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Comparative Study on Integrated Psychosocial Stimulation, Nutritional Support, Water Sanitation Hygiene Interventions among Malnourished Children in Kanam, North Central Nigeria

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Abstract
This study is determined to compare the effect of integrated psychosocial stimulation, nutritional support, and water sanitation hygiene interventions on malnourished children. An individual randomized trial design comprising weekly home visits for 3 months in four locations of Kanam Local Government Area, Plateau state, was adopted. The eligible malnourished children were identified through a door–to–door survey using standard procedures of anthropometric measurements (weight, height, mid-upper arm circumference) and children with body mass index (BMI) < 16Kg/m^2 were selected. A focus group discussion session, follow-up home visitation on weekly and monthly facilitation/support of mother-to-mother, weekly distribution of food supplements, home stimulation environment through the provision of WASH material and age-specific psychosocial stimulation activities were part of intervention strategies adopted for the study. The result shows a significant difference between base-line and end-line data, impacted by integrated package delivery which enhanced and improved nutritional and developmental outcomes of malnourished children over the period of intervention. Furthermore, the findings reveal that there is a non-significant difference among the study groups. However, the observed effect on outcomes based on average BMI indicators is at causal pathways to improve child nutritional status outcomes. The study concludes that the integrated intervention package improved the developmental and nutritional outcomes in malnourished children. Implementation of these integration packages over a longer duration is needed to witness a significant improvement.

Keywords: *Integrated Intervention, malnourished, nutritional support, psychosocial stimulation, WASH*

1. Background

Public Health experts see malnutrition as one of the major public health and development concerns globally in the 21st century, particularly in developing countries. Early childhood undernutrition is associated with inadequate dietary intake and disease, poor current and later cognitive development and school achievements (Grantham-McGregor, 1995; Patlan – Hernandez et al., 2022). In sub-Saharan Africa, particularly Nigeria, child undernutrition is associated with several diet-related factors such as poor infant feeding practices where complementary foods are low in macro and micronutrients, nutrient and energy-dense complementary foods are not affordable for many families (Onoja et al., 2014). Such families often depend on inadequately processed traditional foods consisting mainly of supplemented cereal porridges made from maize or sorghum or millet. The Multidimensional Child Poverty Analysis using the Multidimensional Overlapping Deprivation Analysis approach in Nigeria reveals that approximately 54 percent of children

are multidimensionally poor, more prevalent in the rural (65.7 percent) than in urban areas (28.4 percent) (MODA, 2021). The report also indicated that the children faced at least three deprivations across seven dimensions of child rights, including nutrition, healthcare, education, water, sanitation, adequate housing, and information. Poor nutrition in a child's early stage has a long-standing irreversible effect, including stunting, wasting, poor cognitive development and eventually death in some severe cases (Sharifzadeh et al., 2010). Nutrition endemic in Nigeria has been attributed to poverty leading to a lack of access to nutritious food, which influences people to poor nutrition. Malnutrition has a long-standing effect on children. This includes stunting, wasting, poor cognitive development and eventually death in some severe cases. Undernutrition affects brain development directly and also affects physical growth, motor development, and physical activity, which may, in turn, influence brain development through both caregivers' behaviour and child interaction with the environment (Prado & Dewey, 2014). Long-term nutrition deficits are linked to impairment in intellectual performance, work capacity, reproductive outcomes and overall poor health during adolescence and adulthood. However, marked improvements in development can occur if severely undernourished children are adopted and exposed to more nurturing environments (Colombo et al., 1992). Unfortunately, most caregivers are incapacitated to avert the problem of malnutrition due to a lack of basic health and hygiene facilities, poor nutrition, and childcare practices, among others.

Most studies have tested the effect of standalone interventions within the first 1000 days window, primarily in the domain of health, nutrition, WASH, and psychosocial health, with a modest effect on linear growth (Hamadani et al., 2006). It is yet uncertain whether the effects are synergistic if interventions are delivered together as a package. Home fortification of complementary foods using food-to-food supplementation has been shown to contribute quality and quantity of nutrients that can provide means to address the increasing burden of many resources in poor communities (Onoja et al., 2014). It is obvious from the literature that there is a link between nutrition, water sanitation, and hygiene (Fenn et al., 2012; Shrestha et al., 2020). The impact of inappropriate water facilities, hand washing, and hygiene practices results in poor nutrition and health outcomes in children (Joshi & Amadi, 2013). A recently published systematic review clearly outlines the benefits of the provision of psychosocial stimulation for improve developmental and nutritional outcomes in children hospitalized with SAM in Jamaica and Bangladesh who received this type of intervention (Daniel et al., 2019; Daniel et al., 2017; Kerac et al., 2010; Grantham-McGregor et al., 1994). Several research reports show that the promotion and support of responsive caregiving can promote better nutritional status and development in children (Aboud et al., 2018; WHO, 2018; Engle et al., 2007; Daelmans et al., 2015). Effects of play-based psychomotor/psychosocial stimulation on acute malnourished children show improved gross motor functions when combined with a standard nutrient-rich diet during hospital follow-up and on fine motor functions during the home follow-up (Abesa et al., 2019).

