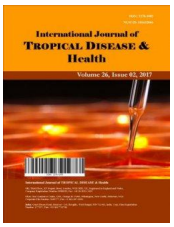

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Compliance with Use of Micronutrient Powder among Caregivers of Children Aged 6-23 Months in a District of a State in North East Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author AMA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AAF and EEI managed the analyses of the study. Author OOA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To assess the knowledge and perception about micronutrient powder (MNP) use, compliance with use of the product, and determine factors influencing compliance to continual use of MNP for food fortification among caregivers of children aged 6-23 months in Konduga LGA, Borno State, Nigeria.
Study Design: A cross-sectional study was conducted.
Place and Duration of Study: The study was conducted in Konduga LGA, Borno State Nigeria in August 2018.
Methodology: A total of 218 caregivers of children aged 6-23 months were selected using a multistage sampling technique. A semi-structured interviewer-administered questionnaire was used

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to interview respondents on socio-demographic characteristics, knowledge about complementary feeding, perception about MNP use and compliance with use of MNP for food fortification. Data were analyzed using descriptive statistics, Chi-square test and logistic regression, with the level of significance set at 0.05.

Results: Respondents were female with 111 (50.9%) below 30 years of age (mean age: 29.3±8.0). Twenty-four (11%) of the respondents have good knowledge of complementary feeding and 77 (35.3%) have a good perception of the use of MNP. Almost two-thirds [135 (61.9%)] of the respondents used MNP. Factors that influenced respondents' compliance with use of MNP include; being <30 years of age (*P*= .04), having a spouse with formal education (*P*= .003) and is not working (*P*= .013) and having good knowledge of complementary feeding (*P*= .01). Among these factors, having a spouse that is not working determined compliance with use of MNP (AOR=3.3, 95% CI= 1.6-7.5).

Conclusion: Although compliance with use of MNP was above average, however, there is need to improve on Infant and Young Child Feeding (IYCF) counselling focusing on the importance of MNP particularly among the older caregivers and their spouse.

Keywords: Complementary feeding; micronutrient-deficiency; micronutrient powder; caregivers; children aged 6-23 months.

1. INTRODUCTION

Malnutrition remains a major burden in low and middle-income countries and has severe consequences for child health and survival [1]. More than half of all childhood mortality is attributable directly or indirectly to under-nutrition. According to United Nations Children's Fund (UNICEF), World Health Organization (WHO) and World Bank group joint global child malnutrition estimate report in 2018, an estimated 151 million under-five children were stunted, 51 million were wasted and 38 million were overweight [2]. In developing countries, the prevalence of underweight, stunting and wasting among children less than five years were 20.5%, 37.3% and 7.8% respectively [3]. In Nigeria, findings from the WHO report showed that 19.8% and 32.9% of children less than five years were underweight and stunted respectively [4]. In North East Nigeria, an estimate of over 80% under-five children was acutely malnourished in some parts of Yobe and Borno States in 2016 [5].

Micronutrient deficiency is a form of malnutrition that occurs due to a lack of essential vitamins and minerals required by the body for proper growth and development [6]. It forms an important global health problem that is affecting vital development outcomes including physical and mental development in children. The Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD) and World Food Program (WFP) report revealed an estimate of more than 2 billion people suffering from micronutrient deficiency globally [7]. In Nigeria, micronutrient deficiency increases the risk of death from common childhood illness such as pneumonia and measles [8]. The previous survey in Nigeria found that 23.3%, 34%, 13% and 20% of children less than five years have Vitamin A deficiency, iron deficiency anaemia, Intellectual and Development Disabilities (IDDs) and zinc deficiency disorders respectively [7].

