International Journal of Modern Developments in Engineering and Science
Volume 4, Issue 12, December 2025
www.ijmdes.com | E-ISSN: 2583-3138 | RESAIM Publishing | www.resaim.com

Multimodal Interventions of Psychosocial Stimulation, Nutrition Support, Water Sanitation Hygiene Among Malnourished Children in Kanam Plateau State, North Central Nigeria

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***Abstract*: This study explores the effectiveness of an integrated intervention combining psychosocial stimulation, nutrition support, and water, sanitation, and hygiene (WASH) practices among malnourished children in Kanam, North Central Nigeria. The intervention aims to address the multifaceted challenges of malnutrition by enhancing caregivers' knowledge and skills while simultaneously improving children's health and developmental outcomes. A mixed method approach that employed multi-stage cluster sampling technique to select malnourished children aged 6-59months residing in the targeting communities was used. Data were collected through surveys and quantitative assessments using anthropometric measurement before and during the intervention to evaluate its impact on child growth and the overall well-being of both children and caregivers. Results indicate significant improvements in nutritional status, psychosocial health, and family dynamics, highlighting the importance of a holistic approach in addressing malnutrition. This integrated model demonstrates the potential for sustainable health improvements in vulnerable populations and underscores the need for comprehensive strategies in public health initiatives. The study recommends scalable implementation of integrated interventions that combine psychosocial stimulation, nutrition support, and WASH practices, while ensuring community involvement and ongoing caregiver training to enhance child health outcomes.**

***Keywords*: Multimodal interventions, psychosocial stimulation, nutrition support, water sanitation hygiene.**

1. Introduction

Malnutrition remains a significant public health concern in many parts of the world, particularly in low- and middle-income countries (LMICs) (Black et al., 2013). Malnutrition in low-income countries is often driven by complex interplay of factors, including food insecurity, poor access to healthcare, suboptimal infant and young child feeding practices, and inadequate water, sanitation, and hygiene (WASH) conditions (UNICEF, 2019), which can lead to stunting, a result of chronic malnutrition that impairs physical and cognitive development, as well as wasting, a form of acute malnutrition that increases the risk of mortality (Bhutta et al., 2013) .Nutrient deficiencies, such as vitamin A, iron, and zinc, are prevalent in low-income countries, contributing to a higher burden of diseases and impaired immune function (WHO, 2020). These nutrients deficiencies are often exacerbated by limited dietary diversity, poor access to nutrient-rich foods and underlying infectious diseases (UNICEF, 2019). In Nigeria, the prevalence of malnutrition among children under five years of age is high, with an estimated 37% experiencing stunting, 7% wasting, and 22% being underweight (National Population Commission (NPC) & ICF, 2019). The Kanam region in North Central Nigeria is known to be particularly affected by high rates of malnutrition and characterized by remote, hard-to-reach communities with limited infrastructure and poor accessibility, with many families lacking the financial resources to access nutritious foods, clean water, and sanitation facilities (Jacob et al., 2024a). The region has diverse cultural beliefs and practices that may influence feeding behaviors, hygiene practices, and attitudes towards psychosocial stimulation.

Addressing malnutrition requires a multifaceted approach that addresses both the immediate and underlying causes (UNICEF, 2013). Psychosocial stimulation, nutrition support, and water, sanitation, and hygiene (WASH) interventions have been identified as effective strategies for improving the nutritional status of children in LMICs (Grantham-McGregor et al., 2014; Humphrey, 2009; Bhutta et al., 2013). Psychosocial stimulation has been shown to enhance cognitive and social-emotional development in malnourished children, leading to improved growth and developmental outcomes (Grantham-McGregor et al., 2014). Nutrition support, including the provision of nutrient-dense foods and micronutrient supplementation, is crucial for addressing the immediate causes of malnutrition (Bhutta et al., 2013). Additionally, WASH

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interventions, such as improving access to clean water, sanitation facilities, and promoting hygiene practices, can help reduce the burden of infectious diseases, which are closely linked to malnutrition (Humphrey, 2009).

