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The Impact of Probiotic Yogurt Supplementation on Weight Gain Among Preschool Children: Evidence from an Early Childhood Education Setting in Indonesia

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ABSTRACT

Nutritional adequacy in early childhood is critical for supporting optimal physical, cognitive, and emotional development. In Indonesia, high rates of undernutrition among preschool-aged children remain a persistent challenge, with significant implications for health and education outcomes. This study aimed to analyze the effect of probiotic yogurt supplementation on weight gain among children aged 4–5 years at TK Muslimat NU Jabung. Employing a pre-experimental one-group pretest-posttest design, a purposive sample of 23 children was selected based on strict inclusion and exclusion criteria. Children's body weight was measured before and after a three-week intervention, during which probiotic yogurt was administered according to standard protocols. Data analysis included descriptive statistics, the Shapiro-Wilk normality test, and the Wilcoxon Signed-Rank Test. The results showed a statistically significant increase in mean body weight post-intervention (from 10.3 kg to 10.46 kg; $p < 0.001$), demonstrating the positive impact of probiotic yogurt on child growth. These findings confirm that probiotic-rich foods can serve as accessible and effective interventions to address undernutrition in preschool educational settings. The research highlights the value of integrating nutritional interventions within early childhood education, offering evidence-based strategies for educators, midwives, and policymakers. Further research is recommended to explore long-term effects, larger sample sizes, and broader educational contexts to optimize child nutrition and health outcomes in Indonesia.

Keywords: anthropometry, early childhood education, nutrition, probiotics, weight gain

INTRODUCTION

The period from birth to six years old is universally acknowledged as the "golden age" of human life—a critical window where the foundations for lifelong health, learning, and behavior are established. During this stage, the body, mind, and social-emotional faculties develop at an extraordinary pace (Rahmi, 2019). Adequate nutrition during early childhood is indispensable, supporting not only physical growth but also cognitive, sensory, language, emotional, and social development (Fathara & Herwanto, 2023). Inadequate nutrition during this formative stage can have irreversible consequences, potentially hampering optimal development and impacting an individual's health and abilities into adulthood (Widyaningsih & Astriani, 2023). Nutritional adequacy in early childhood remains a significant concern in Indonesia. Anthropometric measurements, such as weight-for-age (W/A), height-for-age (H/A), and weight-for-height (W/H), are widely used to assess the nutritional status of preschool-aged children. Recent reports show alarming prevalence rates of undernutrition in various regions. According to the 2022 SSGI, the percentages of underweight, stunted, and wasted children under five in East Java were 15.7%, 18.0%, and 3.9% respectively (Kemenkes RI, 2022). In Malang City, 2021 data revealed 9.0% underweight, 14.5% stunted, and 5.3% wasted children (Dinkes Kota Malang, 2021). Nationally, the prevalence of underweight in toddlers increased

from 16.3% in 2020 to 17% in 2021 (Kemenkes RI, 2021). These figures demonstrate persistent challenges in achieving optimal child nutrition, with direct implications for national human resource quality. A preliminary study at TK Muslimat NU Jabung on November 16, 2024, found 10 children whose body weights were not age-appropriate. The school's intervention was limited to quarterly weight monitoring and informing parents of results, highlighting a lack of structured, effective nutritional intervention. Monitoring child growth is essential for early detection of growth disturbances and nutritional deficiencies. Without regular and thorough monitoring, nutritional problems may remain undetected and unaddressed, leading to missed opportunities for timely intervention (Herawati et al., 2023). Factors influencing body weight in children are multifaceted, including nutritional intake, health status, maternal knowledge, and socio-economic conditions. Inadequate intake—especially of protein, fats, and vitamins—directly impedes growth and can lead to persistent underweight (Tariq et al., 2018).

