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Integrated Intervention on the Linear Growth and Psycho-Cognitive Development of Malnourished Children Aged 6-59 Months in Kanam, Plateau State, Nigeria

Sunday Jacob¹, Audu Andrew Jatau², John Wukatda Darbe³, Falade Job Olakunle⁴, Helen. S. Jacob⁵,
Mohammed Buhari⁶

¹ Social Studies Department, Federal College of Education, Pankshin, Plateau State, Nigeria.

E-mail: sundayjacobyahoo.co.uk

² Physical and Health Education Department, Federal College of Education, Pankshin, Plateau State, Nigeria.

E-mail: andyjatauyahoo.com

³ Home Economics Department, Federal College of Education, Pankshin, Plateau State, Nigeria.

E-mail: johndarbemail.com

⁴ Department of Psychology, Federal College of Education, Pankshin, Plateau State, Nigeria.

E-mail: falade.olakunleyahoo.com

⁵ Home Economics Department, Federal College of Education, Pankshin, Plateau State, Nigeria.

E-mail: helenjacobhj9gmail.com

⁶ Home Economics Department, Federal College of Education, Pankshin, Plateau State, Nigeria.

E-mail: buharimohammedfst20gmail.com

Correspondence: Sunday Jacob. Email: sundayjacobyahoo.co.uk

Abstract

This study examines the impact of an integrated intervention programme on the linear growth and psycho-cognitive development of malnourished children aged 6-59 months in Kanam, Plateau State, Nigeria. The intervention employs a multifaceted approach, including nutritional supplementation, psychosocial stimulation, water, sanitation and hygiene. A mixed method approach that employed multi-stage cluster sampling technique to select malnourished children aged 6 to 59 months residing in the targeted communities was used. Quantitative assessments of anthropometric measurements height/length, weight and mid-upper arm circumference were undertaken to assess nutritional status, and psycho-cognitive assessment along with qualitative data from caregiver interviews and community feedback, were utilized to evaluate the intervention's effectiveness. The findings of the study show that community whose children received the complete package recorded higher linear growth. This was followed by communities whose children received two packages of nutrition and psychosocial support, as well as nutrition and water, sanitation, hygiene respectively. The community whose children received only nutrition had the least linear growth. Furthermore, the study shows a greater improvement in psycho-cognitive development among children in two communities that had psychosocial support added to their packages compare to the children from the other two communities without psychosocial support been added. Recommendations made include the need to establish community food-based intervention programmes, create awareness among parents to be more involved in psychosocial activities with children, provision of age-appropriate stimulation materials, training of

parents/caregivers on responsive caregiving practices, and the need to establish safe spaces for play and learning in schools and communities.

Keywords: Children, Integrated Intervention, Linear Growth, Malnutrition, Psycho-Cognitive Development

1. Introduction

The issue of malnutrition among children under the age of five continues to pose a significant public health challenge in numerous communities, largely because of its significant effects on both physical and cognitive growth and development. According to Black et al. (2013), the deep-seated consequences of malnutrition during infancy and early childhood are linked with the health and development of the child, potentially resulting in stunted growth, hindered brain development, heightened vulnerability to infections and chronic ailments, as well as symptoms like fatigue, irritability, delayed motor skills, and diminished learning abilities. One of the numerous factors impacting a child's development is malnutrition. Children who are malnourished are susceptible to nutritional deficiencies, which can contribute to elevated rates of mortality and morbidity (Olofin et al., 2013). The consequences of malnutrition also foretell compromised cognitive development and subsequent academic performance (Clark et al., 2010). This results in inadequate motor and cognitive development, reduced educational achievements, and increased risk of developing metabolic disorders, which can hinder productivity in adulthood (Victora et al., 2008). Also, the World Health Organization (WHO) stresses that malnutrition plays a substantial role in global child mortality rates, underscoring the necessity of interventions aimed at the 6-59 months age bracket to attain sustainable development objectives concerning health and well-being (WHO, 2018).