A. Statement of the Problem

Despite the high prevalence of malnutrition in Kanam region of North Central Nigeria, the existing interventions have been fragmented and have not adequately addressed the multifaceted nature of the problem. Malnutrition in the region is driven by a complex interplay of factors, including poverty, limited access to nutritious foods, poor water, sanitation, and hygiene practices, and suboptimal psychosocial stimulation for child development. An integrated approach that simultaneously addresses these key determinants of child nutrition is expected to have a synergistic effect, leading to more sustainable and holistic improvements in the overall well-being of malnourished children in the Kanam region.

1) Purpose of the Study

The study examined the impact of integrated psychosocial stimulation, nutrition support, water sanitation hygiene interventions among malnourished children in Kanam, North Central Nigeria. Specifically, the study sought to:

i. Examine the developmental changes of the malnourished children who received the integrated intervention of psychosocial stimulation, nutrition support, and water, sanitation and hygiene over the period of intervention.
ii. Compare the developmental changes of the malnourished children who received the integrated intervention with those who received one of the intervention only, over the period of the research.
iii. Compare the developmental changes of the malnourished children who received integrated intervention with the children who received two of the integrated intervention over the period of the study.
iv. Examine the impact of the integrated intervention of the psychosocial stimulation, nutrition support, and WASH on the childcare practices of the caregivers of the malnourished children in the study area.

B. Research Questions

The study sought answers to these questions:

i. What are the developmental changes of the malnourished children who received the integrated intervention of psychosocial stimulation, nutrition support, and water, sanitation and hygiene over the period of intervention?
ii. How does the developmental changes of the malnourished children who received the integrated intervention with those who received one of the interventions only, over the period of the research differ?
iii. How does the developmental changes of the malnourished children who received integrated intervention with the children who received two of the integrated intervention over the period of the study differ?
iv. What is the impact of the integrated intervention of the psychosocial stimulation, nutrition support, and WASH on the childcare practices of the caregivers of the malnourished children in the study area?

2. Review of Literature

A. Conceptual Framework

The conceptual framework that aligns well with the multifaceted approach of integrated intervention targeting malnourished children in the Kanam region of North Central Nigeria is the Socio-Ecological Model (SEM). The socio-Ecological Model (SEM) is a comprehensive framework that considers the multiple levels of influence on an individual health and wellbeing including intrapersonal, interpersonal, organizational, community, and societal factors (Bronfenbrenner, 1979, McLeroy et al., 1988). This model is particularly relevant for understanding and addressing the complex determinants of malnutrition, which often extend beyond the individual characteristics and behaviours of malnourished children, such as their nutritional status, cognitive development and health-related practices. The framework addresses direct impact of psychosocial stimulation and nutrition support components on the child's growth, development, and well-being through examining the roles of caregivers, family members, and social networks in shaping the child's nutrition, care and stimulation practices. The study seek to consider the capacity and functioning of local health facilities and focuses on the availability of essential resources such as clean water sanitation facilities, and hygiene practices, within the target communities, and examines the broader socioeconomic, political, and cultural factors that influence the prevalence and persistence of malnutrition in the region.

B. Literature Review

Malnutrition is a significant public health issue in Nigeria, particularly in Plateau State, leading to impaired development and increased mortality. In Jos East LGA, stunting rates among school-aged children reach as high as 10.34%, while the overall malnutrition prevalence in Qua'an Pan LGA stands at 39.45% (Abah, et al. 2017, Damar et al., 2025). In Kanam communities, high malnutrition rates among children aged 6-59 months are linked to the poor socioeconomic status of their parents (Jacob et al., 2024). Due to the intricate combination of factors leading to malnutrition, multimodal approaches are becoming more widely acknowledged as crucial (Sharn et al., 2025). These strategies usually combine nutrition-focused methods, such as dietary supplements and enhanced feeding practices, with nutrition-sensitive actions that tackle fundamental issues like water, sanitation, hygiene (WASH), and psychosocial support (Lenters et al., 2016; Zhang et al., 2021).