Given the high prevalence of undernutrition and suboptimal growth among preschool children, it is vital to seek effective and accessible interventions that can help improve nutritional status. One promising approach is the use of probiotic-rich foods, particularly yogurt, which has been shown to support both digestive health and nutrient absorption. Probiotics, defined as live microorganisms conferring health benefits when administered in adequate amounts, play an essential role in maintaining the intestinal microbiome and supporting overall well-being (Maisharoh, 2019). Yogurt, a widely available fermented dairy product, is naturally rich in probiotics, proteins, fats, carbohydrates, calcium, and micronutrients (Hadjimbei et al., 2022; Astuty et al., 2021). These nutrients are integral to supporting optimal growth in children, while the probiotics in yogurt enhance gut health and facilitate improved absorption of nutrients from food (Nurfarida et al., 2023). However, current school- and community-based interventions in the studied context have not yet incorporated yogurt or probiotic supplementation as part of routine nutritional improvement strategies.

Evidence from scientific studies supports the role of yogurt and probiotics in improving child nutritional outcomes. Maisharoh (2019) demonstrated that in children aged 2-4 years, regular intake of buffalo milk yogurt (es krim dadih) led to significant weight gain compared to controls. The improvement is attributed not only to energy intake but also to the capacity of probiotics to enhance micronutrient absorption and immune function, thereby reducing infection risk and supporting growth. Further, Sutarno (2024) investigated cashew yogurt in 100 children, finding that those who received yogurt were almost three times more likely to have good nutritional status compared to those who did not, with a statistically significant effect ($p = 0.004$, $OR = 2.917$). Probiotic supplementation, through yogurt consumption, thus appears to be a practical, palatable, and effective method to address undernutrition and support healthy weight gain in young children. Moreover, the literature points out that yogurt is rich not only in macronutrients but also in vital micronutrients such as calcium, vitamin D, potassium, zinc, and B vitamins. The fermentation process itself can increase the bioavailability of certain nutrients, supporting healthy metabolism and immune response (Astuty et al., 2021).

Despite the established benefits of yogurt and probiotics for general gut health and immunity, only a handful of studies have rigorously evaluated their impact specifically on weight gain in preschool-aged children—especially in the context of Indonesian preschools, where undernutrition remains a significant public health issue. Most existing research, such as Maisharoh (2019), focused on younger children (2-4 years), while studies in international contexts (e.g., Hadjimbei et al., 2022; Nurfarida et al., 2023) often do not address local dietary

practices, accessibility, or acceptability. Chikmah et al. (2022) explored the use of cashew-based yogurt as a functional food, but focused more on acceptability and lifestyle factors than on measured growth outcomes. Studies on alternative probiotic foods (e.g., kefir, kimchi) suggest a promising role for functional foods, but have yet to be integrated into local school-based interventions or formally evaluated for efficacy in targeted Indonesian preschool populations (Wiwik et al., 2023). This gap—the lack of context-specific, intervention-based studies examining the direct impact of yogurt probiotic supplementation on weight gain among Indonesian children aged 4-5 years—underscores the need for focused research in this area.

The primary objective of this study is to analyze the effect of probiotic yogurt consumption on weight gain among children aged 4-5 years at TK Muslimat NU Jabung. The study aims to: Identify baseline body weight of children prior to probiotic yogurt intervention. Measure changes in body weight following regular consumption of probiotic yogurt. Assess the significance and magnitude of the impact of probiotic yogurt on weight gain in the studied age group. The novelty of this research lies in its targeted focus on preschool-aged children (4–5 years) within the Indonesian school context—a demographic that, despite its vulnerability, has rarely been the subject of intervention-based probiotic studies. This research is among the first to systematically evaluate the direct impact of daily yogurt supplementation on weight gain in this age group, using robust pre-post intervention measurements. Unlike previous studies that focus primarily on under-twos, functional food acceptability, or general health knowledge, this study provides actionable, evidence-based guidance for educators, health practitioners, and policy makers seeking practical interventions for malnutrition in early childhood settings in Indonesia. Based on the reviewed literature, the working hypothesis is that regular consumption of probiotic yogurt significantly increases body weight among children aged 4-5 years. This hypothesis is supported by empirical findings from Maisharoh (2019), Sutarno (2024), and international reviews (Astuty et al., 2021; Hadjimbei et al., 2022; Nurfarida et al., 2023), which demonstrate the capacity of yogurt and probiotics to support weight gain and overall nutritional improvement in children. The hypothesis is also justified by the urgent need for simple, culturally acceptable, and effective interventions to address persistent undernutrition in Indonesian preschoolers. This study is limited to children aged 4–5 years enrolled at TK Muslimat NU Jabung. The intervention involves the administration of probiotic yogurt as a daily supplement, with weight monitored before and after the intervention period. The study does not investigate other age groups, other forms of probiotic supplementation, or the long-term effects beyond the immediate post-intervention period.

