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Effectiveness of Moringa Extract Liquid Supplement on Increasing Children's Appetite in the Cerdas and Insani Playgroup

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Abstract

Masalah nafsu makan rendah pada masa kanak-kanak awal masih menjadi tantangan gizi yang berdampak pada pertumbuhan dan perkembangan anak. Penelitian ini bertujuan untuk mengevaluasi efektivitas suplemen cair ekstrak daun moringa (Moringa oleifera) terhadap perubahan perilaku makan anak, meliputi frekuensi makan, jumlah porsi yang dikonsumsi, dan respons terhadap makanan. Penelitian ini menggunakan desain quasi-eksperimental pretest-posttest tanpa kelompok kontrol, melibatkan 30 anak berusia 2-5 tahun. Data dikumpulkan melalui observasi terstruktur dan kuesioner orang tua, dan dianalisis menggunakan uji t sampel berpasangan. Hasil menunjukkan peningkatan signifikan dalam rata-rata frekuensi makan dari 2,47 ± 0,68 menjadi 3,50 ± 0,51 kali per hari (p = 0,001) dan porsi makan dari 52,33% ± 12,59 menjadi 73,38% ± 12,59 (p = 0,001), selain itu, respons anak-anak terhadap makanan berubah dari dominan "menolak" menjadi "ragu-ragu" dan "antusias". Temuan ini menunjukkan bahwa suplemen cair ekstrak daun moringa efektif dalam meningkatkan nafsu makan pada anak usia dini dan berpotensi menjadi alternatif alami dalam intervensi gizi anak.

Kata kunci: Daun moringa, nafsu makan, anak usia dini, gizi anak

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Abstract

The problem of low appetite in early childhood is still a nutritional challenge that has an impact on child growth and development. This study aimed to evaluate the effectiveness of moringa leaf extract (Moringa oleifera) liquid supplementation on changes in children's eating behaviour, in terms of frequency of eating, number of servings consumed, and responses to food. This study used a quasi-experimental pretest-posttest design, involving 30 children aged 2-5 years without a control group. Data were collected through structured observation and parent questionnaires, and analysed using a paired sample t-test. Results showed a significant increase in mean meal frequency from 2.47 ± 0.68 to 3.50 ± 0.51 times per day (p = 0.001) and meal portion from 52.33% ± 12.59 to 73.38% ± 12.59 (p = 0.001), in addition, children's responses to food changed from predominantly "refusing" to "hesitant" and "enthusiastic". These findings suggest that moringa leaf extract liquid supplement is effective in increasing early childhood appetite and has the potential to be a natural alternative in child nutrition interventions.

Keywords: Moringa oleifera, appetite, early childhood, child nutrition.

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INTRODUCTION

Low appetite in children is a significant challenge in child health, particularly in developing countries such as Indonesia. Children with appetite disorders experience decreased food intake, impacting their nutritional status and physical and cognitive development (Aguayo & Menon, 2016). According to the Rikesda (2018) report,the prevalence of under-five children with under- and severely

undernourished status is still high, indicating that nutritional challenges have not been fully addressed in society (Kumar & et al., 2021) Given the importance of this growth period, addressing the problem of inadequate appetite must be implemented immediately to achieve success in children's health and education (Dipasquale et al., 2020; Sari, 2025)

Children often suffer from poor eating habits and food aversions, leading to a lack of essential nutrients for optimal growth and development. Various attempts have been made to improve appetite, ranging from multivitamins to behavioural interventions, but many of these methods are difficult to accept or have adverse side effects (Rotenberg et al., 2024). Nature provides natural-based alternatives, such as Moringa (Moringa oleifera) leaves, to support children's health, which is essential to research (Gomes et al., 2023)

The main issue in this study is children's low appetite, which leads to nutritional deficiencies and impairs their long-term growth and development. Children with decreased appetite are more susceptible to various diseases, developmental delays, and poor learning achievement (Sharma et al., 2023). The lack of effective intervention programmes, especially in lower-middle-income countries that have limited access to child health supplements, means that families who do not have the resources to access supplements or medical interventions often struggle to find solutions to this problem, hence the urgent need for pragmatic, natural, and safe solutions that can improve children's appetite. This study focuses on the effectiveness of moringa leaf extract supplement in liquid form as an alternative that can significantly increase children's appetite, and is in line with this need (Bavurhe et al., 2024; Mohamed et al., 2021)