Nutrition support, including breastfeeding, proper complementary feeding, and oral supplements, is vital for malnourished children, as it leads to better clinical outcomes, lower infection rates, and shorter hospital stays (AlQahtani et al., 2025; Lenters et al., 2016). Inadequate WASH conditions

lead to malnutrition via diarrheal diseases, parasitic infections, and environmental enteropathy (WHO, 2023), making interventions like better water quality, sanitation, and handwashing crucial. However, research shows that the impact of these WASH interventions on acute malnutrition is not always clearly proven (Patlán-Hernández et al., 2022). Psychosocial stimulation is crucial for the cognitive and socio-emotional development of malnourished children and has been shown to enhance their developmental outcomes (David & Kumar, 2023, (Tessema et al., 2025). Integrated approaches in many countries have demonstrated positive impacts on nutritional status and related outcomes (WHO 2023). Despite these advances, more research is needed to assess the effectiveness of multimodal interventions in specific contexts, such as Kanam Plateau State.

3. Research Method

A. Location

The study was carried out in Kanam Local Government Area (LGA), situated in the central zone of Plateau state, Nigeria. Kanam LGA is a rural region where the majority of the households are engaged in subsistence farming. The area is located at coordinates 9.54^0N and 10.09^0E and had a total population of 165,898 according to the 2006 census, with an annual growth rate of 2.7%.

B. Study Population and Sampling Technique

The target population for the study comprised of all children aged 6-59 months within the area, and a random sampling technique was used to identify four communities, each with one public Primary Health Care (PHC) were purposively selected based on distance and accessibility. Malnourished children were identified through anthropometric measurements, including weight, height, and mid-upper arm circumference (MUAC), taken at the public primary health care facilities in their respective localities using standard procedures, and their body mass index (BMI) was calculated. Children were enrolled in the study if they met the enrolment criteria, which included MUAC less than 12.5cm, weight-for-height z-score (WHZ) between -3 and -2, or weight-for-age z-score (WAZ) greater than-1.5. Health workers explained the purpose of the study to the caregivers in the local language (Hausa), obtained verbal consent from the caregivers to participate; and collected demographic information, as well as details about the child's appetite and recent infectious symptoms, but those children with any serious illness were excluded. A total of 100 malnourished children were selected with each cluster containing 25 children each, and a comprehensive baseline data were collected prior to the implementation of the integrated intervention.

C. Intervention

The impact of the integrated intervention on the nutritional status and developmental outcomes of malnourished children using anthropometric measurement (weight, height, mid-upper arm circumference), indicators of child development (cognitive development) and household-level factors (WASH practices) were determined. A weekly weight-based supply of enriched supplementary food formulated from millet, toasted soy, and sesame fortified with crayfish, dried *Moringa oleifera* leaves, baobab fruit pulp, and orange-fleshed sweet potato flour blends were produced locally with increased micronutrient contents (Darbe et al., 2024). For psychosocial stimulation, play and communicate at home activity book guided the caregivers on use of toy/play materials. WASH materials supplies were detergents, handwashing basins, soap, dettol, and toilet tissues among others. 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. However, semi-structured interviews were conducted with caregivers, community health workers, and other key stakeholders to explore their perceptions, experiences, and attitudes related to the integrated intervention. Focus group discussions with caregivers, discussions at men meeting place (majalisa), community members and local authorities provided insights into sociocultural factors, barriers, and facilitators affecting the implementation and adoption of the integrated intervention. The study adopted an approach where topics on childcare practices and the importance of adequate nutrition, water, sanitation and hygiene (WASH), communication, and play were discussed with the participants. Bimonthly facilitation of discussion at majalisa (men meeting place) on the roles of men in child care practices and parenting were achieved. Structured observations of the intervention delivery, household practices, and community dynamics provided understanding in the context and the implementation process. Additionally, the intervention strategies involved weekly and monthly facilitation of mothers-to-mothers counselling and support visits. The study delivered an integrated package of interventions through trained workers, including (1) psychosocial stimulation, food supplementation, and water sanitation hygiene (PFW); (2) psychosocial stimulation, food supplementation (PF), (3) water sanitation hygiene and food supplementation (WF), (4) food supplementation alone (FA). The intervention period lasted for six months.

