statistics, NBS [5] reported that the predisposing factors of malnutrition among Nigerian under-fives especially in the first

two years of life include inappropriate complementary feeding practices. Appropriate complementary feeding practices have however been recommended to commence from the sixth month when only breast milk could not meet the dietary demands of infants. The report further stated that infants in Nigeria receive complementary foods either too early or in most cases, the diet received are inadequate with respect to nutritional value, protein, energy and micronutrients, quantities and frequency of food.

Incidentally, findings from previous survey have demonstrated that the quality and quantity of feeding in early childhood depend largely on the basic nutritional knowledge of mothers [6,7]. Improving infants' feeding practices through nutrition education for mothers and caregivers has therefore been observed to significantly reduce stunting and its related burden of diseases among infants and young children [8,9]. Nutrition education thus refers to any combination of educational approaches, planned to encourage voluntary acceptance of food varieties and other food and nutrition-related behaviours beneficial to health and well-being [8]. Nutrition education is delivered through various means and includes activities of individual, community, and policy makers [9]. Such nutritional education program will help in improving health outcomes, contribute to maintaining a healthy weight and lowering the chances of developing weight-related chronic diseases [10].

Mothers are the principal providers of primary care for children especially during early

childhood and the quality of care and feeding practices of a child depends to a large extent on the mother's knowledge and understanding of basic nutritional needs [6]. Improving maternal nutrition knowledge about infant feeding has therefore been observed to be pivotal towards promotion of appropriate infants feeding behaviour [1]. Similarly, studies have also acknowledged the impact of nutrition education for mothers towards enhancing appropriate feeding practices, dietary diversity and child optimal growth [11,12].

In spite empirical evidences from previous studies supporting the importance of nutrition education of mothers, previous and existing design of nutrition education packages for mothers have recorded marginal improvement in the relevant indicators (food variety /diversity, feeding frequency) relating to infants diet and nutritional status [12,13]. This could be due to the fact that existing nutrition education intervention packages could only achieve minimal behavioural changes that are essential for meaningful improvement in infant feeding practices. Furtherance to the above, the national policy on Infant and Young Child Feeding (IYCF) in Nigeria recommend development of Communication for Behaviour and Social Change packages (CBSC) expected to deliver appropriate, technically appropriate up-to-date information on optimal infant and young child feeding [14]. Nutrition education communication based on behaviour and social change approach through the application of appropriate theory of change have been recommended for effective dissemination and implementation of the policy on infant and young child feeding in the Nigeria [14,15]; the effectiveness of this approach has not been fully explored in this study area. This study therefore applied Social Cognitive theory into Behaviour Change Communication (BCC) package as a nutrition intervention for infants' mothers in South-west Nigeria. Social Cognitive Theory (SCT) established by Albert Bandura [16] describes a triadic reciprocal phenomenon in which behaviour, cognition (and other personal factors) and environmental factors influence each other bi-directionally. Social Cognitive theory describes the effect on individual, the actions of others and environmental factors on individual's health behaviour through instilling expectations, self-efficacy and use of reflective education to realize desired behaviour change.

This study therefore assessed mothers' baseline knowledge about complementary feeding and

complementary feeding practices. Study also assessed the effectiveness of the behaviour change communication on mothers' knowledge and complementary feeding practices among the intervention group and compared the nutritional status of infants whose mothers received an intervention and infants of mothers in the control group. These were with a view to improving the present nutritional educational intervention for mothers and primary care givers and to make appropriate recommendations for better compliance with existing policies and guidelines on infant and young child feeding in Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Design

Study was a quasi-experimental study, conducted in three phases: pre-intervention phase, intervention and post intervention phases. At the pre-intervention phase, selected mothers and their infants were randomly assigned into control and intervention groups following which baseline data relating to mothers' socio-demographic characteristics, knowledge about complementary feeding, complementary feeding practices and infants' nutritional status in both groups were collected.

At the intervention phase, mothers in the intervention group received three sessions of monthly Behaviour Change Communication on complementary feeding for three consecutive months while mothers in the control group received routine health talks only. Mothers and their infants in both groups were followed up for a period of six months (this included the three months of intervention) following which the effectiveness of the intervention was evaluated. The post-intervention phase of this study assessed the effectiveness of the BCC on mothers' knowledge about complementary feeding, complementary feeding practices and infants' nutritional status in the intervention group.

### 2.2 Study Setting

Study was conducted in Osun state, South-west Nigeria between March and September, 2019. Osun state covers total landmass of about 12,820 square kilometers. Politically, the state is divided into three Senatorial districts with a total of 30 Local Government Areas (LGAs) and one area office. The state is located within the interior of the cocoa belt of South-western Nigeria. The

2006 National Population Census, published that Osun States has an estimated population of about 3,423,535 residents with about 1,740,619 males and 1,682,916 females. Osun state has 30 Local Government Areas (LGAs) and one area office which are organized into three Federal Senatorial districts: Osun Central Senatorial district, Osun East Senatorial district and Osun West Senatorial district. Nineteen out of the 30 Local Government Areas (LGAs) are designated as rural Local Government Areas while 11 LGAs are considered urban. The major sub-ethnic groups of the Yorubas in Osun State are the Ife people, the Ijeshas, Oyo and Igbominas, though there are also people from other parts of Nigeria such as the Ibos, Itsekiris, Ijaws, Hausas, Igalas, Fulanis and several other ethnic groups. Yoruba and English are the official languages. The people of the state are mostly farmers, producing cash crops such as cocoa, and palm produce and food crops such as yam, maize, cassava, beans, plantain, banana and cocoyam.