Valuable insights for the selection of study intervention were provided by an extensive literature review on interventions that influence growth and development outcomes in children (Hamadani et al., 2006). The current management of severely malnourished children in Nigeria mainly focuses on food and micronutrient supplementation. Despite recommendations by the World Health Organization (WHO, 1999) to incorporate psychosocial stimulation, there is little evidence about the effectiveness of these interventions for severely malnourished children, particularly when serious food shortages and lack of balance diet prevail. Incorporating psychosocial stimulation and Water, sanitation, and Hygiene has generally not been incorporated into managing malnourished children at home or community–based level, which is believed to be potentially more feasible and less expensive. Interventions are needed in the domains of nutrition, WASH, and psychosocial stimulation as a package. It is yet uncertain whether the effects of concurrent delivery of integrated packages covering these continuums are synergistic. The impact of concurrent delivery of integrated packages to children aged 6-59 months in rural areas of Nigeria is yet unexplored, which has the greatest number of children at risk of poor development. Indeed, the only previous home-visiting study from India was set in rural areas with positive effects on child development and delivered simple messages to mothers regarding feeding and play practices (Vazir et al., 2013). This programme provides an opportunity to add psychosocial stimulation, WASH, and nutrition support to the existing treatment of malnutrition. There is no study on integrated psychosocial stimulation, nutritional support, and WASH interventions for malnourished children and caregivers in Kanam LGA. This necessitated the present study. The study seeks to deepen understanding around concurrent delivery of an integrated package covering the three continuums psychosocial stimulation, WASH, and nutritional support to improve the health, nutrition, and psychosocial status of malnourished children. The secondary objectives are to compare the effects of psychosocial stimulation with food supplementation and water, sanitation hygiene (PFW); psychosocial stimulation with food supplementation (PF); water, sanitation hygiene with food supplementation (WF) and food supplementation alone (FA) at the household level. It is hypothesized that the integrated intervention package will improve developmental and nutritional outcomes in undernourished children.

2. Methods and Design

2.1. Research Design, Setting and Participant

The study is an individually randomized trial with a factorial design to test the hypothesis that an integrated package of psychosocial stimulation, nutrition support, and water and sanitation hygiene interventions can improve developmental and nutritional outcomes in malnourished children. The study was conducted in Kanam LGA, Plateau State, Nigeria, a rural area where most householders are peasant farmers. Kanam Local Government Area (LGA) is located in 9.54N and 10.09E central zone of Plateau State, with a total population of 165,898 at the 2006 census and an annual growth rate of 2.7%.

2.2. Setting

The target population for the study was all children aged 6-59 months within the area. A random sampling technique was used to identify four communities with 1 public Primary Health Centre (PHC) each. The research was confined to rural areas where poor water, sanitation and hygiene conditions are highly concentrated, as well as lack of interaction between the child and parents/caregiver and lack of access to nutritious food are predominant. The eligible malnourished children were identified through a door–to–door survey carried out by two trained research assistants (health workers), each from three public primary healthcare facilities in the localities. Anthropometric measurements of weight, height, and mid-upper arm circumference of all the study children were taken using standard procedures and body mass index (BMI) computed. Children with mid-upper arm circumference (MUAC) less than 12.5 cm or weight for height z score (WHZ) between -3 and -2 or WAZ > - 1.5 were identified. If the children met the enrolment criteria, the health workers explained the purpose of the study to the caregivers in the local language. They consented to participate via verbal consent and were enrolled in the study. The caregiver was interviewed for demographic information, appetite, and recent infectious symptoms such as fever, cough, and diarrhea, but those with any serious illness were excluded.