D. Statistical Analysis

Statistical analyses were conducted using SPSS software version 26 and Microsoft Excel, Frequency and mean were used to analyze the research questions. A decision point of 2.50 was used to determine the acceptability of the questionnaire items. ANOVA was employed to test the hypotheses at a 0.05 level of significance.

4. Results and Discussion

A. Answering of Research Questions

a. Research question one: What are the developmental changes of the malnourished children who received the integrated intervention of psychosocial stimulation, nutrition support, and water, sanitation and hygiene over the period of intervention?

The table 1 presents the developmental changes of malnourished children's body mass index (BMI) who received the integrated interventions over the period. The result revealed an improvement in the malnourished children's body mass index between the baseline readings and their corresponding end line readings across the community in focus. There is positive and gradual increase in developmental changes of malnourished children in terms of body mass index when exposed to integrated interventions of nutritional support, psychosocial stimulation, water sanitation and hygiene.

b. Research question two: How does the developmental changes of the malnourished children who received the integrated intervention with those who received one of the interventions only, over the period of the research?

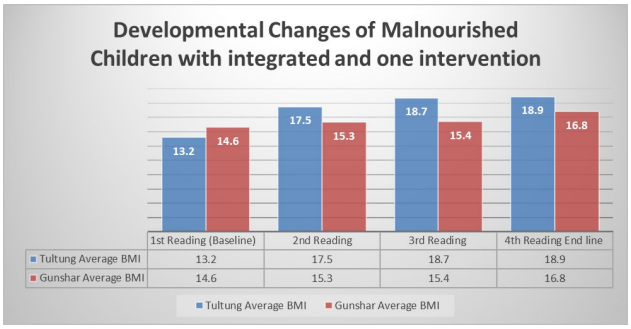

Fig. 1. Average developmental changes of malnourished children BMI with complete integrated and one intervention

The figure 1 present the developmental changes of the malnourished children who received the complete integrated intervention with those who received one of the interventions only, over the period of the research. The result revealed that those who received the complete integrated intervention of psychosocial stimulation, nutritional support, water sanitation and hygiene had a higher developmental change in term of the body mass index than their counterpart who received only nutritional support alone in the study. This finding indicates that a holistic approach combining multiple interventions is more effective than nutritional support alone in managing malnutrition and fostering healthy development in children. Similarly, meta-analyses indicate that WASH interventions combined with nutrition have a positive effect on height-for-age z-score (HAZ) and weight-for-age z-score (WAZ) (Bekele et al., 2020).

c. Research question three: How does the developmental changes of the malnourished children who received integrated intervention with the children who received two of the integrated intervention over the period of the study differ?

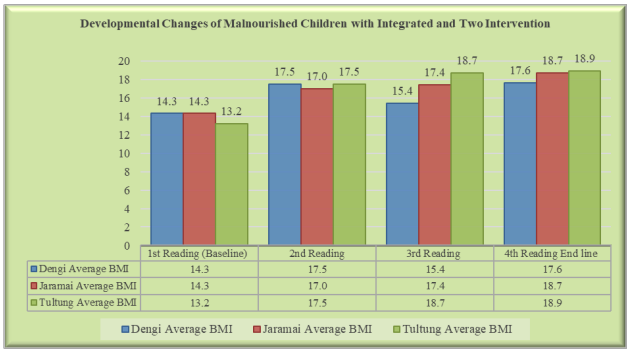

Fig. 2. Average developmental changes of malnourished children BMI with complete integrated and two of interventions