### 2.3 Study Population

The study involved mothers in selected Local Government Areas, Osun state. The selected Local Government Areas were Ife Central, Ife East, Oriade and Atakunmosa West Local Government Areas.

### 2.4 Inclusion Criteria

Mothers or primary care givers whose infants were six month old were included in this study. This was to reduce the possibility of recall bias about pregnancy history and feeding type in the first 6 months of life.

### 2.5 Exclusion Criteria

Mothers whose infants had gross congenital or chronic abnormalities such as cleft lips, cleft palates, gross neurological deficits which could impair feeding or anthropometric measurements were excluded from this study.

### 2.6 Sample Size Determination

Sample size for this study was estimated using the formula for comparison of two proportions [17] with the equation;  $n = (Z_{\alpha} + Z_{\beta})^2(P_0(1-P_0) + (P_1(1-P_1) / (P_1 - P_0)^2$ .

$n$ =minimum sample size for each group,  $Z_{\alpha}$  = standard normal deviate corresponding to the probability of making type I error ( $\alpha$ ) at 95%

(level of significance) = 1.96 ,  $Z_{\beta}$  = standard normal deviate corresponding to the probability of making type II error ( $\beta$ ) at 90% (Power of the test at 80%) = 0.842.  $P_1$  is the proportion of mothers whose infants were fed in accordance with the recommendation of Infants and Young Child Feeding (IYCF) practices estimated to be 11% [18],  $P_2$  is the proportion of mothers expected to be fed their infants in accordance with recommendation of Infants and Young Child Feeding practices. This study aims at improving on the present proportion from 11% to 20% (maternal nutrition education is capable of achieving 20% reduction in malnutrition among under-five [19]. With the 10% attrition rate, minimum sample size was approximated to 102 mothers per group, giving a total estimated sample size of 204 mothers (for both control and intervention groups).

### 2.7 Sampling Technique

A multistage sampling technique was employed for this study: In the first stage, one senatorial district was selected out of the three senatorial districts in Osun state by simple random sampling technique. Stage two involved selection of two rural and two urban Local Government Areas from a list of rural and urban LGAs within the Senatorial district [20] by simple random sampling technique giving a total of four LGAs. The selected LGAs were randomly assigned into intervention and control groups. In stage three, one Primary Health Care Centre (PHC) was purposively selected (PHCs with highest number of daily attendees obtained during a preliminary survey) from each rural and urban LGAs to give a total of four PHCs. In the fourth stage, mothers who met the inclusion criteria were purposively selected in the Primary Health Care Centres. Mothers were selected during their visit to the PHCs in selected Local Government Areas. Selection of mothers continued daily until the required number of mothers from each Primary Health Centre was attained. A total of 204 mothers (102 mothers each for study and control groups) were selected.

### 2.8 Instruments Data Collection

#### 2.8.1 Semi-structured questionnaire

Semi-structured questionnaire was used to collect quantitative data. The questionnaire contained sections A-E: Sections A and B (adapted from Nigeria Demographic and Health Survey, NDHS) [18] ; section A obtained

information about background characteristics of infants' mothers, section B obtained information about child's pregnancy history, history of delivery and immunization, child's age, sex and child's breastfeeding history. Section C is adapted from Food and Agricultural Organisation (FAO) guidelines for assessing nutrition-related model questionnaires [21]. This section has ten items which assessed mothers' knowledge about complementary feeding. Section D (Adapted from Food and Agriculture Organization (FAO) dietary assessment) [21] is a 24 hour infants' food recall. The section obtained information on mothers' feeding practices using WHO/IYCF indicators [22]: Minimum meal frequency, Minimum dietary diversity and Minimum acceptable diet. Information regarding these indicators were obtained by recall of food and liquid consumed by infants the previous day prior to data collection. Section E contained information on infants' anthropometry: length, weight, mid-upper arm circumference.

### **2.8.2 Instruments for anthropometric measurements**

An MB130 Detecto digital baby weighing scale was used to weigh infants. The scale has a digital display, calibrated to the nearest 0.1kg, a removable tray and has a maximum weighing capacity up to 20 kg. A measuring board calibrated to the nearest 0.1cm with a stationary vertical headboard and a movable distal part which ensures accurate measurements.

### **2.8.3 Validity of research instruments**

Face and content validity of the research instruments were undertaken by subjecting the instruments to review by experts in the field of Public Health, Paediatrics and Child Health, Nutrition and Dietetics, Demography and Social Statistics. Each item of the instruments was reviewed to ensure appropriateness and ability to meet up with the stated objective. Necessary corrections were effected after review by experts.