Research on moringa leaves shows that the plant is rich in nutrients, such as vitamins A, C, B complex, proteins, and essential minerals (Gomes et al., 2023; Susiloningtyas et al., 2023). The nutritional diversity offered by moringa may have the potential to improve the nutritional status of children. For example, research shows that moringa leaves can help increase the weight of children with an undernourished status (Amoadu et al., 2024; Daryati & Suryadi, 2025). Previous studies have partly only explored the benefits of moringa in solid dosage forms, such as powder or capsules, which may be difficult for children to consume. No studies have yet exhaustively tested the effectiveness of moringa liquid supplements as a medium to increase children's appetite, so this study will contribute to filling the knowledge gap in this area (Hojati et al., 2023; Pratama & Saputra, 2025).

The basic concepts are drawn from child nutrition, feeding behaviour, and phytotherapy. Various physiological, psychological, and environmental factors influence children's appetite (Paramita et al., 2021). Moringa leaves have been recognised in traditional medicine for their comprehensive nutritional properties and bioactive components that can improve children's metabolism and appetite (Alflah & Alrashidi, 2023). The independent variable in this study was the administration of moringa leaf extract liquid supplement, while the dependent variable was the increase in children's appetite.

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Appetite indicators were measured through daily meal frequency, portions consumed, and children's attitude towards the food served. This approach allows for a more measurable and controlled analysis of changes in feeding behaviour.

This study introduces an innovation: developing moringa extract in liquid form, which is easier for children to consume and accept. This liquid form is believed to provide better absorption and acceptance advantages than solid preparations (Olagunju et al., 2023). This formulation is expected to be easily administered routinely, making it a practical supplement at home and in health services. A systematic quantitative approach will be used to evaluate the effectiveness of this Moringa leaf extract, which is different from many previous studies that have focused more on physiological indicators. Hopefully, this study's results will broaden the community's horizons and applications of child nutrition interventions.

The studies that have addressed the benefits of moringa on children's health have primarily focused on the solid form of the preparation or as a food mixture. A significant gap in this research is the lack of studies examining the effectiveness of the liquid form as the main preparation and its effect on early childhood appetite. On the other hand, there is an urgent need for a practical and readily accepted preparation by children, which has not received much attention from academics and practitioners. This research is here to fill the gap by directly evaluating the effectiveness of moringa leaf extract liquid supplements in increasing children's appetite, considering that many families with lower-middle socioeconomic backgrounds still find it difficult to access adequate health solutions.

This research is essential to enriching the existing literature on using local herbs to improve child nutrition. Moringa leaves, a regional plant with phytopharmaceutical potential, need to be studied further so that they can be a real solution to overcoming nutritional problems experienced by children (Gomes et al., 2023). The results of this study are expected to provide new references in the development of natural supplements and inform policies related to child nutrition interventions. Moringa liquid supplements that children readily accept are expected to help parents and medical personnel provide a safe and effective alternative to improve children's appetite and health. This study is also relevant to the national programmes the government is promoting to combat stunting and improve the nutritional status of children.

This study aims to assess the effectiveness of moringa leaf extract liquid supplement in improving appetite in early childhood, through measuring children's eating behaviour before and after supplementation, this study will provide strong empirical data on the benefits of moringa leaf extract, specifically, this study aims to examine the extent to which moringa leaf extract liquid supplementation affects children's meal frequency, number of servings consumed, and interest in food. It is hoped that the results of this study can inform the development of beneficial natural herbal supplement products, as well as guide health practitioners and policy makers in the field of child nutrition.

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METHODOLOGY

Type of study

This study is a quantitative study with a quasi-experimental design. It used a pre-test and post-test approach without a control group. The main objective was to measure changes in children's eating behaviour before and after intervention using moringa leaf extract liquid supplementation.

Time and Place of Research

This research was conducted from July to September 2024. The research location was at the Smart and Insani Play Group in Sukoharjo Regency.

Target of Research

a. Population: All children aged 2-5 years registered at PAUD and Posyandu in the study area, complaining of decreased appetite.
b. Sample: A total of 30 young children (2-5 years old) who met the inclusion criteria:
    1. Not currently experiencing acute or chronic illness
    2. Have complaints of low appetite according to parental reports
    3. Parents are willing to take part in the research series
    4. The sampling technique used was a purposive sampling method, taking into account the predetermined inclusion and exclusion criteria.