A focus group discussion session was held with each study group in their locality, where topics on children's development and the importance of adequate nutrition, WASH, communication, and play were discussed. In addition, home activity materials were presented, and an explanation of their usage was made. A follow-up home visit to collect information on the family's household WASH practices, psychosocial stimulation, and nutritional care practices was obtained, and base-line data were taken. Concurrent delivery of an integrated package of a low-cost program of psychosocial stimulation with food supplementation and water, sanitation hygiene (PFW), psychosocial stimulation with food supplementation (PF), water, sanitation hygiene with food supplementation (WF) and food supplementation (FA) alone were delivered at home through trained study workers. A weekly and monthly facilitation/support of mother-to-mother counseling visitation was part of the intervention strategies adopted for the study.

2.2.1. Intervention

A weekly weight-based supply of supplementary food from millet, toasted soy, and sesame fortified with crayfish, dried *Moringa oleifera* leaves, baobab fruit pulp, and orange-fleshed sweet potato flour blends produced locally with increased micronutrient contents, 348.33 kcal and 13.87% protein distributed in 100-g sachets to children with BMI < 16Kg/m^2 to be consumed in the form of hot cooked gruel in addition to their normal diet. The WASH interventions include:

- Improving drinking water quality through the provision of water treatment reagents (water guard) and storage containers,
- Reducing the fecal load in the environment by providing detergents for cleaning toilets,
- Promoting handwashing to reduce transmission by placing a hand washing station in the household

The researchers did not attempt to make any infrastructural changes for sanitation, as these were not feasible in an individual randomized trial. The researchers equally did not intervene to increase the quality of water due to ethical and social reasons. Caregivers were counselled on the need and importance of age-specific psychosocial stimulation activities such as play (using traditional games and songs), communication (chatting), and comfort (praise, positive feedback) to improve mother-child interaction and accelerate development. Weekly and monthly observations were done for each household by the research assistants and the research team, respectively. During visits, observations were done on different play activities practiced by the caregiver with an emphasis on developing good relationships with the child, communication skills, and celebrating their successes. Other activities include delivery and consumption of food supplements, water, personal and environmental hygiene, including hand washing practices. Weights and heights were taken by pair of research assistants and team members using a digital weighing scale and infantometer. Mid-upper arm circumferences were taken by using MUAC measuring tape. WASH checklist was used to track water, personal, and environmental hygiene practices. Play and simulation progress trackers were used to check child-mother interaction and childcare practices. There were two-time points for data collection: base-line and end-line. The primary outcome is the child's developmental and growth outcome (child's BMI).

2.2.1.1. Statistical Analysis

A descriptive and inferential statistical method was used for data analysis using SPSS version 23. Specifically, mean, standard deviation, chart, and t-test were employed at a significance level of $P<0.05$. The factorial analysis includes a comparison of psychosocial stimulation with food supplementation and WASH (PFW) versus food supplementation alone (FA) (PFW vs. FA); psychosocial stimulation with food supplementation and WASH (PFW) versus psychosocial stimulation with food supplementation (PF) (PFW vs. PF); psychosocial stimulation with food supplementation and WASH (PFW) versus WASH with food supplementation (WF) (PFW vs. WF).

2.2.2. Ethical Considerations

The research trial was registered and approved by the Ethics Committee of the Federal College of Education Pankshin. The Executive Chairman of Kanam Local Government Area was notified and permitted to carry out the study for each study site. Informed consent was obtained from the primary caretaker of the participant through verbal consent. Before the commencement of the project, research assistants informed all the study participants about the objective and likely benefits of participating in the exercise.

3. Results

A total of 16 malnourished children under-five years of age were recruited at base-line and end-line, respectively. Table 1 presents the differences in the developmental outcomes of malnourished children exposed to the integrated package of psychosocial stimulation, nutritional support, and WASH interventions. The individually randomized trial allows for factorial design, which provides an opportunity to examine the effect of base-line and end-line interventions on growth outcomes. The mean difference between base-line and end-line for FA improved by 5.2 (p=0.054), PFW improved by 4.9 (p=0.041), PF improved by 4.8 (p=0.023), and WF improved by 2.6 (p=0.057) points (Table 1). The effect sizes varied from 4.546 to 1.707SD among the randomized individual trial for the groups. There was a significant difference between base-line and end-line of PFW, FA, PF, and WF, respectively. Hence, the observed changes in base-line and end-line data impacted by integrated package delivery enhanced and improved the nutritional status of malnourished children over the period of intervention.