### **2.8.4 Reliability of research instruments**

Internal consistency of the questionnaire was examined by calculating the Cronbach's alpha value for the questionnaire; Cronbach's alpha of 0.74 was obtained. The research instruments were also pre-tested twice among 25 infants mothers at Primary Health Centre, Ipetumodu, Osun state, South-west Nigeria (a different Primary Health Care Center in South-west

Nigeria with similar geographical and socio-political characteristics to the study area) to ensure stability of the research instruments.

## **2.9 Outcome Variables**

In this study are:

- a. Infants' nutritional status.
- b. Mothers' complementary feeding practices: These were assessed based on indicators as recommended by WHO Guideline on Infants and Young Child Feeding [22] and National Guideline on Infants and Young child Feeding [14].

## **2.10 Independent Variables**

Main independent variables: Mothers' knowledge about complementary feeding practices. Other independent variables are selected mothers' socio-demographic characteristics.

## **2.11 Training of Research Assistants**

Six research assistants were trained on the aim and objectives of the study, data collection, explanation of the questionnaire to infants' mothers. Two experts in the field of Nutrition and Dietetics also functioned as nutrition educators.

## **2.12 Data Collection Procedure**

Mothers' knowledge about complementary feeding was assessed using section C of the interviewer-administered questionnaire. The section has 10 items which assessed mothers' knowledge about complementary feeding. Birth weights and age of infants were obtained from child health records. Lengths (Height) of infants were measured using measuring board (crown-heel length). Infants were made to lie in a supine position on the measuring board with the crown of the head touching the stationary vertical headboard. An assistant ensured that the legs remained flat on the measuring board while the movable part of the measuring board was shifted against the heels. Values were recorded in the nearest 0.1 cm.

Child's weight was measured in light clothes (excluding shoes, belts, and sweaters) using digital weighing scale and was also recorded in the nearest 0.1 kg. Two measurements were taken and the mean recorded. Corresponding z scores; (Weight for Age z scores (WAZ), Height for Age z scores (HAZ) and Weight for Height z

scores (WHZ) were derived using Emergency Nutritional Assessment (ENA) for Scientific Monitoring and Relief Treatment (SMART) software version 2011 [23].

### **2.13 Procedure for Behaviour Change Communication for Mothers on Complementary Feeding Practices**

Behaviour Change Communication aimed at improving mothers' knowledge about complementary feeding and motivating them to adopt change in behaviour with respect to appropriate complementary feeding practices.

### **2.14 Materials for Behaviour Change Communication (BCC)**

**1. The BCC guide:** The BCC guide was adopted from the recipe book on complementary feeding for children aged 6-23 months for mothers [24], complementary feeding guidelines for young children in developing countries [25]. Local food items, preparation recipes and feeding styles were incorporated into the BCC guide. The draft BCC guide was subjected to review by experts in nutrition education, nutrition and dietetics for scrutiny. The BCC guide had two sections: section 1 was on hygiene practices and food safety while section 2 was on appropriate feeding practices. The BCC guide was translated into Yoruba language (local dialect) for better understanding of mothers. The BCC was undertaken with the assistance of two experts in the field of Nutrition and Dietetics who also functioned as nutrition educators.

**2. Information Education Communication (IEC) materials:** These included visual aids, charts and other teaching materials.

**3. Samples of food items:** Samples of local food items such as rice, beans, yam, corn, guinea corn, soya bean, eggs, fish, crayfish, meat, milk and other cooking materials were used for demonstration during the BCC practical sessions.

### **2.15 Method of Behaviour Change Communication**

Behaviour Change Communication sessions were held monthly for three consecutive months for mothers in the intervention group in a designated Primary Health Care Centre in the selected one rural and one urban Local

Government Areas. Mothers were divided to smaller groups of ten participants giving rise to five groups in each selected Local Government Areas. Participatory learning methods was employed for the group discussion which encouraged mothers to contribute, ask questions, and clarify issues. The BCC sessions were conducted by trained nutrition educators, the researcher and trained research assistants. Major aspects of infants feeding practices namely food safety and personal hygiene and appropriate feeding practices based on WHO's IYCF indicators were considered. Each session of the BCC lasted about ninety minutes and was conducted in two phases:

#### **Phase1: Group discussion**

Discussions were held on food hygiene, food storage and safe food handling, recipe for preparation of infant food using locally available food items, appropriate frequency of feeding for infants for age, adequacy of food intake for infants, varieties and food combinations using locally available food items.

#### **Phase2: Motivational practical demonstrations**

During this phase, mothers were encouraged to demonstrate observed skills through 'hand-on' practical sessions on use of locally available food items and appropriate combinations of these food items to make nutritious food available for infants. Efforts were made to stimulate self-efficacy in mothers that effective infant feeding can be achieved. Mothers were motivated to set daily goals regarding their infant feeding frequency of 3-4 times daily in addition to in-between meals or snacks, committing more time to feeding and appropriate combination of locally available food items.

