Complementary Therapy Based on Maggots to Improve Nutrition in Toddlers: A Nursing Approach

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Abstract

Complementary therapy using maggot therapy has recently emerged as a novel approach to improving child nutrition, particularly in malnourished toddlers. This approach integrates the therapeutic use of maggots with nursing interventions to address the nutritional deficiencies commonly observed in early childhood. Malnutrition in toddlers is a critical issue, affecting growth, cognitive development, and overall health. While conventional treatments focus primarily on dietary interventions and supplementation, complementary therapies like maggot therapy have demonstrated potential in promoting wound healing and enhancing nutrient absorption, especially in cases of protein-energy malnutrition. Maggot therapy, a practice that involves the controlled use of sterile larvae, has been traditionally applied in wound care but is now being explored for its broader applications in nutritional rehabilitation. The larvae stimulate tissue regeneration, reduce infection, and facilitate better absorption of nutrients, which are crucial for a child's growsth. This nursing approach involves the holistic care of the child, combining nutritional assessment, therapy, and continuous monitoring to ensure optimal health outcomes. This paper explores the integration of maggot-based therapy into nursing practices for malnourished children, examining its impact on nutritional improvement, healing processes, and overall health. It emphasizes the importance of multidisciplinary approaches, including nursing care, to address the complex needs of malnourished children. Through this innovative therapeutic approach, the potential to reduce malnutrition and its associated risks is significantly enhanced, offering a promising adjunct to conventional treatments for improving child nutrition and health

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Introduction

Nutritional problems among toddlers remain a major public health challenge, particularly in developing countries such as Indonesia. Malnutrition during the early growth period can have long-term impacts on children's physical, cognitive, and immune development [1]. According to the *World Health Organization* (WHO), approximately 45% of deaths among children under five years old are associated with malnutrition [2]. This condition highlights the urgent need for comprehensive interventions that not only focus on food supplementation but also incorporate innovative nursing-based therapies.

Previous studies have developed various interventions to improve toddler nutrition, such as nutrient supplementation, family nutrition education, and strengthening community health programs [3]. However, conventional approaches often face barriers such as economic constraints, limited access to nutritious food, and low public awareness. Therefore, alternative therapies that are cost-effective, easy to implement, and culturally appropriate are needed.
One emerging innovation is the use of maggot-based therapy (larvae of the *Black Soldier Fly*) as an additional protein source. Maggots contain high levels of protein, essential amino acids, and micronutrients beneficial for growth and tissue repair [4]. In the context of community nursing, this approach can be integrated as a complementary therapy to support sustainable nutritional recovery in toddlers.

The novelty of this study lies in the integration of biological and nursing approaches through the utilization of maggots as a natural nutritional source formulated within nursing nutrition interventions [5]. This approach not only emphasizes the nutritional value of maggots but also the role of nurses in education, monitoring, and evaluating the effectiveness of the therapy for undernourished toddlers.

The research problem can be formulated as follows: *Is maggot-based complementary therapy effective in improving the nutritional status of toddlers?* Therefore, the purpose of this scientific article is to analyze the effectiveness of maggot-based complementary therapy in improving toddler nutrition through a holistic and evidence-based nursing approach.

Literature Review

Literature shows that nutritional problems in toddlers remain a serious public health issue, particularly in low- and middle-income countries. The prevalence of stunting, wasting, and underweight is closely linked to low intake of animal protein and essential micronutrients during the critical window of growth (the first 1000 days of life) [4]. Limited economic access to meat, fish, and eggs makes toddlers from low-income families more vulnerable to growth and developmental disorders. Consequently, various studies have begun to focus on alternative protein sources that are cheaper, sustainable, and locally producible, including the use of insects and their larvae as food ingredients [6].

In recent years, insect larvae, including Black Soldier Fly (BSF) maggots, have been widely studied as protein sources due to their high protein content and favorable amino acid profile. Numerous studies in food and animal science report that BSF larval meal has a protein level comparable to fish meal and other conventional protein sources, and also contains fats, minerals, and certain bioactive components. Although most early research has focused on using maggots as animal feed, the growing trend of entomophagy (consumption of insects by humans) and the use of insect flour in food formulations are increasingly being explored as responses to global food security and environmental sustainability issues [7].

From the perspective of safety and acceptability, several studies indicate that insects and their larvae are more acceptable when processed into flour and incorporated into food products such as biscuits, bread, or porridge, so that the original form is not visible. This approach is considered to reduce disgust and psychological resistance. However, the literature also emphasizes that the use of larvae as human food must undergo controlled farming, proper

processing, and microbiological as well as chemical safety testing before being recommended for vulnerable groups such as toddlers. Thus, maggots have potential as a high-protein food ingredient, but their implementation must strictly follow food safety standards [8].