Presently, the global challenges of tackling malnutrition are enormous. Ziso et al. (2022) pinpoint several critical concerns, including restricted availability of nourishing food, inadequacies in healthcare infrastructure and services, and obstacles to education. Roberts et al. (2022) highlighted some of the adverse impacts of malnutrition on children's cognitive functions, educational aptitude, and general mental health, encompassing aspects like language acquisition, memory retention, attention span, and problem-solving capabilities. Overcoming these challenges requires holistic strategies that can integrate nutrition, healthcare, and education to enhance psycho-cognitive development and provide support for cognitive stimulation and mental well-being of malnourished children. A meta-analysis examining the impacts of early life intervention on both physical growth and neuro-behavioural development revealed that, aside from nutritional interventions, enhancements in neuro-behavioural development and human potential necessitate interventions directed at caregiving practices and educational opportunities that foster the growth of cognitive, language, motor, and socio-emotional skills (Prado et al., 2019).

An integrated approach in child malnutrition intervention involves combining multiple strategies and sectors to address the various dimensions of malnutrition effect. This strategy usually integrates components from dietary interventions, healthcare services, education, and community involvement to address both the underlying causes and effects (Ziso et al., 2022). This view is further supported by Jacob et al. (2023a) whose study established a significant improvement in the developmental status of malnourished children exposed to an integrated intervention approach. Similarly, a comparative study between the integrated intervention approach to address malnutrition and those that received one form of intervention showed that the average Body Mass Index obtained between baseline and end-line data was a causal pathway that improved nutritional outcomes impacted by integrated package delivery (Jacob et al., 2023b). The progress made through existing research, which concentrates on comprehending memory mechanisms and cognitive abilities, has facilitated the formulation of targeted treatment strategies. Providing proper nutrition from an early age alongside a supportive psychosocial environment can result in a significant alteration in both physical and mental growth, influencing children's cognitive abilities, emotional state and behavioural patterns (Russell et al., 2022). These strategies aim to sustain or enhance the cognitive function and overall well-being of malnourished children. However, not all of these interventions have demonstrated effectiveness in promoting linear growth, largely due to the variability of local foods in terms of calorie content and specific nutrient composition (Mamun et al., 2023).

In Nigeria, the National Population Commission (NPC) and ICF International in their 2019 Demographic and Health Survey (DHS) shows that 7% of children under the age of five suffer from acute malnutrition or wasting, characterized by low weight-for-height while 37% exhibit stunting, denoting low height-for-age. For Plateau state, the 2015 SMART report highlighted that more than 66% of children including those in Kanam Local Government Area (the focus area for this study), are affected by malnutrition. In addition, the study conducted by Jaryum, (2018) in Kanam on the zinc levels in staple grains and household water sources shows that well water samples exhibited higher concentrations of zinc while the bioavailability of zinc in staple food items was hindered by their high phytate content, potentially putting the population at risk of zinc deficiency. Therefore, this study gave mothers a comprehensive integrated approach to increase their understanding of and sensitize them to the prevention and management of malnutrition, focusing on their effectiveness on both the linear growth and psycho-cognitive development of malnourished children. The aim was to investigate the specific impact of an integrated approach on linear growth and psycho-cognitive development of malnourished children and provide evidence-based recommendations to improve existing strategies, fostering a more holistic and sustainable approach to address the complex challenges associated with child malnutrition.

2. Theoretical framework

The Ecological System Theory of Bronfenbrenner 1979 posits that a child's development is influenced by various interconnected systems, ranging from the immediate microsystem to broader macro-system factors. The integrated approach can be understood as an intervention that functions within these systems, targeting not only nutritional aspects but also healthcare, education, and the socio-dynamics of the community. This approach is consistent with Bronfenbrenner's idea that development is influenced by the interplay between an individual and their surroundings. The Bioecological Model of Human Development (Bronfenbrenner and Morris, 2006) reinforces this concept by highlighting the dynamic, reciprocal interactions that occur between biological and environmental factors, ultimately enhancing the overall development of malnourished children. These theoretical perspectives provide understanding of how the integrated approach operates within the intricate web of ecological systems, impacting the linear growth and psycho-cognitive development of malnourished children.