Data Collection Techniques and Instruments

a. Primary data were collected through structured observations and child feeding behaviour questionnaires completed by parents.
b. The indicators observed included:
    1. Daily meal frequency (main meals and snacks per day)
    2. Number of servings consumed (percentage of empty plates)
    3. Child's response to food (refusal, hesitation, or enthusiasm).
c. The preliminary study subjected the questionnaire instrument to validity and reliability tests.
d. Data were also supported by daily observation sheets completed by parents during the intervention period (14 days).

Research Procedure

a. Pre-intervention (Day 1 to 3):
    1. Socialisation with parents
    2. Completion of initial questionnaire (pre-test)
b. Intervention (Days 4 to 17):

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1. Administration of moringa leaf extract liquid supplement 10 ml daily after breakfast for 14 consecutive days.
2. Parents were asked to record their children's daily eating behaviour

c. Post-intervention (Day 18 to 20):
   1. Completion of the final questionnaire (post-test)
   2. Brief interview regarding the child's response to the flavour and dosage form

Data Analysis Technique

a. Data were analysed quantitatively, descriptively, and inferentially using statistical software.
b. Descriptive analysis was used to describe the mean, percentage, and data distribution.
c. Inferential analysis was conducted using a paired t-test to measure significant differences between pre-test and post-test values.
d. The significance level was set at $p < 0.05$.

RESULTS AND DISCUSSION

RESULTS

The moringa leaf extract liquid supplement for children is made by adding brown sugar liquid to have a sweeter taste and make it acceptable to children. Good taste is one of the crucial factors in increasing compliance with supplement consumption at an early age. The liquid supplementation of moringa leaf extract was 10 ml daily after breakfast for 14 consecutive days. Moringa leaves are known to be rich in nutrients that have the potential to increase appetite. In this study, supplementation was carried out routinely for 14 days. The results showed an increase in appetite scores after the intervention.

An initial assessment of children's appetite was conducted before the intervention to obtain an overview of children's food consumption conditions. Measurements included three leading indicators: frequency of meals per day, percentage of food portions consumed, and children's responses to food served. The following data presents the pre-test observation results of 30 child respondents.

Table 1. Table 3. Results of Pre-Test Assessment of Children's Appetite

No.	Name	Frequency of Eating (times/day)	Portion consumed (%)	Response to Food
1	Child 1	2	40%	Refused
2	Child 2	3	60%	Undecided
3	Child 3	2	50%	Refused
4	Child 4	3	70%	Undecided
5	Child 5	1	30%	Refused
6	Child 6	2	45%	Refused
7	Child 7	3	55%	Undecided
8	Child 8	2	40%	Refused
9	Child 9	4	75%	Enthusiastic

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10	Child 10	2	50%	Refused
11	Child 11	3	60%	Undecided
12	Child 12	1	35%	Refused
13	Child 13	2	45%	Refused
14	Child 14	3	65%	Undecided
15	Child 15	2	40%	Refused
16	Child 16	4	80%	Enthusiastic
17	Child 17	2	50%	Undecided
18	Child 18	3	55%	Undecided
19	Child 19	2	40%	Refused
20	Child 20	1	30%	Refused
21	Child 21	3	60%	Undecided
22	Child 22	2	50%	Refused
23	Child 23	3	65%	Undecided
24	Child 24	2	45%	Refused
25	Child 25	4	80%	Enthusiastic
26	Child 26	3	60%	Undecided
27	Child 27	2	50%	Refused
28	Child 28	3	70%	Undecided
29	Child 29	2	45%	Refused
30	Child 30	3	60%	Undecided

Based on Table 1. Pre-test results showed that the majority of children had low appetites. 63.3% of respondents had a frequency of eating 1-2 times daily, while only 36.7% ate 3-4 times daily. The average portion of food consumed was 30% to 60%, indicating a lack of optimal intake. Regarding responses, 50% of children showed a resistant attitude towards food, 43.3% were hesitant, and only 10% were enthusiastic. These findings indicate that before the intervention, most children did not have healthy or optimal eating behaviour regarding quantity and response to the food given.