### **2.16 Data Analysis**

Data obtained were processed and analyzed using IBM SPSS software version 25, findings presented using frequency and percentage distribution while associations between dependent variable and independent variable were evaluated using appropriate statistic. P-value of less than 0.05 was considered significant.

Each correct answer of the 10 items on mothers' knowledge about complementary feeding was scored '1' point while incorrect answer was

scored '0' point. Scores on the ten-item scale assessing mothers' knowledge about complementary feeding were summed up to give a total of ten points: mothers who scored 0-4 points were categorized as having poor knowledge about complementary feeding, mothers who scored 5-10 were categorized as having good knowledge. Findings at pre-intervention phase were compared with that of post-intervention phases while differences and similarities were examined using chi-square statistic.

Complementary feeding practices were assessed based on the indicators as recommended by WHO for Infants and Young Child Feeding [21]:

a. Minimum meal frequency is proportion of infants who receives at least the minimum meal frequency appropriate for age in the last 24 hours prior the survey: a child was assessed to have taken 'adequate number of meals' if an infant received at least the minimum meal frequency appropriate for age in addition to breastfeeding in last 24 hours [22].

b. Minimum Dietary Diversity (MDD): WHO defined Minimum Dietary Diversity as the proportion of children aged six months and above who received foods from at least four out of the seven recommended food groups. The seven food groups used for calculating minimum dietary diversity indicator were: grains, roots and tubers; legumes and nuts; dairy products like milk; fleshy foods such as meat and fish; eggs; vitamin A rich fruits and vegetables; other fruits and vegetables. The dietary diversity score ranged from 0-7 with minimum of '0' if an infant did not consume any of the food groups and 7 if infant receives all the food groups. Thus, from the dietary diversity score, the minimum dietary diversity indicator was approximated using the WHO recommended cut-off point with a value of "1" if an infants at least four out of the seven food groups and "0" if infant eats less.

c. Minimum acceptable diet in this study is a composite variable involving minimum dietary diversity and minimum meal frequency: infants who received both the minimum diversity and the minimum meal frequency the previous day were considered to have met the minimum acceptable diet.

Assessment of infant's nutritional status was done at base line and was repeated at the 12<sup>th</sup> month (post intervention) using WHO infants'

growth indicators. Infants whose length for age Z-score, weight for length Z-score and weight for age Z-score were between -2.0 to 2.0 were categorized as normal; stunting (length for age z-score: < -2.0); Wasting (weight for length z-score: < -2.0) and Underweight (weight for age z-score: < -2.0). Two-way repeated measure analysis of variance (ANOVA) was performed to assess the effectiveness of the Behaviour Change Communication (BCC) intervention on infants' nutritional status within groups and in-between groups.

### 3. RESULTS

A total of 204 mothers (102 in the intervention and 102 in the control groups) were recruited for the study. One hundred and ninety three mothers comprising of 96 (94.1% response rate) among control group and 97 (95.0% response rate) among the intervention group were considered in the final statistical analysis. Findings showed that 41 (42.7%) mothers in the control and 36 (37.1%) mothers in the intervention groups were aged 25-29 years old, with mean age 27 years for infants' mothers in the control group and 26years for infants' mothers in the intervention group (Table 1).

The socio-demographic characteristics of mothers in both intervention and control groups were statistically comparable at the pre-intervention phase.

Thirty six (37.5%) infants in control and 41 (42.3%) in the intervention group commenced complementary feeding within the first three months after delivery; 28 (29.2%) infants in control group and 26 (26.8%) among the intervention group however commenced complementary feeding at the sixth month. The personal characteristics of index infants in both groups were statistically comparable at the pre-intervention phase (Table 2).

The nutritional status of infants among infants in control and intervention groups were statistically comparable at the pre-intervention phase (weight for age,  $p = 0.64$ ; weight for height,  $p = 0.82$ ; height for age,  $p = 0.40$ ) (Table 3).

Mothers' knowledge about complementary feeding among both intervention and control groups at the pre-intervention phase was statistically comparable ( $p = 0.61$ ) (Table 4).