Sample Treatment	Base-line–End-line	Mean Difference	SD	P- value	N
PFW	Base-line 14.5 End-line 19.4	4.9	2.864	0.041	4
FA	Base-line 14.6 End-line 19.8	5.2	3.366	0.054	4
PF	Base-line 11.8 End-line16.6	4.8	4.546	0.023	4
WF	Base-line 12.9 End-line 15.5	2.6	1.707	0.057	4

Table 1: Comparison of Developmental Outcome of Malnourished Children Exposed to Integrated Intervention Before and After Interventions

T-test

Key:

PFW=Malnourished children who received psychosocial stimulation with food supplement and WASH,

PF = Malnourished children who received psychosocial stimulation with food supplement,

WF= Malnourished children who received WASH with food supplement,

FA= Malnourished children who received Food supplement alone

Table 2 presents the effect of psychosocial stimulation, nutritional support, and WASH on malnourished children in various study groups. The PFW vs. FA was not significantly different (p>0.05) from each other, with a mean difference value of 0.04 and p-value of 0.851. The PFW vs. PF with a mean difference value of 2.80 and p-value of 0.231 and PFW vs. WF either were not significantly different (p>0.05). The PFW vs PF+WF had no significant difference (p>0.05) in the developmental status of malnourished children exposed to the three and two interventions in the study.

Combined Intervention	N (Mean Difference)	Effect	P-value
PFW vs. FA	4(0.04)	-0.196	0.851
PFW vs PF	4(2.80)	1.333	0.231
PFW vs WF	4(3.93)	1.923	0.103
PFW vs PF+WF	4(1.78)	0.901	0.389

Table 2: Effect of Psychosocial Stimulation, Nutritional Support and WASH on Malnourished Children in Various Study Groups

T-test (0.005)

Key:

PFW=Malnourished children who received psychosocial stimulation with food supplement and WASH,

PF = Malnourished children who received psychosocial stimulation with food supplement,

WF= Malnourished children who received WASH with food supplement,

FA= Malnourished children who received Food supplement alone,

4. Discussion

This study is conceived with the underlying belief that home intervention of integrated packages could stimulate investing efforts in promoting growth and development among malnourished children. A frailty of the study design is that no control group received either stimulation or WASH alone. Therefore, the researchers were unable to evaluate the effect of intervention alone. The result in table 1 shows statistically significant increases from base-line to end-line, indicating potential benefits in children's developmental outcomes. This integrated package intervention at the household level is a simple and innovative solution that may contribute to the reduction of the malnutrition burden among children.

The non-significant difference is evidenced in the integrated interventions package among malnourished children. However, the observed effect on outcomes based on average BMI indicators is at causal pathways to improve child nutritional status outcomes. Results from similar integrated interventions implemented in Ethiopia, Mozambique, and Tanzania (Fenn et al., 2012; Martinez et al., 2012; Elisaria et al., 2020) also found no improvement in child stunting. Lacks of statistically significant difference in the developmental outcome between the study groups is worrisome and possibly

indicates that the duration of the study was not sufficient enough to yield a high effect on the samples examined. This corroborates with a systematic review by Dulal et al. (2021), who explored the effect of integrated nutrition and stimulation to improve the nutritional status and development of children under 5 years. They found that there was no positive impact on growth outcomes when compared with the usual intervention.

The lack of overall impact on growth outcome among the study groups may be due to a lower-than-expected prevalence of malnutrition at base-line of comparison children. Frequent infections may also have played a role, probably due to personal and environmental hygiene and WASH. Caregivers' time spent on stimulation activities, including varieties of play, games, and communication with the children, was possibly not adequate. The treatment of malnutrition with psychosocial stimulation and WASH intervention at the household level improves caregivers' knowledge of childcare compared to those receiving only food supplements.

The study has some limitations, many of which were outside the control of the research team. The study was an individually randomized trial, making it difficult to implement the whole set of WASH interventions in the individual household. Certain aspects, such as improving sanitation facilities, were not possible in an individually randomized design. There was inappropriate mobility due to the physically challenging terrain and early phasing out of the project activities due to a shortage of funding. The study is encouraging because we focus on improving caregiver-child interaction through concurrent delivery of WASH and psychosocial care to improve developmental outcomes. If the caregiver's behaviour is changed, the benefits to their children's development are more likely to be sustained. Implementation of these integration packages over a longer duration is needed to witness a significant improvement.

5. Conclusion

The 3-month program did not result in significant evidence of malnutrition reduction, but the observed effects on developmental outcome indicators were substantial, ameliorating WASH and psychosocial care practices. Based on these pieces of evidence from other studies, there is an indication that the observed changes in base-line and end-line data impacted by program intervention could contribute to the management of malnutrition among children in the future. More intensive and longer-duration of interventions might be needed to see the effect of these interventions.

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