The home fortification technical advisory group strongly recommends home fortification of foods with micronutrients such as MNP to improve the nutritional status of vulnerable groups particularly infants and young children [9]. MNP can be used to increase the micronutrient content of a child's diet without changing their usual dietary habits. MNP is a single-use 1 gram packet of vitamins and minerals in powder form that can be sprinkled onto any ready to eat semi-solid food consumed at home, school or any other point of use. Although MNP can be used for children 6-59 months of age, however, the primary target is children 6-23 months of age [10]. A review of controlled trials conducted in low-income populations in Asia, Africa and the Caribbean revealed that an estimate of 31% of anaemia and 51% of iron (Fe) deficiency were reduced due to daily home fortification of complementary foods with MNP in children that were 6-23 months of age [11].

Since 2012, partners including UNICEF have been collaborating with the Nigeria government to provide quality nutrition services in states affected by insurgency in the northeast of the country. These states include Borno, Yobe and Adamawa States. Since then, the services of

micronutrient interventions are being reinforced and scaled up to other states. In the UNICEF Nigeria annual report 2015, Community Management of Acute Malnutrition (CMAM) and micronutrient deficiency treatment using MNP were scaled up from 188 to 280 sites in the three states. A total of 6,585 children 6-23 months were given MNP in IDP camps and host communities (UNICEF, 2015). The Nigeria government used the MNP distribution as part of a strategy to improve Infant and Young child feeding (IYCF) in the country [12].

Despite the high number of MNP distributed in Borno, Yobe and Adamawa States in Nigeria, no published study to our knowledge has documented perception about MNP and caregivers' compliance with use of MNP in the three affected states. Previous studies from other countries such as Malaysia [9] and Rwanda [13] showed a high level of compliance with MNP use among caregivers. Given the recent misuse of MNP among caregivers amidst other nutrition interventions, there is a need to explore caregivers' compliance with use of the product. Findings from this study will improve future responses to the prevention of micronutrient deficiency, and enable partners and policymakers to improve uptake of MNP and other related products among caregivers. This study assessed the knowledge and perception about MNP use, compliance to continual use of the product, and determined factors influencing compliance with use of MNP for food fortification among caregivers of children 6-23 months of age in Konduga Local Government Areas (LGA), Borno State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Konduga LGA, Borno State Northeast Nigeria. Borno state was formed in 1976 with the capital in Maiduguri. Konduga LGA is one of the 27 Local Government Areas (LGAs) of the state located in the central senatorial district with an area kilometre of 6,065.89km^2 and a population of 157,322 according to the 2006 census population [12,14]. The headquarter is at Konduga town about 25 km to the southeast of Maiduguri and an area of 5,855 km^2 [15]. The primary languages are Hausa, Shuwa, Arabic, Kanuri and Wandala/Malgwa. Majority of the inhabitants are illiterate and engages in subsistent farming with earnings below US$20 per annum. Previous report showed that the majority of the people did not have access to potable water or electricity and good roads [16].

There are a total of 11 wards in the LGA and 7 are accessible including Auno, Dalori, Jewu, Yale, Konduga, Yaleri/Mairambri/Bazamri and Jewu/Lamboa [17]. The food fortification program using MNP is currently conducted in 4 wards in the LGA including Auno, Dalori, Konduga and Jewu/Lamboa. The numbers of settlements currently benefiting from the MNP distribution program are: Konduga (16 settlements), Auno (40 settlements), Dalori (4 settlements) and Jakana (9 settlements). There are a total of 12 Outpatient Therapeutic Program (OTP) sites in these settlements. The OTP site is a location in the primary healthcare centres where the MNP are being distributed to the caregivers, and is conducted concurrently with IYCF counseling and CMAM.

2.2 Study Design and Participants

A descriptive cross-sectional study designed was conducted in the month of August 2018. The study participants were caregivers of children 6-23 months of age residing in the community. Caregivers that have received MNP earlier were included in the study while those that refused to participate in the study or ill during the study period were excluded. Data were obtained using a semi-structured interviewer-administered questionnaire and piloted in a neighbouring LGA before obtaining data in the study sites.