In relation to the present study, integrated approach can be defined as a comprehensive strategy that combines multiple components to address various dimensions of malnutrition. This approach is designed to synergize efforts from nutritional support, psychosocial stimulation, water sanitation and hygiene to create a holistic intervention. Nutrition support guarantees that the child obtains essential dietary components vital for physical growth, while stimulating activities foster cognitive and psychosocial development. Enhanced water sanitation and hygiene practices aid in preventing recurrent infections that can exacerbate malnutrition (WHO, 2017). Research findings has underscored the beneficial effects of integrating nutritional support, psychosocial stimulation, and water sanitation hygiene interventions across various environments (Reinhardt & Fanzo, 2014, Ziso et al., 2022,). Ansuya et al. (2023) discovered that providing nutrition-focused food tailored to the rural population, developed and delivered within the home environment and at an affordable cost, contributed to improved cognitive development among children in the experimental group compared to those in the control group.

Psycho-cognitive can be inferred as the combination of psychological and cognitive aspects related to mental processes, emotions, and thought patterns. It covers both the emotional and cognitive dimensions of an individual mental functioning, including perception, memory, problem solving, and emotional wellbeing. From a psycho-cognitive perspective, knowledge creation is viewed as a collaborative process, wherein knowledge comprises co-created cognitive structures, challenging the notion that knowledge solely resides within the individual mind (Bolande, 2022). A growing child experiences psychosocial stimulations primarily through responsive parenting practices, such as showing warmth and affection, offering conscious affirmation, engaging in interactive play, and mothers singing or talking to the child. Additionally, fathers provide valuable sources of psychosocial stimulation by offering encouragement, attention, smiles, physical touch, and assisting the child in exploring the outside world (UNICEF, 2012).

Nevertheless, there is insufficient data regarding the factors influencing early childhood development in low-income nations, particularly in rural areas of sub-Saharan Africa and Asia where children face heightened risks of

not attaining their developmental capabilities due to numerous factors that contribute to poor cognitive development (Ranjitkar et al., 2019., Kirolos et al., 2022). Only a limited number of research investigations have delved into the correlation between nutritional status, psychosocial stimulation, and cognitive development. These studies have proposed exploring the combined impacts of nutrients and psychosocial stimulation on the cognitive growth of preschoolers (Nyaradi et al., 2013). Study by Sharma et al. (2023) showed that preschoolers' cognitive development is associated with some socio-economic and demographic factors, including the children's age, ethnicity, and family type all influenced by nutritional status and psychosocial stimulation. This view is further supported by Drago et al. (2020) whose study established a strong association between Socioeconomic status and modest organization of the home environment and its opportunities for cognitive stimulation and cognitive development were found positive.

The 2019 Demographic and Health Survey (DHS) conducted in Nigeria by the National Population Commission (NPC) and ICF International reveals that 7% of children under the age of five suffer from acute malnutrition or wasting, characterized by low weight-for-height, while 37% exhibit stunting, denoting low height-for-age. The 2015 SMART report highlighted that more than .66% of children in Plateau State, Nigeria, including those in Kanam Local Government Area, are affected by malnutrition. Research conducted on the zinc levels in staple grains and household water sources in Kanam Local Government Area found that the well water samples exhibited higher concentrations of zinc. However, the bioavailability of zinc in staple food items was hindered by their high phytate content, potentially putting the population at risk of zinc deficiency (Jaryum, 2018). Considering this, the current study made an effort to give mothers a comprehensive integrated approach to increase their understanding of and sensitize them to the prevention and management of malnutrition, focusing on their effectiveness on both the linear growth and psycho-cognitive development of malnourished children. Hence, this study in Kanam, Plateau state aims to investigate the specific impact of an integrated approach on linear growth and psycho-cognitive development of malnourished children and provide evidence-based recommendations to improve existing strategies, fostering a more holistic and sustainable approach to address the complex challenges associated with child malnutrition.

Objectives of the Study

Specifically, the study seeks to:

1. examine the pattern of the linear growth of malnourished children due to integrated package that encompasses nutrition support, psychosocial stimulation, water sanitation and hygiene.
2. establish the psycho-cognitive development of the malnourished children due to the integrated intervention approaches in the study.

3. Research Questions

1. What is the pattern of linear growth of malnourished children exposed to integrated intervention package of nutrition support, psychosocial stimulation, water sanitation and hygiene for four (4) months of the study?
2. How does the psycho-cognitive development of malnourished children exposed to the integrated intervention of complementary nutritional support, psycho-social stimulation, water sanitation and hygiene compare between the baseline and mid-term assessments in the communities?