**Table 1. Socio-demographic characteristics of mothers**

<b>Variables</b>	<b>Control group n (%)</b>	<b>Intervention group n (%)</b>	<b>Total n (%)</b>	<b>Statistic <math>\chi^2</math></b>	<b>df</b>	<b>p</b>
<b>Mothers' Age (years)</b>				0.80	4	0.93
Less than 20	5 (5.2)	5 (5.2)	10 (5.2)			
20-24	26 (27.1)	31 (32)	57 (29.5)			
25-29	41 (42.7)	36 (37.1)	77 (39.9)			
30-34	19 (19.8)	19 (19.6)	38 (19.7)			
35-39	5 (5.2)	6 (6.2)	11 (5.7)			
<b>Marital status</b>				2.01	2	0.37
Married	91 (94.8)	87 (89.7)	178 (92.2)			
Single	4 (4.2)	9 (9.3)	13 (6.7)			
Widowed	1 (1.0)	1 (1.0)	2 (1.0)			
<b>Family type</b>				3.20	2	0.20
Monogamous	78 (81.3)	69 (71.1)	147 (76.2)			
Polygamous	14 (14.6)	19 (19.6)	33 (17.1)			
Single parents	4 (4.2)	9 (9.3)	13 (6.7)			
<b>Parity</b>				1.30	2	0.52
Primipara	19 (19.8)	22 (22.7)	41 (21.2)			
Multipara	76 (79.2)	72 (74.2)	148 (76.7)			
Grand multi para	1 (1.0)	3 (3.1)	4 (2.1)			
<b>Highest level of education</b>				0.80	3	0.85
No education	12 (12.5)	7 (7.2)	12 (6.2)			
Primary	8 (8.3)	9 (9.3)	17 (8.8)			
Secondary	60 (62.5)	55 (56.7)	115 (59.6)			
Tertiary	23 (24.0)	26 (26.8)	49 (25.4)			
<b>Employment status</b>				0.70	3	0.87
Not employed	12 (12.5)	15 (15.5)	27 (14)			
Self-employed	63 (65.6)	60 (61.9)	123 (63.7)			
Employed by Government	15 (15.6)	14 (14.4)	29 (15)			
Employed in private sector	6 (6.3)	8 (8.2)	14 (7.3)			
<b>Place of residence</b>				0.30	1	0.61
Rural	50 (52.1)	47 (48.5)	97 (50.3)			
Urban	46 (47.9)	50 (51.5)	96 (49.7)			
<b>Ethnicity</b>				2.28	3	0.41
Yoruba	73 (76.0)	64 (66.0)	137 (71.0)			
Hausa	13 (13.5)	17 (17.5)	30 (15.5)			
Igbo	8 (8.3)	11 (11.3)	19 (9.8)			
Urhobo / Itsekiri	2 (2.1)	5 (5.2)	7 (3.6)			
<b>Religion</b>				1.31	2	0.53
Christianity	62 (64.6)	55 (56.7)	117 (60.6)			
Islam	31 (32.3)	38 (39.2)	69 (35.8)			
Traditionalist	3 (3.1)	4 (4.1)	7 (3.6)			



**Table 2. Personal characteristics of index infants**

Variables	Control group (n=96) n (%)	Intervention group (n=97) n (%)	Total n (%)	Statistic		
				$\chi^2$	df	p
<b>Sex</b>				0.13	1	0.72
Male	38 (39.6)	36 (37.1)	74 (38.3)			
Female	58 (60.4)	61 (62.9)	119 (61.7)			
<b>Birth weight (kg)</b>				0.16	1	0.58
Low Birth Weight	20 (20.8)	18 (18.6)	38 (19.7)			
Normal Birth weight	76 (79.2)	79 (81.4)	155 (80.3)			
<b>Immunization Status</b>				0.35	1	0.55
Fully immunized	84 (87.5)	82 (84.5)	166 (86.0)			
Not fully immunized	12 (12.5)	15(15.5)	27 (14.0)			
<b>Time of commencement of Breastfeeding after birth</b>				2.72	2	0.26
Within 1 hour	13 (13.5)	22 (22.7)	35 (18.1)			
Between 1 hour and 24 hours	48 (50.0)	44 (45.3)	92 (47.7)			
After 24 hours	35 (36.5)	31(32.0)	66 (34.2)			
<b>Types of Breastfeeding in the first 6 month after delivery</b>				0.13	1	0.72
Exclusive breastfeeding	28 (29.2)	26 (26.8)	54 (28.0)			
Mixed feeding	68 (70.8)	71 (73.2)	139 (72.0)			
<b>Age at Commencement of Complementary feeding (months)</b>				0.46	2	0.80
≤ 3months	36 (37.5)	41 (42.3)	77 (39.9)			
4-5months	32 (33.3)	30 (30.9)	62 (32.1)			
6 months	28 (29.2)	26 (26.8)	54 (28.0)			
<b>Breastfeeding Status at 12 months old</b>				8.95	1	0.27
Stopped breastfeeding	26 (27.1)	10 (10.3)	36 (18.7)			
Still breastfeeding	70 (72.9)	87 (89.7)	157 (81.3)			

**Table 3. Nutritional status of index infants at pre-intervention phase**

Indicator	Control group (n=96) n (%)	Intervention group (n=97) n (%)	Total n (%)	Statistic		
				$\chi^2$	df	p
<b>Weight for Age</b>				0.21	1	0.64
Underweight	22 (22.9)	25 (25.8)	47 (24.4)			
Normal	74 (77.1)	72 (74.2)	146 (75.6)			
<b>Height for Age (Stunting)</b>				0.71	1	0.40
Stunted	5 (5.2)	8 (8.2)	13 (6.7)			
Normal	91 (94.8)	89 (91.8)	180 (93.3)			
<b>Weight for Height (Wasting)</b>				0.05	1	0.82
Wasted	16 (16.7)	15 (15.5)	31 (16.1)			
Normal	80 (83.3)	82 (84.5)	162 (83.9)			