2.3 Sample Size and Technique

A minimum sample size of 384 participants was estimated to be interviewed using the single proportional sample size; where the confidence level of 95%, type 1 error (α) of 0.05, the critical value of 1.96 and proportion of 51% [18] were used. Each household represents a sampling unit while the units of enquiry were members of the household that are caregiver of children 6-23 months of age. Respondents were selected using a multistage sampling method. In the first stage, two wards were selected from four wards currently conducting MNP distribution program in Konduga LGA using simple random sampling by balloting. In the second stage, three communities were randomly selected from the wards; two communities from Auno ward and one from Jakana were selected. During the third stage, houses which correspond to the sample size were selected by systematic random sampling

technique from each community. The first house was selected by simple random sampling from a list of buildings 1 to K and subsequently, every Kth building was selected until the sample size was reached. The K factor was determined from the formula K= N/n, where N is the total house in the communities and n is the total house required to meet up the sample size. A household (which represent one or more people living in the same dwelling and also sharing meals or living accommodation) was selected per building using the table of random numbers. In households where there are more than one caregivers with children 6-23 months of age, a caregiver was selected by simple random sampling technique.

2.4 Data Collection and Management

The questionnaire was adopted from a previous related study [19]. The questionnaire contained data on socio-demographic characteristics, knowledge of complementary feeding, perception about MNP use and child feeding practices.

Knowledge of respondents about complementary feeding was determined by assigning a point to correct response to five-item knowledge questions. Respondents with 3 or more points were categorized as those with good knowledge of complementary feeding. Also, the perception of respondents about MNP use was determined using 5-item perception questions. A point was assigned to each of the response that indicates positive perception. Participants with a positive response were those who approved the use of MNP for their child. On aggregate, respondents with scores above 2 points were considered as those with favorable perception about MNP use.

Data were entered using the Statistical Package for the Social Science (SPSS) version 20 software and analyzed with both SPSS and online OpenEpi software. Frequency tables were generated as well as graphs. In addition, cross-tabulation of variables was conducted with the dependent variable being compliance with the use of MNP for food fortification. The level of significance was determined to be p-value of less than 0.05. The Chi-square test was used to identify factors influencing respondents' compliance to use MNP for food fortification. The predictors of compliance with use of MNP were identified using logistic regression analysis. Variables that were significant at $p<0.2$ on the bivariate analysis were included in the logistic regression analysis to estimate the adjusted odds ratio [20].

3. RESULTS

3.1 Socio-demographic Characteristics of Respondents

A total of 224 respondents were approached for an interview and 218 responded, giving a response rate of 97%. One hundred and twenty-six (57.8%) of the respondents resided in Jakana community followed by those that lived in Auno community 49 (22.5%). The mean age of respondents was 29.3±8.0 years with 73 (33.5%) between the age of 30-39 years. Majority of the respondents 191 (87.6%) and their spouse 188 (86.2%) have no formal education. The mean age of respondents' index child was 11.8±4.6 months and 139 (59.6%) of the children were males (Table 2).

3.2 Knowledge of Respondents about Complementary Feeding

Table 3 shows knowledge of respondents about complementary feeding including MNP. About a fifth 46 (21.1%) of the respondents knew that it is not appropriate to give food or water to a child that is 4 months old, 98 (45%) knew that breastfeeding should not be stopped for a child that is one year of age, 52 (23.9%) knew that MNP can prevent malnutrition, 137 (62.8%) knew that MNP can be given to a moderate acute malnourished (MAM) child, 91 (41.7%) knew RUTF is not meant to be given to a child that is MAM. In general, 24 (11%) of the respondents have good knowledge of complementary feeding.

3.3 Perception about MNP Use among Respondents

Thirty-eight (17.4%) of the respondents agreed that MNP is not good for their child (Table 4). Majority 132 (60.6%) perceived that MNP did not have good nutrient while 113 (51.8%) agreed that MNP is not sweet. More than a quarter 87 (39.9%) don't like MNP because it made their child eat more food than usual and 174 (79.8%) agreed that RUTF is better than MNP for their child. On aggregate, 77 (35.3%) have good perception about the use of MNP.