4. Statement of Hypotheses

1. There is no significant difference between the baseline and the mid-term body mass index obtained to determine the linear growth development of malnourished children exposed to intervention in the study.
2. There is no significant difference in the psycho-cognitive development of malnourished children exposed to intervention across the four (4) communities under consideration of the study.

5. Methodology

This study employed a cluster-randomized controlled trial design to assess changes in linear growth and psycho-cognitive development over a period of four months among malnourished children receiving nutritional support, psychosocial stimulation, water sanitation and hygiene practices. The cluster of moderate and severe uncomplicated underweight children between six and fifty-nine of months whose mothers are living in rural areas where most householders are peasant farmers were included in the study. The study was conducted in Kanam LGA, Plateau state, Nigeria. Kanam Local Government area (LGA) is located on 9.54N and 10.09 E central zone of Plateau State. Purposive sampling technique was used to identify the samples from four communities namely Dengi, Jarmai, Tuttung and Gumshar. These communities have functional public Primary Health Care (PHC) centres each. The eligible malnourished children were identified through a door-to-door survey carried out by two trained research assistants (health workers) each from four public primary health care facilities in the locality. Standard procedures were employed to take anthropometric measurements including weight, height, and mid-upper arm circumference for all children participating in the study. Additionally, Body Mass Index (BMI) was calculated. Children with a Mid-upper Arm Circumference (MUAC) below 12.5 cm, or a weight-for-height z score (WHZ) between -3 and -2, or a weight-for-age z score (WAZ) greater than -1.5 were identified, selected and enrolled after consent was obtained from their parents or guardians.

Concurrent delivery of an integrated package of a low-cost programme of psychosocial stimulation, nutrition support, and water sanitation hygiene practices were done to the four centres. The control group received only nutrition without either psychosocial stimulation, or Water Sanitation and Health (WASH), two groups received either nutrition-psychosocial stimulation only, or nutrition-WASH only. The fourth group received nutrition-psychosocial stimulation-WASH combined. This design helps to isolate the specific impact on linear growth and psycho-cognitive development. Anthropometric tools such as weight, height scales and Mid-upper-arm circumference (MUAC) were taken monthly to validate changes that occur within the timeframe. WASH checklist, Play and Communicate Calendar, Play and Stimulation Progress Tracker, and Psycho-cognitive Assessment scales were used to collect additional data. Baseline assessments on malnourished children before, during and at the end of the intervention were carried out. Data analysis was conducted utilizing SPSS version 23, employing both descriptive and inferential statistical techniques. Specifically, measures such as mean, standard deviation, charts, as well as t-tests and analysis of variance (ANOVA), were utilized with a significance level set at $P < 0.05$.

6. Ethical Considerations

The research study was registered and approved by the Ethics Committee of the Federal College of Education, Pankshin. Permission to conduct the study at each site was granted by the Executive Chairman of the Kanam Local Government Area. Prior to participation, informed consent was acquired from the parents or guardians of the malnourished children.

7. Results

7.1. Research question 1: What is the pattern of linear growth of malnourished children exposed to integrated intervention package of nutrition support, psychosocial stimulation, water sanitation and hygiene for four (4) months of the study?

Table 1: The Distribution of Malnourished Children Average Body Mass Index for Three Readings and Across the Communities

Communities	1 st Reading (Baseline)	2 nd Reading	3 rd Reading
Dengi Average BMI	14.3	16.0	16.8
Jarmai Average BMI	14.3	17.0	17.4
Tultung Average BMI	13.2	17.5	18.7
Gunshar Average BMI	14.6	15.3	15.4

The table presents the average Body Mass Index of the malnourished children obtained from the baseline to four months mid-term across the four (4) communities involved in the study. The result revealed a steady increase in

the values of Body Mass Index among the four communities of Jaramai, Tultung, Gunshar and Dengi. The increase between the baseline and the 3rd reading shows that Tultung whose children received the complete package recorded higher rise of 5.5. This was followed by Jaramai whose children received nutrition and psychosocial support with an increase of 3.1. Gunshar whose children received only nutrition had the least increase of 0.8. The general increase and improvement in the linear growth of the malnourished children from baseline data to mid-term based on the result obtained implies that the integrated intervention produced an upward linear growth among the malnourished children exposed to the nutritional support, psychosocial stimulation, water sanitation and hygiene.