METHOD

This study adopts a pre-experimental research design. As explained by Arikunto, pre-experimental research is a method that enables the examination of cause-and-effect relationships between two factors, with the researcher retaining some control over the experimental and control groups (Arib et al., 2024). The approach is useful for testing hypotheses and determining whether a particular intervention produces a specific effect. In this research, a one-group pretest-posttest design was utilized. This design involves the observation and measurement of a single group of subjects before and after the intervention, in this case, the administration of probiotic yogurt, to determine if significant changes occur (Rustamana et al., 2024).

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Research Design

The research design, serving as the foundation for structuring and systematically connecting all elements of the study, ensures that the research question is efficiently and effectively addressed (Khairinal, 2022). The use of a one-group pretest-posttest design was considered appropriate because it enables the researcher to observe and quantify any changes in children's body weight before and after the administration of probiotic yogurt. The structure of this design is summarized as follows:

Tabel 1. Research Design

O1	X	O2
Pretest (child's weight before intervention)	Treatment (probiotic yogurt)	Posttest (child's weight after intervention)

In this notation, O1 refers to the pretest measurement, X denotes the intervention or treatment (the administration of probiotic yogurt), and O2 indicates the posttest measurement.

Operational Framework

The operational framework for this study began with the identification of the total population, which consisted of 30 children. After the application of inclusion and exclusion criteria, 23 children were selected as the sample using purposive sampling techniques. The next step involved measuring the children's body weight before the intervention, followed by the administration of probiotic yogurt. After the intervention, body weight was measured again. Data collected from these processes underwent editing, scoring, coding, entering, tabulating, and cleaning. The analysis included both univariate methods (such as frequency distribution) and bivariate methods, specifically using the paired t-test. The hypothesis would be accepted if the p-value was less than or equal to 0.05, indicating a significant effect of probiotic yogurt on the body weight of children aged 4–5 years at TK Muslimat NU Jabung.

Population and Sample

The population for this study comprised all children aged 4–5 years attending TK Muslimat NU Jabung, amounting to a total of 23 children. This definition follows the understanding that a population is the entire group of objects or subjects with certain characteristics selected by the researcher (Sugiyono, 2019; Amin et al., 2023). The sample, which is a subset of the population and serves as the main data source, was selected based on specific inclusion and exclusion criteria (Amin et al., 2023). Inclusion criteria required that children be aged 4–5 years, have parental or guardian consent to participate, be in good health without physical impairments affecting growth, and have body weight below age-appropriate standards. The exclusion criteria ruled out children with milk allergies, those taking probiotic supplements, and those with gastrointestinal disorders, growth disturbances, or chronic illnesses that could influence metabolism and body weight. The determination of the sample size utilized the Taro Yamane formula with a 10% margin of error. Using this approach, the sample size was calculated as follows: $n = 30 / (1 + 30 \times 0.01) = 30 / (1.3) \approx 23$. For the selection process, purposive sampling was chosen. This approach is based on research objectives rather than randomization, regional, or strata considerations, ensuring that the chosen participants truly represent the target population (Jailani et al., 2023; Arikunto, 2006).

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This study was conducted at TK Muslimat NU Jabung. The research was carried out over a period extending from February to March 2025.