The relationship between children's response to food and their eating behaviour was analysed by mean and standard deviation based on the response categories: refused, hesitant, and enthusiastic. This analysis will see each category's eating frequency and portion size trends.

Table 2: Mean and Standard Deviation of Pre-Test Based on Responses to Food

No	**Response Category**	**100**	**Average Meal Frequency (times/day)**	**SD Frek Makan**	**Average Portion consumed (%)**	**SD Portion (%)**
1	Refused	14	2	0,38	43,20%	6,57
2	Undecided	13	2,92	0,28	61,20%	5,64
3	Enthusiastic	3	4	0	78,30%	2,89

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The results showed that children who refused food had the lowest meal frequency (average 2 times/day) and the lowest meal portion (43.2%). Children with hesitant responses showed improvement in both indicators (frequency of eating 2.92 times/day and portion size 61.2%). Meanwhile, children who were enthusiastic about eating had the highest frequency (4 times/day) and the most significant portion of food (78.3%).

Table 3. Table: Categorisation of Percentage of Portion Spent on Pre-Test

No.	Category Limits	Interval (%)	∫i	Category	(%)
1	Low	30 - 44	7	Low	23,30%
2	Medium	45 - 64	17	Medium	56,70%
3	High	65 - 80	6	High	20,00%
Total			**30**		**100%**

Based on Table 3. Results Most respondents (56.7%) were in the medium category, spending between 45% to 64% of the given meal portion. 23.3% of children were in the low category, and only 20% were in the high category. This shows that before the intervention, most children had not fully consumed their meals, with most consumption still at a moderate level. After the intervention, the children's appetite was re-measured by assessing meal frequency, portion size, and responses to food. The following table presents the post-test data of 30 respondents.

Table 4. Results of Post-Test Assessment of Children's Appetite

No	Respondent Name	Frequency of Eating (times/day)	Portion consumed (%)	Response to Food
1	Child 1	3	65%	Undecided
2	Child 2	4	80%	Enthusiastic
3	Child 3	3	70%	Undecided
4	Child 4	4	85%	Enthusiastic
5	Child 5	3	60%	Undecided
6	Child 6	3	70%	Undecided
7	Child 7	4	85%	Enthusiastic
8	Child 8	3	60%	Undecided
9	Child 9	4	90%	Enthusiastic
10	Child 10	3	65%	Undecided
11	Child 11	4	85%	Enthusiastic
12	Child 12	3	60%	Undecided
13	Child 13	3	70%	Undecided
14	Child 14	4	80%	Enthusiastic
15	Child 15	3	60%	Undecided
16	Child 16	4	90%	Enthusiastic
17	Child 17	4	85%	Enthusiastic
18	Child 18	4	80%	Enthusiastic

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19	Child 19	3	65%	Undecided
20	Child 20	3	60%	Undecided
21	Child 21	4	80%	Enthusiastic
22	Child 22	3	65%	Undecided
23	Child 23	4	80%	Enthusiastic
24	Child 24	3	60%	Undecided
25	Child 25	4	85%	Enthusiastic
26	Child 26	4	80%	Enthusiastic
27	Child 27	3	70%	Undecided
28	Child 28	4	85%	Enthusiastic
29	Child 29	3	65%	Undecided
30	Child 30	4	80%	Enthusiastic

Based on Table 4. Post-test results showed a general improvement in appetite indicators, with most children showing a frequency of 3-4 meals per day. Portions spent also increased, with many children achieving 70% and above consumption rates. In terms of responses to food, there was a significant shift from the "refused" to "hesitant" and "enthusiastic" categories. 16 out of 30 children (53.3%) showed an enthusiastic attitude towards food, which was previously only three children (10%) in the pre-test. The results indicated that the intervention positively impacted increasing children's appetite. To see more about the development of children's appetite after the intervention, the mean and standard deviation of meal frequency and portion of food consumed based on the category of response to food were analysed. The following table presents the results of grouping the post-test data by response category.

Table 5. Mean and Standard Deviation of Post-Test Based on Responses to Food

No	Response Category	n	Mean Meal Frequency (times/day)	SD Frek Makan	Average Portion consumed (%)	SD Portion (%)
1	Undecided	15	3,07	0,26	64,67%	3,87
2	Enthusiastic	15	4	0	83,67%	3,45
Total		30	7,07	0,26	148,34%	7,32

Based on Table 5, the grouping results show that children who fall into the "enthusiastic" category eat 4 times per day, with an average portion of food spent reaching 83.67%. Meanwhile, children with "hesitant" responses eat an average of 3.07 times per day and a meal portion of 64.67%. This difference shows that the more positive the child's response to food, the higher the frequency and amount consumed.