3.4 Compliance with Use of MNP among Respondents

Figs. 1 and 2 shows compliance with the use of MNP among the respondents. One hundred and thirty-five (61.9%) of the respondents reported to

be using MNP as food fortification for their index child. Among those 83 (38.1%) that reported not to be using MNP, 38 (45.8%) reported that MNP makes their child be sick followed by it makes them spends more money on feeding [19 (22.9%)] (Fig. 2).

Table 1. Socio-demographic characteristics of respondents

	Number of respondents (n=218)	Percentage (%)
Site		
Jakana	126	57.8
Auno	49	22.5
Pompommari	43	19.7
Age at last birthday		
<20	46	21.1
20-29	65	29.8
30-39	73	33.5
40-49	34	15.6
Mean (SD)	29.3±8.0	
Education completed		
No formal education	191	87.6
Primary education	27	12.4
Education spouse completed		
No formal education	188	86.2
Primary	22	10.1
Secondary	8	3.7
Religion		
Christian	5	2.3
Islam	213	97.7
Ethnic group		
Kanuri	171	78.4
Fulani	24	11.0
+Others	23	10.6
Occupation		
Housewife	210	96.3
Trading	3	1.4
Farmer	5	2.3
Occupation of spouse		
Farmer	119	54.6
Trading	24	11.0
Driver	13	6.0
No job	42	19.3
*Others	20	9.2
Income		
<25000	182	83.5
25000-50000	29	13.3
50000-100,000	7	3.2

** Mechanic, Teacher; +=Yoruba, Marigi, Hausa*

Table 2. Socio-demographic characteristics of respondents' index child

	Number of respondents (n=218)	Percentage (%)
Age of child (months)		
6	28	12.8
7-12	102	46.8
13-24	88	40.4
Mean ±SD	11.8±4.6	
Sex of index child		
Male	130	59.6
Female	88	40.4

Table 3. Knowledge of complementary feeding among respondents

	Number of respondents (n=218)	Percentage (%)
A child is given food or water by 4 months old		
Yes	169	77.5
No	46	21.1
Don't know	3	1.4
Breastfeeding should be stopped for a child when he or she is one year old		
Yes	93	42.7
No	98	45.0
Don't know	27	12.3
Micronutrient Powder can prevent malnutrition		
Yes	52	23.9
No	143	65.6
Don't know	23	10.6
Micronutrient powder can be given to a child that is MAM		
Yes	137	62.8
No	74	33.9
Don't know	7	3.3
RUTF is meant to be given to a child that is MAM		
Yes	119	54.6
No	91	41.7
Don't know	8	3.7

Table 4. Perception about micronutrient powder use among respondents

	Number of respondents (n=218)	Percentage (%)
MNP is not good for my child		
Yes	38	17.4
Don't know	10	4.6
No	170	78.0
MNP did not have good nutrient		
Yes	132	60.6
Don't know	9	4.1
No	77	35.3
MNP is not sweet and I don't like it for my child		
Yes	113	51.8
Don't know	24	11.0
No	81	37.2
I don't like MNP because it makes my child eat more food		
Yes	87	39.9
Don't know	38	17.4
No	93	42.7
RUTF is better than MNP for my child		
Yes	174	79.8
Don't know	11	5.1
No	33	15.1