**Table 4. Mothers' knowledge about complementary feeding at pre-intervention phase**

Knowledge	Control group (n=96)	Intervention group (n=97)	Total n (%)	Statistic		
	n (%)	n (%)		$\chi^2$	df	p
Poor	46 (47.9)	50 (51.5)	96 (49.7)	0.25	1	0.61
Good	50 (52.1)	47 (48.5)	97 (50.3)			

**Table 5. Complementary feeding practices at pre-intervention phase**

Complementary Feeding	Control group (n=96)	Intervention group (n=97)	Total n (%)	Statistic		
	n (%)	n (%)		$\chi^2$	df	p
<b>Meal Frequency</b>				0.21	1	0.64
2-3 times	74 (77.1)	72 (74.2)	146 (75.6)			
3-4 times	22 (22.9)	25 (25.8)	47 (24.4)			
<b>Minimum Dietary Diversity</b>				0.06	1	0.81
Inadequate	59 (61.5)	58 (59.5)	117 (60.6)			
Adequate	37 (38.5)	39 (40.2)	76 (39.4)			
<b>Minimum Acceptable Diet</b>				0.52	1	0.47
Inadequate	84 (87.5)	88 (90.7)	172 (89.1)			
Adequate	12 (12.5)	9 (9.3)	21 (10.9)			

**Table 6. Mothers' knowledge about complementary feeding at post-intervention phase**

Mothers' Knowledge	Control Group		Intervention Group	
	Pre-Intervention n (%)	Post Intervention n (%)	Pre-Intervention n (%)	Post Intervention n (%)
Poor	46 (47.9)	36 (37.5)	50 (51.5)	19 (19.6)
Good	50 (52.1)	60 (62.5)	47 (48.5)	78 (80.4)
Total	96 (100.0)	96 (100.0)	97 (100.0)	97 (100.0)
Statistic	$\chi^2 = 2.13$ ; df = 1; p = 0.15		$\chi^2 = 21.62$ ; df = 1; p = 0.001	

**Table 7. Complementary feeding practices of mothers at post-intervention phase**

Complementary Feeding	Control Group		Intervention Group	
	Pre-Intervention n (%)	Post Intervention n (%)	Pre-Intervention n (%)	Post Intervention n (%)
<b>Meal frequency</b>				
2-3 times	74 (77.0)	67 (69.8)	72 (77.0)	56 (57.7)
3-4 times	22 (22.9)	29 (30.2)	25 (25.8)	41 (42.5)
Statistic	$\chi^2 = 1.31$ ; df = 1; p = 0.25		$\chi^2 = 5.88$ ; df = 1; p = 0.01	
<b>Minimum Diversity</b>				
Inadequate	59 (61.5)	53 (55.2)	58 (59.5)	39 (40.2)
Adequate	37 (38.5)	43 (44.8)	39 (40.2)	58 (59.8)
Statistic	$\chi^2 = 0.77$ ; df = 1; p = 0.38		$\chi^2 = 7.44$ ; df = 1; p = 0.01	
<b>Minimum Acceptable Diet</b>				
Inadequate	84 (87.5)	76 (79.2)	88 (90.7)	68 (70.1)
Adequate	12 (12.5)	20 (20.8)	9 (9.3)	29 (29.9)
Statistic	$\chi^2 = 2.40$ df = 1; p = 0.12		$\chi^2 = 13.09$ ; df = 1; p = 0.01	

Table 5 also showed that complementary feeding practices among intervention and control groups were also statistically comparable at pre-intervention phase (meal frequency,  $p = 0.64$ ; minimum dietary diversity,  $p = 0.81$  and minimum acceptable diet,  $p = 0.47$ ).

At the post-intervention phase, findings revealed that the proportion of mothers in the intervention group who had good knowledge about complementary feeding increased by 31.9% from 47 (48.5%) at pre-intervention phase to 78 (80.4%) at post-intervention phase while the proportion of mothers who had poor knowledge about complementary feeding reduced correspondingly. These changes were statistically significant ( $\chi^2 = 21.62$ ;  $p = 0.001$ ) (Table 6). Similarly, the proportion of mothers who had good knowledge about complementary feeding in the control group increased from 50 (52.1%) at pre-intervention phase to 60 (62.5%) at post-intervention phase. The increase in the proportion of mothers who had good knowledge at the post-intervention phase among the control group was not statistically significant ( $\chi^2 = 2.13$ ,  $p = 0.15$ ) (Table 6).

This study also revealed that the proportion of mothers who fed their infants 3-4 times a day among the intervention group increased by 16% from 25 (25.8%) at pre-intervention phase to 41 (42.5%) at post intervention phase (Table 7). This increase was statistically significant ( $\chi^2 = 5.88$ ,  $p = 0.01$ ) while the proportion of mothers among the control group who fed their infants 3-4 times a day also increased from 22.9% at pre-intervention phase to 30.2% at post intervention phase. This increase was however not statistically significant ( $\chi^2 = 1.31$ ,  $p = 0.25$ ).