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Table 6. Table: Categorisation of Percentage of Portion Spent on Pre-Test

No.	Category Limits	Interval (%)	∫i	Category	(%)
1	Low	60-64	6	Low	20,00%
2	Medium	65-74	7	Medium	23,30%
3	High	75-100	17	High	56,70%
Total			30		100%

The categorisation results showed that most of the children (56.7%) were in the high category, which means they consumed 75% or more of their food portion. 23.3% of children were in the medium category, and only 20.0% were in the low category. This finding indicates an increase in appetite in most children after the intervention, as seen from most children who finished most of their food. This comparison graph was created to strengthen these findings and provide a clearer picture of changes in children's food portions in the pretest and posttest. This graph visualises the eating portion of each child at the pre-test and post-test stages, making it easier to see any improvements or patterns of change that occur individually.

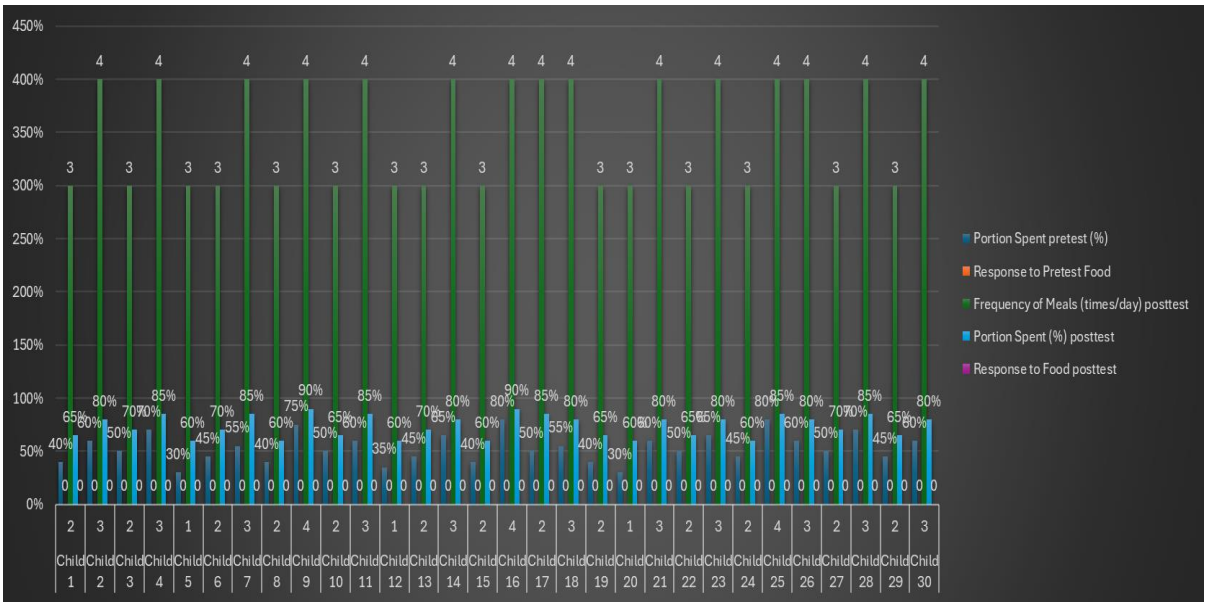

Image 1. Graphic Comparison of Pre- and Post-Test Meal Portions Given Moringa Leaf Extract Liquid Supplement

Based on the graph above, it can be seen that almost all respondents experienced an increase in the percentage of food portions after the intervention. Most of the children who initially only consumed around 40-60% of the meal portion showed an increase to 70-90% in the post-test, indicating that the intervention provided had a positive influence on increasing children's appetite. Before further analysis, the normality and homogeneity of the pre-test and post-test data were first tested. The normality test determines whether the data is usually distributed, while the homogeneity test is used to see the variance

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similarity between groups. These two tests are essential to decide on the appropriate type of statistical test.