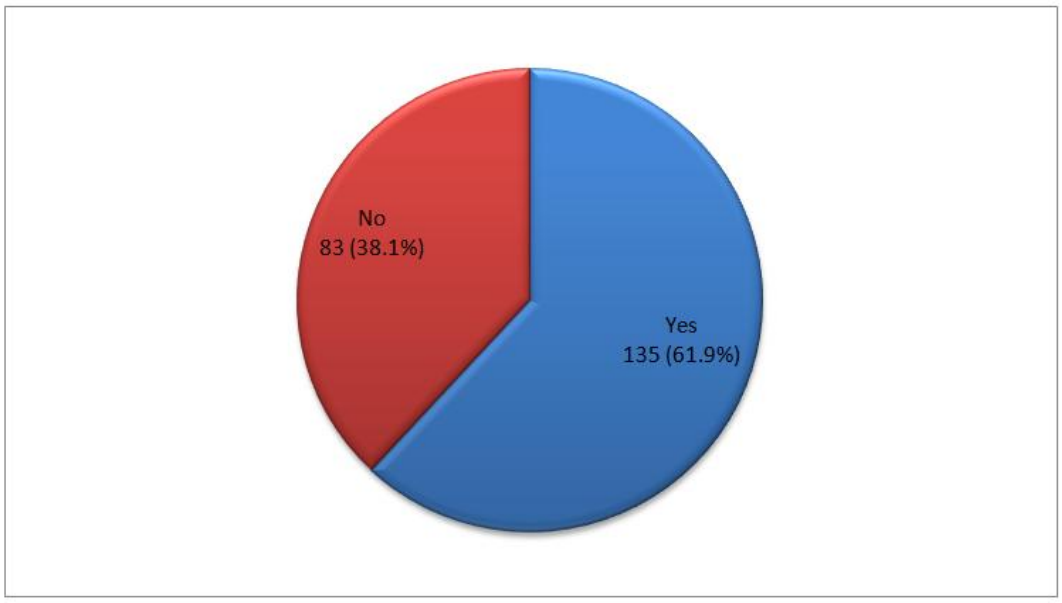

Fig. 1. Compliance with the use of micronutrient powder among respondents

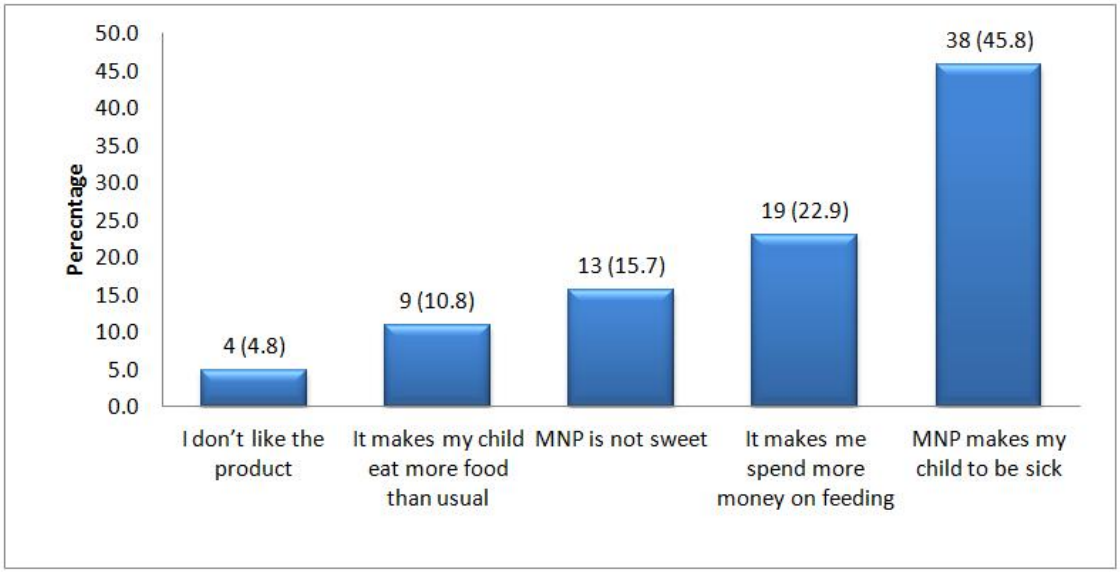

Fig. 2. Reasons for not using micronutrient powder among respondents

3.5 Factors Influencing Compliance with Use of Micronutrient Powder among Respondents

Significantly, the age of caregivers, spouses' education and occupation and knowledge of complementary feeding influenced respondent's compliance with the use of MNP. A higher proportion (68.5%) of respondents that were <30 years of age use MNP compared to those that were 30 years and above (55.1%) (p= 0.043). A higher proportion (86.7%) of respondents whose spouse has formal education gave their child MNP compared to those with no formal education (58.0%) (p=0.003). A higher proportion of respondents (78.6%) whose spouse was not working use MNP compared to those whose spouse was working (57.6%) (p= 0.013). More respondents with good knowledge of complementary feeding (87.5%) use MNP