Furthermore, the proportion of mothers in the intervention group who fed their infants with adequate meal diversity significantly increased significantly from 39 (40.2%) at the pre-intervention phase to 58 (59.8%) at the post-intervention phase; an increase of about 19.6 % ( $\chi^2 = 7.44$ ,  $p = 0.01$ ) whereas there was only 6.3% increase from 37 (38.5%) at the pre-intervention to 43 (44.8%) at post-intervention phase among mothers in the control group ( $\chi^2 = 0.77$ ;  $p = 0.38$ ). Table 7 also showed that the proportion of mothers in the intervention group who fed their infants with minimum acceptable diet increased from 9 (9.3%) at the pre-intervention phase to 29 (29.9%) at the post intervention phase ( $\chi^2 = 13.09$ ;  $p = 0.01$ ). This increase was statistically significant. The proportion of mothers in the control group who fed their infants with minimum acceptable diet however increased from 12 (12.5%) at the pre-intervention phase to 20 (20.8%) at the post-intervention phase. This increase was however not statistically significant ( $\chi^2 = 2.40$ ;  $p = 0.12$ ).

This study also observed 14% reduction in the proportion of under-weight infants among the intervention group from 25 (25.8%) at pre-intervention phase to 11(11.3%) post intervention. This change in the proportion of under-weight among the intervention group was statistically significant ( $\chi^2 = 0.69$ ,  $p = 0.01$ ). Only 3% reduction in under-weight (from 22 (22.9%) at pre-intervention phase to 19 (19.8%) post intervention) was observed among infants in the control group ( $\chi^2 = 0.28$ ,  $p = 0.60$ ) (Table 8).

**Table 8. Nutritional status of index infants at post-intervention phase**

Indicator	Control Group		Intervention Group	
	Pre-Intervention n (%)	Post Intervention n (%)	Pre-Intervention n (%)	Post Intervention n (%)
<b>Weight for Age</b>				
Underweight	22 (22.9)	19 (19.8)	25 (25.8)	11 (11.3)
Normal weight	74 (77.1)	77(80.2)	72 (74.2)	86 (88.7)
Statistic	$\chi^2 = 0.28$ , df = 1, $p = 0.60$		$\chi^2 = 0.69$ , df = 1, $p = 0.01$	
<b>Stunting</b>				
Stunted	5 (5.2)	6 (6.3)	8 (8.2)	5 (5.2)
Normal	91 (94.8)	90 (93.8)	89 (91.8)	92 (94.8)
Statistic	$\chi^2 = 0.10$ , df = 1, $p = 0.76$		$\chi^2 = 0.74$ , df = 1, $p = 0.39$	
<b>Wasting</b>				
Wasted	16 (16.7)	15 (15.6)	15 (15.8)	7 (7.2)
Normal	80 (83.3)	81 (84.4)	82 (84.5)	90 (92.8)
Statistic	$\chi^2 = 0.04$ , df = 1, $p = 0.85$		$\chi^2 = 3.28$ , df = 1, $p = 0.07$	

Two-way repeated analysis of variance on the effectiveness of BCC revealed a significant interaction between the effects of the BCC intervention on infants' nutritional status (weight for age) in both study and control groups ( $F(1,191) = 275.34$ ;  $p = 0.04$ ).

Furthermore, there was only 3% reduction in the proportion of stunting among infants in the intervention group from 8 (8.2%) at pre-intervention phase to 5 (5.2%) at post intervention ( $\chi^2 = 0.74$ ,  $p = 0.39$ ) while an increase from 5 (5.2%) pre-intervention in the proportion of stunted infants to 6 (6.3%) at the post-intervention phase was observed among infants in the control group ( $\chi^2 = 0.10$ ,  $p = 0.76$ ). The observed marginal changes in the proportion of stunting among infants in both control and intervention group were not statistically significant (Table 8).

Similarly, a two-way analysis of variance however revealed no significant interaction between the effects of BCC intervention on infants' nutritional status (height for age) in both study and control groups ( $F(1,191) = 1.15$ ;  $p = 0.06$ ). Findings from this study revealed 8.6% reduction in the proportion of infants who were wasted among infants in the intervention group (from 15 (15.5%) at the pre-intervention phase to 7 (7.2%) at the post-intervention phase while only 1.1% reduction was observed among infants in the control group (from 16 (16.7%) pre-intervention to 15 (15.6%) post intervention phase (Table 8). These changes in the proportion of wasted infants among the intervention group were also not statistically significant ( $\chi^2 = 3.28$ ,  $p = 0.07$ ; intervention group) and ( $\chi^2 = 0.04$ ,  $p = 0.85$ ; control group) though, a two-way analysis of variance revealed no significant interaction between the effects of the BCC intervention on infants' nutritional status (weight for height) in both study and control groups ( $F(1,191) = 100.58$ ;  $p = 0.25$ ).