Table 7. Normality Test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardised Residual
N		30
Normal Parameters[a,b]	Mean	3.47
	Std. Deviation	.51
Most Extreme Differences	Absolute	.157
	Positive	.122
	Negative	.157
Test Statistic		.157
Asymp. Sig. (2-tailed)		.155[c]
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		

Based on Table 7. The normality test results using the One-Sample Kolmogorov-Smirnov Test obtained the value Asymp. Sig. (This value is greater than α = 0.05, meaning the residual data is usually distributed.

Table 8. Test of Homogeneity

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Child appetite	Based on Mean	1,347	1	58	.251
	Based on Median	1,285	1	58	.262
	Based on Median and with adjusted df	1,285	1	57,412	.263
	Based on the trimmed mean	1,347	1	58	.251

Based on Table 7. The results of the Levene test, it can be concluded that the variance of children's appetite between groups is homogeneous, with the assumption of homogeneity of variance fulfilled and further statistical analysis that assumes homogeneity of variance, so that inferential analysis can be continued paired t-test test to measure significant differences between pre-test and post-test values, so that it can be seen the effectiveness of moringa extract liquid supplements on increasing food appetite in children, this can be seen in tables 9 and 10.

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Table 9. Frequency of eating

	n	Mean±s.b	Difference Mean±s.b	*p*
Pretest	30	2,47±0,68	0,92±0,355	0.001
Post Test	30	3,50±0,51		

The children's eating frequency results before intervention (pretest) had a mean of 2.47 times/day with a standard deviation of ±0.68. After the intervention, there was an increase in eating frequency of 0.92 times/day with a standard deviation of ±0.355. The difference in mean frequency of eating between the pretest and posttest was statistically tested and resulted in a p-value = 0.001. The p-value indicates that the difference in eating frequency before and after the intervention was statistically significant at the 0.05 significance level ($p < 0.05$), indicating that the intervention successfully increased children's eating frequency. In other words, there is strong evidence that the intervention positively improved children's appetite, which is reflected in an increase in their daily meal frequency.

Table 10: Portion consumed (%)

	n	Mean±s.b (%)	Difference Mean±s.b	*p*
Pretest	30	52,33%±12,59	0,92±0,355	0.001
Post Test	30	73,3%8±12,59		

Based on the analysis results in Table 10, the portion of food spent by children before the intervention (pretest) had a mean of 52.33% with a standard deviation of ±12.59%. After the intervention (post-test), there was an increase in the portion of food spent to 73.3% with the same standard deviation of ±12.59%. The difference in the mean portion of food spent between the pretest and posttest was statistically tested, resulting in a p-value = 0.001. This p-value indicates that the increase in the portion of food spent after the intervention was statistically significant at the 0.05 significance level ($p < 0.05$). This suggests that the intervention successfully increased the number of meal portions consumed by the children. In other words, the intervention effectively increased children's appetite, reflected in the increased meal portions consumed.

DISCUSSION

This study showed a significant increase in the frequency of eating and the portion of food consumed by children after the intervention, as indicated by the results of the paired sample t-test, which yielded a significance value ($p = 0.001$). This central finding supports the initial hypothesis that the approach provided (e.g., menu modification, educational approach, or interaction techniques) can increase children's positive response to food, as evidenced by increased food portions and a change in attitude to be more enthusiastic.

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The results indicate the intervention's positive effect on children's eating behaviour. Before the intervention, most children showed a refusal or hesitant response to food, with a low frequency of eating (1-2 times per day) and portion sizes below 60%. After the intervention, there was an increase in the average frequency of eating and food portions, accompanied by a change in attitude to become more enthusiastic. This suggests that a supportive environment and appropriate food presentation strategies can significantly influence children's eating behaviour. This finding aligns with social learning behaviour theory, which states that eating behaviour can be shaped through positive experiences and social reinforcement.

The results of this study are significant because they show that a systematic and straightforward approach can improve children's eating behaviour, which in turn impacts their nutritional status and development. ECD educators, parents, and health workers can use the findings to design more effective feeding strategies. Theoretically, the findings support models of feeding behaviour interventions based on positive environments and experiences, and enrich the literature on early childhood nutrition.

Pretest Assessment of Children's Appetite for Food

The pretest results showed that most children had a low frequency of eating and did not finish their portions. Most respondents indicated a negative response to food, with 14 children (46.7%) categorised as "Refused", followed by "Undecided" with 13 children (43.3%), and only three children (10%) showing an attitude of "Enthusiastic". Most children's portions were 30-60%, indicating a lack of interest or an optimal appetite.