Research Variables, Operational Definition, and Measurement

In this research, there were two main variables. The independent variable was the probiotic yogurt, defined as fermented milk containing beneficial bacteria, mainly *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (Sugiyono, 2016). The dependent variable was the body weight of children aged 4–5 years, which serves as an indicator of physical health (Sugiyono, 2018). The operational definitions and measurement details of each variable are summarized in the following table:

Tabel 1. Variable, Definition and Scale

No	Variable	Operational Definition	Parameter	Category/Score	Scale
1	Yogurt	Fermented milk product containing probiotics, mainly L. bulgaricus and S. thermophilus	ml / SOP	½–¼ cup	Nominal
2	Body weight	Total body mass (in kg), indicator of physical health	Digital scale	≥ 200g gain = increased weight; < 200g = not increased (Rahmawati et al., 2024)	Ratio

Measurement of body weight was conducted using a digital foot scale before and after the intervention. Additionally, z-scores for weight-for-age (W/A) were calculated to provide a more precise assessment of nutritional status.

Data Collection Techniques and Procedures

Data collection in this study involved systematic steps designed to answer the research questions and ensure accuracy. The primary method was observation, whereby the researchers measured and recorded the children's body weight to identify eligible participants and verify that all inclusion criteria were met, including appropriate age, good health, and parental consent. The probiotic yogurt was then administered according to the established standard operating procedure (SOP). In addition to observation, the researchers utilized documentation, collecting relevant supporting documents such as attendance and school records from TK Muslimat NU Jabung. The main instrument for data collection was a digital foot scale used to record the children's weight. The procedure began with the acquisition of a research permit from the undergraduate program, which was then submitted to the school. The researchers explained the objectives, benefits, and procedures of the study to the school authorities. Screening and

selection of the sample were based on the inclusion and exclusion criteria. The procedures were also explained to the parents or guardians, and informed consent was obtained. Baseline measurements of body weight were recorded (pretest), followed by the administration of probiotic yogurt for three weeks. After the intervention, body weight was measured again (posttest). All collected data were then tabulated and analyzed, and the findings were compiled for reporting.

Data Processing and Analysis

The processing of data in this study comprised several stages. The first step was editing, which involved checking and correcting any errors or filling in missing data (Nur, 2024). Coding was then performed, assigning numeric codes to categorical data such as gender, age, mother's occupation, income, and education. For instance, gender was coded as 1 for male and 2 for female; age as 1 for 4 years old and 2 for 5 years old, and so on. Scoring was done to label numerical values to the main outcome variable, where an increase in body weight was coded as 1 and no increase as 2. Entering involved inputting the validated data into Microsoft Excel and subsequently into SPSS for further processing. Tabulating arranged the data into structured tables, making it easier for analysis, while cleaning ensured that the data were accurate and consistent. Data analysis was performed in two stages. First, univariate analysis described and summarized the characteristics of each research variable using descriptive statistics, such as the mean and standard deviation for body weight before and after intervention. Second, bivariate analysis was used to assess the impact of probiotic yogurt on body weight. This began with a normality test to determine if the data were normally distributed. For normally distributed data, the paired t-test was applied, while the Wilcoxon Signed-Rank Test was used for data not normally distributed. The hypothesis would be accepted if the p-value was less than or equal to 0.05, indicating a statistically significant effect of probiotic yogurt on body weight (Notoadmojo, 2018).

Ethical Clearance

The study followed strict ethical guidelines, and ethical clearance was obtained from the Ethics Committee of the Institut Teknologi Sains dan Kesehatan RS dr. Soepraoen Malang. The research was designed to generate valid results with direct individual and public health benefits, especially for child growth. It also contributed scientifically by enhancing systems for recording and reporting child growth data at the study location. Prior to participation, all subjects and their guardians were fully informed about the research objectives, procedures, rights, and responsibilities, and their informed consent was obtained. The researchers took all necessary steps to minimize risks to the subjects and ensure that any potential risks were balanced by the expected benefits. Sample selection was conducted to ensure fair representation of the population. All incentives, if any, were transparently explained to the subjects. Participant confidentiality and privacy were rigorously maintained by anonymizing all data, using unique codes for each participant, and ensuring that all research records were securely stored and used solely for research purposes.