The figure 2 present developmental changes of the malnourished children who received the complete integrated intervention with those who received two of the integrated interventions over the period of the research. The result revealed that the malnourished children who received the complete integrated intervention of psychosocial stimulation, nutritional support, water sanitation and hygiene had a steady developmental change in term of the body mass index than their counterpart who received two of the integrated intervention in the study. Hence, the integrated intervention was seen to be steadily increasing the developmental changes of malnourished

Table 1
Average developmental changes of malnourished children by BMI in the four communities

Communities	1st Reading (Baseline)	2nd Reading	3rd Reading	4th Reading End line
Dengi Average BMI	14.3	17.5	15.4	17.6
Jarmai Average BMI	14.3	17.0	17.4	18.7
Tuttung Average BMI	13.2	17.5	18.7	18.9
Gumshar Average BMI	14.6	15.3	15.4	16.8

Table 2
Mean of the impact of the multimodal intervention on the childcare practices of the caregivers of malnourished children

S.No.	Variables	Mean (Baseline assessment)	Mean (End line assessment)	Decision
A	**Caregivers Water sanitation and hygiene**			
1	Water sanitation and hygiene practice	2.08	3.19	Improved
2	Caregivers Practice towards drinking water	2.34	3.43	Improved
3	Caregivers cleaning of the environment	2.50	3.32	Improved
4	Caregivers use of hygiene materials	2.15	3.42	Improved
5	Caregivers practice on handwashing	2.50	2.98	Improved
B	**Caregivers Nutritional practice**			
1	Caregivers Knowledge of nutrition	2.35	3.34	Improved
2	Caregivers attitude toward nutrition	2.49	2.87	Improved
3	Practices associated with child nutrition	1.92	2.47	Improved
C	**Children psychosocial assessment**			
1	Malnourished children in Gumshar	2.12	3.42	Improved
2	Malnourished children in Dengi	2.37	3.27	Improved
3	Malnourished children in Jaramai	1.81	3.74	Improved
4	Malnourished children in Tultung	2.12	3.24	Improved

children exposed to it.

d. Research question four: What is the impact of the integrated intervention of the psychosocial stimulation, nutrition support, and WASH on the childcare practices of the caregivers of the malnourished children in the study area?

The table 2 presents the mean impact of the integrated intervention on childcare practice of the caregivers of malnourished children at the baseline and end line assessment in the study. The result revealed a positive improvement between the baseline assessment and the end line assessment conducted in the study. This further established the impact of the integrated intervention of psychosocial stimulation, nutritional support, water sanitation and hygiene on childcare practices.

B. Discussion

In this study, the findings were similar to studies done in Southern (Tessem et al 2025) which found that integrated interventions of psychosocial stimulation on the development, nutrition, and treatment outcomes of hospitalised children with severe acute malnutrition significantly improved the BMI of malnourished children. Similarly, an examination of integrated interventions typically shows positive correlations with improved BMI and developmental changes (Khadilkar, et al. 2025 and Daniel et al., 2017) emphasizing that gender be considered when implementing the interventions. Although, the previous study in Ethiopia was done in hospital setting that concentrated on severely malnourished children and the hospital setting may be causing emotional stress for caregivers, however some studies report mixed results, influenced by intervention duration, activities, and socio-economic conditions (Ndlovu et al., 2024; Daniel et al., 2017). The findings suggest a strong positive correlation between WASH (water, sanitation, and hygiene), psychosocial stimulation, and nutrition support because they are interconnected components of optimal child development. The developmental changes of the malnourished children who received the integrated interventions compared with those who received one intervention only over the period showed significantly improved BMI, suggesting synergistic effect of combine components. Poor WASH practices can lead to illnesses that impair nutrient absorption, while psychosocial stimulation fosters cognitive and emotional development, and nutrition support offers essential components for physical and mental growth. Interventions that combine all three elements are more effective than those focusing on just one, resulting in better nutritional status, growth, and cognitive development for children (Jacob et al, 2024). Similarly, research by Dulal et al. (2021) indicates that integrated interventions provide notable advantages for children's developmental outcomes, especially in cognitive and language skills, when compared to individual nutrition interventions.