7.2. Research question 2: How does the psycho-cognitive development of malnourished children exposed to the integrated intervention of complementary nutritional support, psycho-social stimulation, water sanitation and hygiene compare between the baseline and mid-term assessments in the communities?

Table 2: Mean of the Mid-term Observed Psycho-cognitive Development of the Malnourished Children across the Four Communities

s/n	Psycho-cognitive items statement	Baseline Average	Mid-term Average
1	The child participates in play activities around interestingly.	2.57	2.93
2	Activities that make up the child's everyday experiences are demonstrated.	2.22	2.90
3	There are specific child's daily functional behavior/activities as reported.	2.00	2.89
4	Ascertain the child behaviours that sustain child engagement		
	Strengths	2.08	2.92
	Interests	1.93	2.83
	Preferences	2.19	3.04
5	Identify materials (objects, toys, etc.) and interact with it in playing activities.	2.08	2.97
6	Activities/learning behavior that support and strengthen the child competencies		
	Throwing things	2.13	2.68
	Clapping hands	2.57	2.86
	Singing songs	2.22	2.83
7	Assess the child learning progress based on the attention given to play activities around.	2.00	2.97
8	The child is gaining in the learning opportunities available.	2.03	3.00
9	The child Looks closely at an interesting object or person	2.08	4.13
10	The child reaches or searches for an object or person that move away from his/her sight.	1.93	3.08
11	The child points to something that attract his/her attention.	2.19	3.05
	Overall Mean	2.11	3.01

The table presents the baseline and mid-term four months psycho-cognitive development of malnourished children across the four communities exposed to integrated intervention in Kanam LGA of Plateau state. The result revealed an increase in the psycho-cognitive development of the malnourished children in all aspect of the psycho-cognitive items observed by the researchers with overall mean of 0.9. The result implies that malnourished children gained psycho-cognitively as a result of the integrated intervention. Hence, malnourished children health and psycho-cognitive development can be effectively enhanced using the integrated approach of complimentary nutritional support, psychosocial stimulation, water sanitation and hygiene as demonstrated in this study.

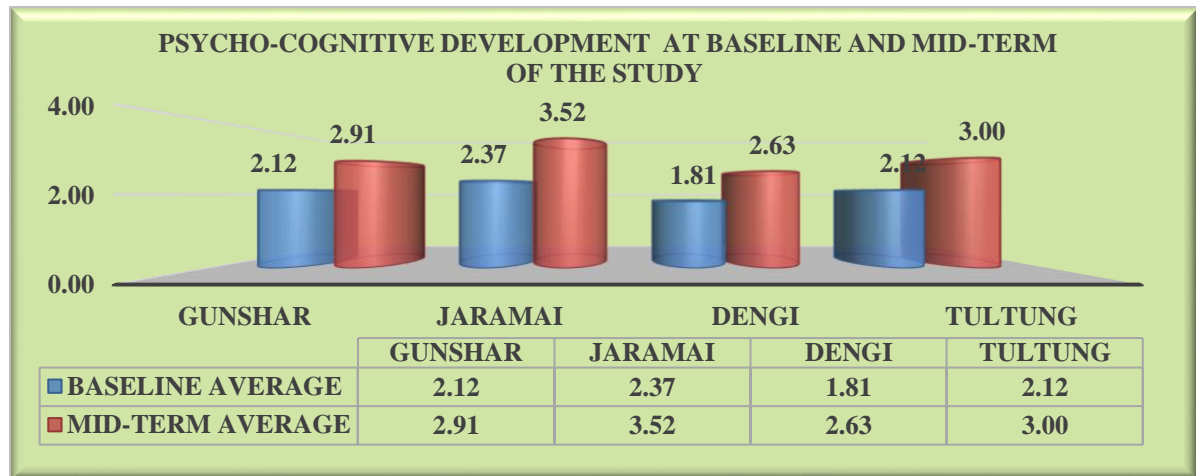


Figure 1: Average of the Psycho-cognitive Development of Malnourished Children based on each Community

The figure shows the results between the baseline average and midterm average for each of the 4 communities. From the results, two communities of Tultung and Jaramai whose children received addition of psychosocial support had an increase of 2.03 in psycho-cognitive development. Gunshar and Dengi whose children did not received psychosocial support had an increase of 1.61 in psycho-cognitive development. This means that psychosocial support has an important role in the development of children's psycho-cognitive development.