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RESULTS AND DISCUSSION

Research Setting and Period

This research was conducted at TK Muslimat NU Jabung, located at Jl. Sidodadi, No. 238, RT. 19 RW. 03, Sukolilo, Jabung District, Malang Regency. The study period spanned from February 3 to March 2, 2025. TK Muslimat NU Jabung hosts 96 students in Group A (aged 4–5 years), distributed across four classes, facilitated by seven teaching staff. The school's learning activities commence at 07:00 and conclude at 10:00 WIB.

Respondent Demographics

This study involved 30 respondents selected based on defined inclusion and exclusion criteria. The following data describe the sociodemographic characteristics of the respondents.

Table 2. Respondent Age Distribution

Age Variable	Frequency	∑	(%)
4 Years	13	43.3	43.3
5 Years	17	56.7	56.7
Total	30	100.0	100.0

The data reveal that the majority of respondents were 5 years old (56.7%), with the remaining 43.3% aged 4 years. This aligns with typical age distributions in early childhood education settings (van der Gaag et al., 2021).

Table 3. Respondent Gender Distribution

Gender Variable	Frequency	∑	(%)
Male	12	40.0	40.0
Female	18	60.0	60.0
Total	30	100.0	100.0

The sample was predominantly female (60%), a pattern not uncommon in early childhood research cohorts (Keller et al., 2017).

Table 4. Parental Occupation Status

Occupation	Frequency	∑	(%)
Farmer	1	3.3	3.3
Laborer	7	23.3	23.3
Private Sector	14	46.7	46.7
Entrepreneur	5	16.7	16.7
Civil Servant	1	3.3	3.3
Others	2	6.7	6.7
Total	30	100.0	100.0

Most parents worked in the private sector (46.7%), followed by laborers (23.3%).

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Table 5. Parental Income Levels

Income (IDR)	Frequency	∑	(%)
1,000,000 – 2,000,000	21	70.0	70.0
4,000,000 – 5,000,000	9	30.0	30.0
Total	30	100.0	100.0

A large majority of respondents' parents earned between 1–2 million rupiah (70%).

Table 6. Parental Education Levels

Education	Frequency	∑	(%)
Primary School	5	16.7	16.7
Junior High	10	33.3	33.3
Senior High	13	43.3	43.3
Bachelor's	2	6.7	6.7
Total	30	100.0	100.0

Most parents had a senior high school education (43.3%), with only 6.7% attaining a bachelor's degree.

Table 7. Body Weight Before and After Intervention

Variable	N	Mean	Min	Max	SD
Pre-intervention	30	10.300	8.0	12.0	1.0875
Post-intervention		10.457	8.1	12.4	1.0871

Before intervention, the mean body weight was 10.30 kg (SD = 1.0875), with the lowest at 8.0 kg and the highest at 12.0 kg. Post-intervention, the mean increased to 10.457 kg (SD = 1.0871), with the range extending from 8.1 kg to 12.4 kg.

Table 8. Shapiro-Wilk Normality Test: Pre-Post Body Weight

Variable	Df	Sig.	Description
Pre-intervention body weight	30	0.014	Non-normal distribution
Post-intervention body weight		0.284	Normal distribution

The Shapiro-Wilk test indicated that pre-intervention body weight was not normally distributed ($p = 0.014 < 0.05$), whereas post-intervention body weight distribution was normal ($p = 0.284 > 0.05$).

Table 9. Shapiro-Wilk Normality Test: Difference in Body Weight

Variable	Df	Sig.	Description
Difference (pre–post)	30	0.003	Non-normal distribution

The p-value for the difference was 0.003 (<0.05), indicating a non-normal distribution; therefore, the Wilcoxon Signed-Rank Test was employed.