Table 5. Factors influencing compliance with use of micronutrient powder among respondents

Variables	Use MNP as food fortification for index child		Total	P-Value	Unadjusted odds ratio	Adjusted odds ratio (lower and upper 95% CI)
	Yes n(%)	No n(%)				
Age in years						
<30	76 (68.5)	35 (31.5)	111	0.043	1.8	1.4 (0.7-2.6)
≥30	59 (55.1)	48 (44.9)	107			
Education spouse completed						
Formal education	26 (86.7)	4 (13.3)	30	0.003	4.7	1.8 (0.5-6.5)
No formal education	109 (58.0)	79 (42.0)	188			
Occupation of spouse						
Not working	33 (78.6)	9 (21.4)	42	0.013	2.7	3.3 (1.6-7.5)
Working	102 (58.0)	74 (42.0)	176			
Ethnic group						
Kanuri	111 (64.9)	60 (35.1)	171	0.083	1.8	1.5 (0.7-3.1)
Other tribes	24 (51.1)	23 (48.9)	47			
Income (naira)						
≥25,000	24 (66.7)	12 (33.3)	36	0.522	1.3	
<25,000	111 (61.0)	71 (39.0)	182			
Age of child						
>12 months	60 (68.2)	28 (31.8)	88	0.118	1.6	1.6 (0.8-2.9)
≤ 12 months	75 (57.7)	55 (42.3)	130			
Sex of child						
Female	58 (65.9)	30 (34.1)	88	0.319	1.3	
Male	77 (59.2)	53 (40.8)	130			
Knowledge of complementary feeding						
Good	21 (87.5)	3 (12.5)	24	0.006	4.9	3.2 (0.8-13.1)
Poor	114 (58.8)	80 (41.2)	194			
Perception about micronutrient powder use						
Good	46 (59.7)	31 (40.3)	77	0.623	1.2	
Poor	89 (63.1)	52 (36.9)	141			

compared to those with bad knowledge (58.8%) (p= 0.006). Among these factors, the occupation of a spouse was the determinant of compliance with use of MNP among the respondents on the logistic regression analysis. The odds of compliance with use of MNP increased by 3 fold among respondents whose spouse were not working compared to those that were working (AOR=3.3, 95% CI= 1.6-7.5).

4. DISCUSSION

Home fortification with micronutrient powder has been widely known as an effective way to increase micronutrient intake among young children 6-23 months [21]. This is a cross-sectional study that assessed the knowledge, perception and compliance to continual use of MNP among caregivers of children 6-23 months of age in a LGA in Borno State, Nigeria.

The result on respondents' knowledge of complementary feeding including MNP differs from findings of previous process evaluation report on MNP distribution through maternal, neonatal and child health weeks in Benue State, Nigeria [18]. In this study, slightly above one-tenth of the respondents have good knowledge of MNP compared to study in Benue State where majority correctly stated the meaning of MNP and its' usefulness. The study area and education of the respondents may be attributable to different outcomes of the studies. This study was conducted in a state in northeast Nigeria which is affected by insurgency and likewise, the majority of the respondents were internally displaced persons (IDPs) with the majority having no formal level of education. This is unlike the study in Benue where all of the respondents have secondary education or higher. Education has been shown to improve

knowledge of programs in the previous report [22].

Currently, Infant and Young child feeding (IYCF) counseling are conducted at the health facility, while Mother Support Group (MSG) discussions on IYCF are conducted at the community consecutively. However, despite these interventions less than half of the respondents had good perception about MNP use. This finding may be linked to low emphasis on MNP importance and usage during counseling session at the health facility and community. This finding is similar to that of the previous pilot program on MNP use in Benue State Nigeria [21]. However, previous study in Rwanda reported very high perceived benefits of MNP among caregivers [13].