7.3. Testing of Hypotheses

7.3.1. Hypothesis 1: There is no significant difference in the body mass index of the malnourished children that indicate their linear growth before and during the intervention in the study.

Table 3: ANOVA Test Result on the Significant Difference in the BMI of the Malnourished Children Linear Growth

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	3024.188	1	3024.188	5523.630	.000
Error	1.642	3	.547		

The table presents the analysis of variance result that indicate the significant difference in the linear growth using the body mass index of the malnourished children exposed to integrated intervention. The hypothesis was rejected since the p-value of 0.00 was less than the 0.05 significance level. Therefore, there is significant difference in the linear growth of the malnourished children exposed to complementary nutrition support, psychosocial, water sanitation and hygiene in the study.

7.3.2. Hypothesis 2: There is no significant difference between the baseline and mid-term psycho-cognitive development of malnourished children exposed to integrated intervention in the four communities under consideration.

Table 4: Paired Sample t-test on the Significant Difference Between Baseline and Mid-term Psycho-cognitive Development of Malnourished Children

	Mean	N	Std. Dev	t	df	Sig (2-tailed)
Baseline average	2.15	15	.196	8.203	14	.000
Mid-term average	3.01	15	.328			

The table presents the t-test result on the significant difference between the baseline and mid-term result of the psycho-cognitive assessment of the malnourished children exposed to integrated intervention. The result revealed

that the hypothesis was rejected since the p-value of 0.00 was less than the 0.05 significance level. The implication is that the psycho-cognitive development of malnourished children significantly improved when exposed to the integrated intervention in the study. This indicates that the improvement was as a result of nutrition support, psychosocial stimulation, water sanitation and hygiene.

8. Discussion

The study in the research question one and hypothesis one revealed that there is a general linear growth in the development of malnourished children exposed to integrated intervention with a significant impact through their body mass index. However, a closer look at the results shows that Taltung whose children received the complete package recorded higher rise than those that received two packages. Interestingly, Gunshar whose children received only one package (nutrition) had the least increase. This finding aligns with that of Ziso et al., (2022) who also established the positive impact of combining nutritional support, psychosocial stimulation, water sanitation hygiene interventions in diverse settings improve the development of malnourished children. Similarly, this study supports WHO (2017) finding that affirmed that, nutrition support ensures that the child receives the necessary dietary elements for physical/linear growth, while stimulation activities contribute to cognitive and psychosocial development and improved water sanitation and hygiene practices helps prevent recurrent infections that contribute to malnutrition. Moreover, the finding corroborates Jacob et al., (2023) who found a significant improvement in the developmental status of malnourished children exposed to integrated intervention approach.

The research question two generally revealed and established that there is an improvement in the psycho-cognitive development of malnourished children exposed to complementary nutrition support, psychosocial stimulation, water sanitation and hygiene. However, in specific term, children from Taltung and Jaramai that had psychosocial support added to their packages had better improvement compare to the other two communities without psychosocial support. The finding validated Ansuya et al. (2023) who found that, a home-based nutrition-focused food, developed and delivered with context-specific and affordable to the rural population helps to enhance experimental group children's cognitive development compared to the control group. The result of this study revealed that there was a significant difference in the psycho-cognitive development of malnourished children with a focus on their social interaction, cognitive coordination and activities that enhance child development.

9. Conclusion

This study concludes that liner growth of children can be enhanced through an integrated mechanism of nutrition, psychosocial support and WASH. Also, psycho-cognitive development of children improved significantly especially among those whose packages include psychosocial stimulation.

10. Recommendations

The study therefore, recommends the establishment of community food-based intervention programmes to ensure access to nutrient-dense foods and fortified blended local foods among rural dwellers towards reducing cases of malnutrition. Also, awareness should be created among parents on the need to be more involved in psychosocial activities with children towards improving their psycho-cognitive development. Furthermore, there is the need to integrate Early Childhood Development interventions into existing health and nutrition services to support the cognitive, social, and emotional development of young children. Such services among others include the provision of age-appropriate stimulation materials, training of parents/caregivers on responsive caregiving practices, and by establishing safe spaces for play and learning in schools and communities.

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