Table 10. Wilcoxon Signed-Rank Test

	Z	Asymp. Sig. (2-tailed)
Pre–Post	-3.969	0.000

The Wilcoxon Signed-Rank Test yielded a Z value of -3.969 and a significance level of 0.000, confirming a significant difference between pre- and post-intervention weights.

Baseline Body Weight Status: Before Yogurt Intervention

The baseline analysis revealed that the mean weight of participants was 10.3 kg, with a range from 8 kg to 12 kg and a standard deviation of 1.0875. This value places a substantial portion of children in the "underweight" category based on national standards for Indonesian children aged 4–5 (Kemenkes RI, 2019). Similar findings have been documented in other Indonesian preschool cohorts, indicating undernutrition remains a widespread issue (Mutiara & Ety, 2019; Paramita et al., 2024). Body weight in early childhood is a sensitive indicator of overall health and nutrition. Acute weight loss or failure to thrive can indicate infection, inadequate dietary intake, or underlying chronic illness (Victora et al., 2021). Regular monitoring of child growth is therefore essential not only for individual child health but also for broader public health surveillance (Black et al., 2013; World Health Organization [WHO], 2020). Inadequate or fluctuating weight gain among preschoolers is a known risk factor for stunting and malnutrition (de Onis et al., 2013). Stunting can impair cognitive development and reduce school readiness (Prado et al., 2019). Parents and educators must therefore routinely measure and track body weight to promptly address any deviations from expected growth trajectories (Victora et al., 2021; WHO, 2020).

Effects of Probiotic Yogurt Intervention

Following the intervention—provision of probiotic yogurt twice weekly over four weeks—the mean body weight increased by 0.157 kg (157 g), with post-intervention mean weight reaching 10.457 kg. The increase, albeit modest, was statistically significant (Wilcoxon test: $p < 0.001$). This finding aligns with the results of Maisharoh (2019), who reported significant weight gain among children aged 2–4 after a similar intervention. Sutarno (2024) likewise observed that cashew yogurt administration significantly improved children's nutritional status, with intervention recipients being 2.9 times more likely to achieve normal nutritional status. This result is corroborated by several international studies. For instance, Chouraqui et al. (2018) and Maldonado et al. (2012) found that probiotic-supplemented dairy products led to improved weight gain and growth parameters in preschool children. A meta-analysis by Onubi et al. (2015) confirmed that probiotics, including those administered via yogurt, contributed positively to weight gain and height increments among malnourished or underweight children. Further, the strain specificity and delivery matrix (e.g., yogurt vs.

capsules) can influence the effectiveness of probiotic interventions (Szajewska & Kołodziej, 2015; Jones et al., 2022).

The benefits of probiotic yogurt can be attributed to several mechanisms. Probiotics such as *Lactobacillus bulgaricus* and *Streptococcus thermophilus* improve gut microbiota composition, which enhances digestion and nutrient absorption (Hill et al., 2014; Plaza-Diaz et al., 2019). Enhanced gut health supports more efficient extraction of nutrients from food, particularly micronutrients like calcium, zinc, and B vitamins, which are critical for growth (Sanders et al., 2019; Quigley, 2018). Children with improved gut flora experience fewer gastrointestinal infections and better bowel regularity, as shown in a study by Nurfarida et al. (2023) and supported internationally by Suez et al. (2019) and Arrieta et al. (2014). The resultant gut environment is conducive to optimal nutrient absorption and healthy weight gain (Walton et al., 2022).

Several international studies support the findings observed in this research. In a randomized controlled trial, Costello et al. (2022) demonstrated that regular yogurt supplementation in preschoolers led to significant improvements in both body weight and height over a three-month period. Similarly, Maldonado et al. (2012) noted that daily consumption of probiotic yogurt by children aged 1–3 resulted in measurable increases in weight-for-age and reduced incidences of diarrhea, supporting healthy growth trajectories. Meta-analyses by Szajewska & Kołodziej (2015) and Onubi et al. (2015) further confirm that probiotic supplementation is a practical and effective strategy to support weight gain and reduce the risk of undernutrition in early childhood. These reviews also highlight the importance of selecting appropriate probiotic strains and delivery vehicles (e.g., dairy-based yogurt) for maximum benefit.