Multimodal interventions combining psychosocial stimulation, nutritional support, water, sanitation and hygiene (WASH) are generally more effective in improving developmental outcomes and nutritional status in malnourished children than those who received two of the integrated interventions. Studies suggest a synergistic effect when these components are combined leads to improved developmental outcomes and nutritional status in malnourished children (Bekele et al., 2020). Implementing WASH interventions alongside nutrition and psychosocial support alongside nutrition support improves outcomes (Bekele et al, 2020, Patlán-Hernández et al., 2021). Studies by Abessa et al., (2019) have shown that insufficient psychosocial stimulation in severely acutely malnourished children can result in stunted growth, hindered motor and cognitive development, lower IQ, and persistent behavioral and emotional issues in children. Research by Mshida et al. (2018) in Tanzania found that poor WASH practices harm malnourished children by perpetuating a cycle of infection and malnutrition, where diarrhea hampers nutrient absorption and a weakened immune system heightens infection risk. Therefore, strategies that incorporate effective psychosocial stimulation, nutrition support, safe water, sanitation and hygiene are crucial for tackling malnutrition, indicating that integrated approaches are more effective than either one or two interventions. Some studies indicate that there is no significant overall effect on reducing stunting, and the effectiveness of these programs may be constrained by issues such as poverty, insufficient spousal support, and overstretched services (Habtu et al., 2022, Grantham-McGregor et al., 2014).

The impact of integrated interventions involving psychosocial stimulation, nutrition support, and WASH on childcare practices of caregivers on malnourished children between the baseline assessment and the end line is significant. These integrated interventions enhance caregivers' knowledge and attitudes toward childcare, as evidenced by focus group discussions revealing shifts in their understanding and practices (Jacon et al., 2023). Caregivers experience better relationships and communication, along with enhanced knowledge and skills in responsive care and nutrition, which are crucial for children's development and recovery (Yousafzai, et al.,2016). Research by Mekuriaw et al. (2025) and Alemwork et al. (2025) revealed a notable improvement in the mental and emotional well-being of both malnourished children and their caregivers. Integrated interventions that combine psychosocial stimulation, water sanitation and hygiene (WASH) practices with nutrition-specific strategies significantly influence parents and their behaviors, leading to better prevention of diarrheal diseases and enhanced child growth (Bekele et al., 2020). These interventions also enhance well-being for caregivers, strengthen bonds between caregivers and their children, and improve family ties. The findings may not be applicable to regions with different socio-economic or cultural contexts, limiting the intervention's broader relevance. Additionally, focusing on immediate outcomes could overlook long-term effects on child health, while resource-intensive implementation may pose challenges in resource-limited settings.

5. Conclusion

The integrated intervention combining psychosocial stimulation, nutrition support, and water, sanitation, and hygiene (WASH) practices in Kanam, North Central Nigeria, demonstrated significant improvements in the health and well-being of malnourished children. Results indicate enhanced

nutritional status, better mental health outcomes, and strengthened caregiver-child relationships. The holistic approach of addressing multiple factors contributing to malnutrition proved effective, highlighting the interconnectedness of nutrition, psychosocial support, and hygiene.

6. Recommendations

The study recommends that,

i. The studies be replicated in other regions with diverse cultural contexts to establish the impact and relevance for child health and development.
ii. Federal and State governments should provide continuous caregiver training on responsive care, nutrition, and hygiene while promoting community involvement in program design to enhance intervention effectiveness.
iii. Federal and State governments should promote policies that endorse integrated child health, nutrition, and hygiene strategies while securing resources for comprehensive programs.

Acknowledgement

This publication is derived from research supported by the TETFUND National Research Fund (NRF) Intervention.

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