#### 4. DISCUSSION

Findings revealed that there was 31.9% increase in the proportion of mothers in the intervention group who had good knowledge about complementary feeding at the post-intervention phase with a corresponding 31.9% reduction of in the proportion of mothers who had poor knowledge at the post intervention phase. The above finding corroborate the result of a nutritional education intervention conducted in Kenya where an improvement in mothers'

nutritional knowledge was observed among mothers in the intervention group [11]. Similar observations were made in a nutritional educational intervention for mothers in Malawi and Ethiopia an improvement in mothers' nutritional knowledge was reported after an intervention program [12]. This finding is also consistent with outcome of a study on behaviour change communication for mothers conducted in Russia where an improvement in nutritional knowledge, attitudes and feeding behaviour of mothers and caregivers were observed [26]. Improvement in nutritional knowledge of mothers and primary carers should therefore be priority of intervention programs towards reduction in childhood malnutrition.

Our study also observed that the proportion of mothers who fed their infants 3-4 times a day among the intervention group increased by 16%. Similarly, the proportion of mothers among the intervention group who fed their infants with adequate dietary diversity increased significantly by about 19.6 %. This improvement in meal diversity observed among infants in the study group corroborate the report of a study conducted in Gombe state, Nigeria in which nutritional intervention program for mothers improved dietary intake and nutritional status of infants [27]. This observation is also similar to findings from a community-based nutritional educational intervention for mothers in Kenya where an improvement of 27% was observed in dietary diversity of complementary diets in Western Kenya [11]. Similar observations were made in a nutritional educational intervention for mothers in Malawi and Ethiopia [12].

This study also observed 20.6% increase in the proportion of mothers in the intervention group who fed their infants with minimum acceptable diet. The Nigeria National Nutrition and Health Survey (NNHS) [4] however reported that only 17% of children 6 to 23 months received the minimum acceptable diet in Nigeria. This however contrasts the report from NDHS [18] which reported that 11% of children 6 to 23 months in Nigeria received the minimum acceptable diet.

This study also observed 14% reduction in the proportion of under-weight among infants in the intervention group. The reduction in the proportion of under-weight infants observed at the post-intervention phase of this study is similar to finding from a study which assessed the impact of mothers' education about

complementary feeding on infants' nutritional outcomes in Karachi, Pakistan in which a proportionate reduction of 5% in under-weight was achieved after a nutritional intervention study [28]. In addition, finding from this BCC intervention also corroborate the report of a behaviour-based nutrition intervention program in an Indonesian study in which there was a reduction in the prevalence of malnutrition among obsessed mothers and their stunted children after the intervention program [29]. This intervention also resulted in the reduction of underweight among infants in the intervention group from 25.8% at pre-intervention phase to 11.3% at the post intervention phase. The proportion of underweight (11.3%) among infants in the intervention group at the post intervention phase of the study was less than 13.2% reported for Osun State and 17.0 % reported for South West Nigeria [4].

Furthermore, only 3% reduction in proportion of stunting was observed among infants in the intervention group at the post intervention phase. The observed marginal change in proportion of stunting was probably due to the fact that the six months follow up period for this study was not sufficient enough to observe appreciable changes in the height/ length of the infants in both groups. The proportion of stunting (5.2%) observed among infants in the intervention group at the post-intervention phase in this study was however lesser than 22.3% reported Nigeria Demographic and Health Survey (NDHS) [18] among under-5 children in Osun State and also less than 20.8% among children 6 to 24 months in South West Nigeria reported [4]. The proportion of infants with wasting (7.2%) observed among infants in the intervention group at the post intervention phase was higher than 6.8 percent reported by the by NBS [4] among children 6 to 24 months old in South West Nigeria and also higher than 4.8% reported among under 5 children in Osun state, Nigeria [4].

## 5. CONCLUSION

Behaviour Change Communication (BCC) significantly improved mothers' knowledge about complementary feeding, meal frequency, dietary diversity and minimum acceptable diets among intervention group, BCC significantly reduced under-weight among infants in the intervention group. Effective nutritional intervention strategies for mothers and primary caregivers should therefore incorporate appropriate behaviour

change approach towards improving mothers' knowledge about complementary feeding, complementary feeding practices and infants' nutritional status.

## IMPLICATION OF FINDINGS ON PUBLIC HEALTH AND FOOD SECURITY

Nutritional education interventions for mothers and primary care givers employing relevant behaviour change approach in relatively food-secure populations would have direct positive impact on feeding practices and linear growth of infants and children. This approach is capable of improving nutritional status of infants and children and consequently reduce malnutrition and related complications in early childhood.

## CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the Ethics and Research Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Osun state (approval number IPH/OAU/12/1138). Informed consents were also obtained from mothers prior to the study. Mothers were also informed that they are free to withdraw from the study anytime they consider it fit but were encouraged to participate fully in the study.

## RISK AND BENEFIT OF STUDY TO STUDY PARTICIPANTS

This study pose no risk to study participants. Infants' mothers in the control group however received routine health talks while there were improvement in mothers' knowledge about complementary feeding and nutritional status of infants in the intervention group.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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