Acceptance and adherence to MNP use for children have been a major problem for the MNP program currently implementing at the OTP sites in Borno State, Nigeria. In some instances, caregivers reject the MNP after counseled on IYCF and preferred the RUTF which is given to severe acute malnourished (SAM) patients in the CMAM program conducted alongside the MNP distribution activity. In this study, more than one-third of the caregivers were not using MNP as food fortification for their index child. This finding is not consistent with finding of; a systematic review and meta-analysis of home fortification of complementary food including MNP [23], an evidence study of a twelve-month home fortification with MNP in Rwanda [13] and that of a previous study among caregivers of 6-59 months of age children in north central of Nigeria [21] where high acceptability of MNP as home fortification were reported. These previous studies were conducted in controlled settings, and this may serve as a possible explanation for the difference in findings compared to this study. For instance, Korenromp et al. (2015) study samples were both facility-based and home-visit drawn from caregivers that are already motivated to attend Maternal, Neonatal and Child Health Week (MNCHW) in the north central of Nigeria [21].

In this study, respondents reported not to be using MNP mainly because of their perceived negative effect on their child health and the thought of incurring more cost on feeding their children. A similar report was made in a previous study in Philippines [24] and Rwanda [13].

Several factors may influence caregiver's compliance with use of MNP however; respondents' age and occupation, education and occupation of spouse and knowledge of complementary feeding significantly influenced their compliance to use MNP in this study. Among these factors, the occupation of spouse significantly determined compliance to use MNP on the logistic regression analysis. Compared to this study, perceived benefit of MNP was the most influential factor facilitating adherence to MNP use in a reviewed study [18], while wealth index was reported in a previous study in Bangladesh [25] however, these factors did not significantly influence MNP use by respondents of this study.

Similar to this study, Kejo et al. [26] found that paternal education and maternal age were significant determinants of compliance to pay for MNP among caregivers in Tanzania. A similar report was also made in Lagos State, Nigeria [27]. However, the study conducted in Lagos found that respondents with occupation had good practices of complementary feeding compared to this study that found that respondents that had spouse with no occupation complied with using MNP. Father's involvement in childcare has been proven to improve child feeding practices [28]. Fathers with no occupation may have more time with the family and support the wife to obtain services that will benefit the children such as the MNP distribution program. Furthermore, a husband with no occupation resulting in low family income may increase the tendency to accept commodities such as MNP which is distributed free in the health facility. This may explain the reason why fathers with no occupation determined compliance to use MNP among the caregivers.

The survey was conducted in locations where other nutrition interventions are being conducted alongside MNP distribution activity hence; participants may respond to questions in a manner that they think will lead to being accepted and liked which may be linked to social disability bias. However, this bias was minimized by asking questions that will validate response to an initial or previous question.

5. CONCLUSIONS

Compliance to use MNP as food fortification for children was low among the respondents, particularly among those: that are older, with spouse that had no formal education and working. High proportion of the respondents has little knowledge about complementary feeding

and negative perception about MNP use. This indicates the need to improve caregiver's knowledge and perception about MNP by ensuring that IYCF counseling conducted both at the facility and community level focus on the importance of MNP and how it can be used for food fortification. Also, spouse/husband of the caregivers should be involved during the counseling session.

CONSENT

The participants have given their informed consent for the manuscript to be published.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the Ethical Review Committee of the Borno State Ministry of Health. Written informed consent was obtained from the participants before the interview was conducted. Participants voluntarily decided to participate in the study after the purpose of the study was clarified to them. There was no penalty attached to those that declined to participate in the study. To ensure confidentiality of the data obtained, the questionnaires were identified with numbers, and every data obtained was safely locked and protected from the third party. The research does not require the collection of invasive materials. Therefore, it does not affect the safety of the participants. The only discomfort that may occur was the time taken in responding to the questions, which was kept minimal. IYCF counseling was provided to the participants after each interview section.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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