The significant improvement in body weight among children receiving probiotic yogurt intervention underscores its potential as a public health strategy in early childhood settings. Considering that most children in this study originated from low- to middle-income families—with over 70% of parents earning less than IDR 2 million per month—accessible nutritional interventions are crucial (Günther et al., 2017). The inclusion of yogurt as a supplement in school-based feeding programs is feasible, culturally acceptable, and appealing to children, supporting both compliance and program sustainability (Marangoni et al., 2020). Probiotic yogurt also delivers other essential nutrients (e.g., protein, calcium, vitamin D) that are frequently lacking in the diets of children from lower socioeconomic backgrounds (Prado et al., 2019).

Mechanisms Underpinning Weight Gain from Probiotic Yogurt

Probiotic yogurt's impact on weight gain is partly mediated through modulation of the intestinal microbiota. According to Hill et al. (2014) and Plaza-Diaz et al. (2019), probiotics introduced via yogurt consumption enhance the abundance of beneficial bacteria (e.g., *Lactobacillus* and *Bifidobacterium*), suppress pathogenic species, and improve gut barrier function. These effects collectively foster a gut environment that optimizes digestion, reduces intestinal inflammation, and facilitates nutrient assimilation (Arrieta et al., 2014; Quigley, 2018).

Beyond its microbial benefits, yogurt provides high-quality proteins and essential micronutrients such as calcium, phosphorus, magnesium, and B vitamins, which are fundamental for tissue synthesis and bone development (Haug et al., 2011; Sanders et al., 2019). Studies by Gunther et al. (2017) and Marangoni et al. (2020) highlight that the palatability and digestibility of yogurt can stimulate appetite and encourage higher food intake among picky eaters, indirectly contributing to healthy weight gain.

Implementing yogurt supplementation within school-based nutrition programs, as modeled in this study, offers a scalable and practical strategy to address undernutrition. Previous research by Prado et al. (2019) and Marangoni et al. (2020) advocates for the inclusion of dairy-based probiotics in institutional meal plans, noting improvements not only in growth outcomes but also in cognitive performance and immune function among young children.

Limitations

Despite the strengths and novel contributions of this study, several limitations should be considered. First, yogurt administration frequently coincided with snack breaks, which sometimes resulted in incomplete consumption due to satiety. The delivery time of 09:00 was close to school dismissal, potentially limiting the intervention's effectiveness if children were preoccupied or in a hurry to leave with their parents. In addition, the 40-minute transport time required to bring yogurt from home to the research site presented logistical challenges, especially regarding temperature control to maintain palatability and safety. These operational challenges could influence both compliance and intervention effectiveness, as well as the accuracy of measured outcomes. Similar logistical barriers are reported in field-based nutrition research, underscoring the importance of storage, temperature, and palatability in intervention fidelity (Jones et al., 2022).

Recommendations for Future Research

Given the encouraging results, future research should aim to overcome these logistical hurdles by using on-site refrigeration and more flexible delivery schedules to enhance compliance. Expanding the sample size, prolonging the intervention period, and including a randomized control group would strengthen causal inference. Further, integrating comprehensive dietary assessments and evaluating cognitive and immunological outcomes could provide a more holistic understanding of the benefits of probiotic yogurt supplementation in early childhood education settings.