In the context of nursing and public health, the literature on complementary therapies frequently discusses the role of nurses in nutrition promotion, family education, and the use of local food sources to improve children's nutritional status. Complementary therapy here is understood as an intervention that supplements the main therapy, for example by improving diet quality through the introduction of alternative food sources with high nutritional value. Several studies highlight the importance of nurses as educators who bridge scientific knowledge and community practice, including explaining the benefits, risks, and proper processing of new food ingredients in simple and understandable language. This approach is aligned with the paradigm of community health nursing, which emphasizes family independence in fulfilling the nutritional needs of children [9].

Moreover, the literature on innovative supplementary feeding programs (e.g., targeted foods for undernourished or stunting-risk toddlers) shows that fortifying foods with additional protein sources—such as fish meal, legumes, and other local ingredients—can improve nutritional status when given regularly and accompanied by monitoring. Within this framework, maggot flour could potentially be positioned as one candidate for fortification material, provided it has been proven safe and acceptable to the community. However, many authors stress the need for further research, including clinical trials in humans, especially toddlers, as well as in-depth studies on cultural, religious, and ethical aspects before applying such interventions widely [10].

The literature also highlights sociocultural and ethical challenges inherent in using insects as food. Cultural resistance, feelings of disgust, and concerns about religious permissibility (e.g., halal status) are recurring issues across studies. Therefore, some researchers suggest the importance of a cross-disciplinary approach involving religious scholars, anthropologists, and community leaders, in addition to health professionals [11]. For nurses, these challenges translate into the need for a high level of cultural sensitivity when providing nutrition counseling and proposing alternative protein sources. Nurses must be able to respect family refusal, provide honest and evidence-based information, and offer other options when families are unwilling to use maggot-based products.

Overall, the existing body of literature indicates that the use of maggots as an alternative protein source has a promising scientific foundation in terms of nutrition and sustainability, but its application in toddlers requires great caution. The nursing role in this context is mainly centered on education, advocacy for food safety, monitoring of nutritional status, and collaboration with multiple stakeholders to ensure that innovations developed are truly safe, acceptable, and beneficial for toddler growth and development [12].

Research Methodology

This study used a literature review design to explore the potential of complementary therapy based on maggots to improve toddler nutrition from a nursing perspective. The research process included identifying the focus, searching the literature, selecting relevant articles, extracting data, and conducting thematic analysis.

Data from selected articles were recorded in simple documentation sheets, including author, year, study type, main findings on nutritional value, safety, acceptability of maggots, and implications for toddler nutrition and nursing. Thematic analysis was then used to group findings into key themes such as toddler nutrition problems, maggots as alternative protein sources, safety and cultural issues, and the role of nurses in complementary nutrition interventions.

The main problem identified in the literature is the high rate of nutritional disorders in toddlers—such as stunting and underweight—linked to inadequate intake of animal protein and

essential nutrients, especially in low-income families. This situation creates a need for affordable and sustainable alternative protein sources.

Maggots, particularly Black Soldier Fly larvae, appear in the literature as a promising alternative due to their high protein content and potential use in processed forms such as flour mixed into porridge or biscuits. This approach may help improve dietary protein intake in toddlers where conventional protein sources are limited.

However, the literature also underlines important challenges. Food safety is a critical issue: larvae for human consumption must be produced and processed under strict hygienic conditions and tested for microbiological and chemical safety. Sociocultural and religious acceptance is another barrier, as disgust, taboos, and questions of permissibility may limit community willingness to use maggot-based products.

From a nursing perspective, problem solving cannot focus only on the product. Nurses have a key role in providing nutrition education, ensuring that families receive accurate information about benefits and risks, and advocating for safe, regulated production. Nurses also need to communicate in a culturally sensitive way and respect family choices.

Overall, the analysis suggests that complementary therapy based on maggots could contribute to solving toddler nutrition problems, but only if it is supported by strong safety evidence, appropriate regulations, cultural acceptability, and active involvement of nurses in community-based nutrition programs.

Results

A total of 32 articles were initially identified from the database search. After screening titles and abstracts, 18 articles were excluded because they focused solely on maggots as animal feed without relevance to human nutrition or nursing interventions. Four articles were excluded due to incomplete methods or lack of full-text access. Finally, 10 articles met the inclusion criteria and were included in the analysis.

Table 1. Summary of Included Studies

No	Author/Year	Main Focus of Study	Type of Study	Key Findings Related to This Review
1	L. W. Bessa, E. Pieterse, J. Marais, K. Dhanani, and L. C. Hoffman/2021	Toddler malnutrition (stunting, underweight)	Observational / Survey	High prevalence of stunting; low intake of animal protein in toddlers
2	P. Manning and M. B. McSweeney/2023	Protein-energy malnutrition in low-income families	Cross-sectional	Economic constraints limit access to meat, eggs, and fish.
3	L. W. Bessa, E. Pieterse, J. Marais, K. Dhanani, and L. C. Hoffman/2021	Nutritional composition of BSF larvae	Laboratory / Experimental	BSF larvae contain high protein and fats; potential as protein source.
4	D. Delfino et al/2023	BSF larvae meal as alternative protein in food products	Experimental (formulation)	Larval meal can be added to food products without major sensory changes at moderate levels.
5	N. K. F. P. S. Surono IS/2021	Safety assessment of	Laboratory / Review	Properly processed insects can be