Implications of Research Findings for Midwifery Education

The significant impact of probiotic yogurt supplementation on body weight among preschool children highlights the critical role of evidence-based nutritional interventions in early childhood. For midwifery education, these findings emphasize the importance of equipping student midwives with up-to-date knowledge and practical skills in child nutrition, growth monitoring, and the use of probiotics as part of comprehensive nutritional counseling. This evidence can be directly integrated into midwifery curricula, especially within modules related to maternal and child nutrition, growth assessment, and health promotion (Black et al.,

2013; Prado et al., 2019). By incorporating these research insights, midwifery students can develop competencies to provide anticipatory guidance to mothers and caregivers regarding the benefits of probiotic foods, the prevention of undernutrition, and the management of common childhood nutrition issues. These skills are essential in both community and clinical settings, particularly in regions where undernutrition and stunting remain prevalent.

The research demonstrates the value of rigorous experimental design, outcome measurement, and critical data interpretation. Integrating such studies into midwifery education supports the development of students' abilities to critically appraise research evidence and apply findings to practice. Case discussions and problem-based learning, based on this study, can train students to analyze the effectiveness and limitations of nutritional interventions, including the practical aspects such as intervention delivery, compliance, and contextual barriers (Hill et al., 2014; Onubi et al., 2015). The results underscore the multidisciplinary nature of child health, involving collaboration between midwives, nutritionists, pediatricians, and educators. In the context of midwifery education, the findings advocate for the inclusion of interprofessional education (IPE) components. Midwives must be prepared to work within teams to design and implement school-based nutrition programs, perform growth surveillance, and deliver health education to families. Experiences from this research can serve as real-world examples for classroom discussions, simulations, or community projects, fostering interprofessional skills (Marangoni et al., 2020).

The intervention's feasibility in a school setting and its cultural acceptability reflect the need for midwives to actively engage in community-based health promotion and preventive care initiatives. For midwifery education, this research supports the expansion of community practice placements, where students participate in school health programs, provide education to parents, and monitor the growth and development of children. This aligns with global recommendations that midwives should take a proactive role in community health, not only focusing on perinatal care but also on the continuum of care for children up to school age (WHO, 2020; Victora et al., 2021). The success of the probiotic yogurt intervention encourages midwifery educators and students to seek and evaluate innovative, accessible, and culturally appropriate nutrition strategies for children. This could include piloting other functional foods, fortification programs, or tailored nutrition education in resource-limited settings. By understanding the underlying mechanisms (e.g., gut microbiota modulation, nutrient absorption), students will be better prepared to advocate for and participate in novel interventions that address child undernutrition and promote optimal growth (Sanders et al., 2019; Plaza-Diaz et al., 2019).

The study demonstrates the value of systematic anthropometric measurements and regular growth monitoring in identifying at-risk children and evaluating intervention outcomes. Midwifery education should emphasize these skills, ensuring students are competent in using growth charts, interpreting z-scores, and making data-driven recommendations. This competency supports midwives in their expanded roles within maternal and child health programs, such as the Indonesian Posyandu system or similar global platforms (Kemenkes RI, 2019; Black et al., 2013). The research also provides an opportunity to discuss ethical considerations and practical challenges encountered in nutrition research and interventions—

such as informed consent, privacy, compliance, and logistics (Jones et al., 2022). Midwifery students can learn from these real-world complexities, preparing them to address ethical dilemmas and implementation barriers in their future professional roles.

CONCLUSION

The primary objective of this study was to analyze the effect of probiotic yogurt supplementation on weight gain among children aged 4–5 years at TK Muslimat NU Jabung. The findings revealed that regular consumption of probiotic yogurt resulted in a statistically significant increase in body weight, with post-intervention measurements demonstrating a clear improvement compared to baseline, as confirmed by the Wilcoxon Signed-Rank Test ($p < 0.001$). These results align with national and international evidence supporting the role of probiotics in improving child growth and nutritional status. The study contributes to the existing literature by providing robust, context-specific evidence of the benefits of yogurt supplementation in an Indonesian preschool population—a demographic with high prevalence of undernutrition yet limited intervention-based research. This research highlights the practical potential of integrating probiotic-rich foods into early childhood nutrition programs, and offers valuable guidance for educators, health practitioners, and policy makers seeking accessible and culturally appropriate strategies to address child malnutrition and support optimal growth during the golden age of development.

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