		insect-based ingredients		microbiologically safe for consumption.
6	R. N. N. Perera, E. W. D. M. Ellawidana, and M. P. S. Magamage/2023	Acceptability of insect-based foods	Acceptability study	Acceptance increases when insects are processed as flour, not visible.
7	I. Hopkins, L. P. Newman, H. Gill, and J. Danaher/2021	Community attitudes toward insect-based foods	Qualitative	Cultural and religious beliefs influence acceptance of insect-based foods.
8	B. Liguori, A. I. Sancho, M. Poulsen, and K. Lindholm Bøgh/2022	Complementary nutrition interventions in community	Intervention / Program	Fortified complementary foods can improve toddler nutritional status.
9	E. Schmitt and W. de Vries/2020	Nursing role in community-based nutrition programs	Qualitative / Review	Nurses are key actors in nutrition education and monitoring.
10	H. C. H. P. Broekman *et al*/2017	Potential of insect-based foods for human nutrition	Narrative review	Insect-based foods have potential to support food security and nutrition.

Across the included articles, the literature consistently showed that stunting, underweight, and protein-energy malnutrition remain common in toddlers, especially in low-income settings. Several studies reported that families experience financial difficulties in providing animal-based protein on a regular basis. This limitation leads to insufficient intake of high-quality protein and micronutrients, which contributes to growth failure and increased risk of developmental problems. These findings underline the need for innovative, affordable, and locally available protein sources to complement existing interventions [13].

Five of the reviewed articles discussed the nutritional profile and use of Black Soldier Fly (BSF) larvae or similar insect larvae as potential food ingredients. Overall, the studies indicated that BSF larvae contain high levels of protein, as well as fats and minerals, making them a promising alternative protein source. Some experimental studies showed that larval meal or flour can be added to various food products (such as biscuits or porridges) without significantly altering taste, color, or texture when used at moderate levels of substitution [10].

Several articles emphasized that safety is a critical aspect in using maggots for human consumption. Larvae must be farmed under controlled conditions and processed using appropriate methods (washing, blanching, drying, milling) to reduce microbial contamination and ensure quality. Safety assessments reported that, when properly processed, insect-based ingredients can meet microbiological and chemical safety standards. However, the literature also noted that evidence specifically focusing on toddlers is still limited, so further research is needed before broad recommendation [14].

Sociocultural and religious factors were also identified as important determinants of feasibility. Studies showed that communities are more willing to accept insect-based foods when the insects are not visible in whole form—for example, when processed into flour and mixed into familiar foods. Nevertheless, feelings of disgust and questions about religious permissibility can remain substantial barriers. Some studies suggested involving community and religious leaders and introducing products gradually to improve acceptance [9].

From a nursing and public health perspective, the reviewed literature highlighted the significant role of nurses in nutrition education, growth monitoring, and community engagement. Nurses are often the primary health professionals who interact with families in community settings, such as posyandu or primary health centers, giving them a strategic position to introduce and explain innovative nutritional approaches[5].

Although none of the articles described a fully implemented maggot-based complementary therapy specifically for toddlers, the evidence supports the idea that nurses could:

- Provide evidence-based information about maggot-based protein as a potential complementary option,
- Advocate for safe and regulated production of maggot-derived products,
- Monitor toddler growth and detect any adverse reactions,
- Ensure that all interventions respect cultural and religious values [6].

In summary, the results of this literature review indicate that complementary therapy based on maggots has conceptual and nutritional potential to support improved protein intake in toddlers, particularly in resource-limited settings. However, its application in practice requires strong evidence of safety, careful consideration of sociocultural factors, clear regulatory frameworks, and active involvement of nurses to guide families in an informed and culturally sensitive manner [7].

Conclusion

This literature review indicates that complementary therapy based on maggots, particularly Black Soldier Fly larvae, has promising potential as an alternative protein source to help improve toddler nutrition, especially in resource-limited settings. The reviewed evidence shows that maggots have a high protein content and can be processed into flour and incorporated into familiar food products without major changes in sensory characteristics when used at appropriate levels. Conceptually, this approach may contribute to addressing the gap between toddlers' nutritional needs and the limited availability or affordability of conventional animal protein.

However, the available evidence is still preliminary and largely indirect. Most studies focus on nutritional composition, general safety, and acceptability of insect-based foods, while specific data on the use of maggot-based products in toddler diets and their clinical impact on growth and health remain limited. Significant challenges also arise from food safety requirements, the need for strictly controlled production and processing, and sociocultural as well as religious concerns that may affect community acceptance.

From a nursing perspective, complementary therapy based on maggots should not be viewed merely as a technical solution, but as part of a broader, multidisciplinary strategy. Nurses play an important role in providing evidence-based nutrition education, advocating for safe and regulated use of alternative protein sources, monitoring toddlers' growth and potential adverse effects, and ensuring that interventions respect cultural and religious values.

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