This study is in line with research by Widyaningsih et al (2024) In the 4-6-year-old group, less than 50% of children showed a positive attitude towards food, especially when the presentation or monotonous eating routine was less attractive. These results reflect the significant impact of attractive food presentation on children's perceptions. Monotony of presentation and lack of variety in the menu significantly impact children's interest in trying new foods (Syafiah et al., 2023).

Some children, despite showing a response of "Undecided," could consume food with a portion of more than 60%. This suggests there is potential to develop through psychological approaches or minor modifications to food without major interventions. This result is crucial as it shows the flexibility of eating behaviour that can be utilised in the intervention phase.

The pretest assessment was initially descriptive and did not include the underlying factors behind the child's eating behaviour. The absence of measures related to motivation, emotions, or specific food preferences is a limitation that may affect further interpretation. In addition, the timing of data collection may also have influenced the results (e.g., children's mealtimes vary at home and school).

The pretest results confirm the importance of conducting behaviour-based nutrition interventions, which focus not only on food content but also on presentation, communication, and creating a positive

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eating experience. Teachers and parents can use these results to change their approach to children's mealtimes.

Post Test Assessment of Children's Food Consumption Appetite

The posttest results showed a significant improvement in children's eating behaviour after the intervention. Responses to food underwent a positive change, with children who initially showed a "Refuse" or "Hesitate" attitude now showing more of a "Hesitate" or even "Enthusiastic" attitude. Children who showed an "Enthusiastic" attitude increased from 3 children (10%) in the pretest to 13 children (43.3%) after the intervention. The portion of food consumed also increased, with most children consuming more than 65% of the portion, and the frequency of eating increased to 3-4 times per day.

These improvements indicate that the intervention successfully influenced children's eating behaviour. The change in attitude from "Refusing" to "Hesitant" or even "Enthusiastic" suggests that the children began to accept and even enjoy the food provided. The increase in frequency and portion size also reinforces the finding that children are becoming more accustomed and comfortable with the established eating pattern.

This is theoretically consistent with the social learning theory approach, which states that children will imitate positive eating behaviours if provided with good examples and a supportive atmosphere. Interventions that may include visual approaches, stories, or a pleasant eating atmosphere contribute to shaping children's positive responses to food.

This finding is in line with the results of a study by Nasution (2020) , which showed that game-based nutrition education can increase children's interest in healthy food. In addition, this result supports research from Jatmikowati et al (2023) which states that creating a fun environment can increase children's food intake. Compared to the pretest, the posttest results show that the number of children in the category of portioned meals >70% has more than doubled. This shows the effectiveness of the approach to modify children's eating habits.

Assessment of the Effectiveness of Moringa Extract Liquid Supplement on Improving Children's Appetite

This study showed a significant difference between the pretest and posttest results in children's eating behaviour, particularly in the increased meal frequency, portion size, and attitude towards food. The paired sample t-test results showed a significant result. (2-tailed) < 0.05, which means there is a statistically significant difference between the pre- and post-intervention conditions.

The average meal portion increased from about 52% at the pretest to 73% at the posttest, indicating that children consumed more food after the intervention. In addition, many children experienced a shift in responses to food from "Refused" to "Undecided" and from "Undecided" to "Enthusiastic." This indicates a change to a more positive attitude towards food.

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The significant mean differences and the modest standard deviations indicate that the changes were consistent across respondents. This finding confirms that the intervention had a real effect in improving children's eating behaviour.

These results are consistent with previous research, such as the study by Husain (2023), which found that a fun learning approach improved early childhood appetite. These results also align with Bandura's learning behaviour theory, where children tend to change behaviour through observation, modelling, and repeated positive experiences. Despite the general improvement, some children still showed the "Hesitant" category in eating attitudes, although the frequency and portion of eating increased. This could be due to internal factors such as personal preferences, previous less favourable eating experiences, or eating habits at home that have not changed.

The main limitation is using simple quantitative measures (frequency and portion) without involving more profound qualitative observations of children's expressions, reasons for refusal, or emotional involvement. In addition, the relatively short observation period may not have been sufficient to see long-term behavioural changes.

The results of this study have substantial practical implications, especially for early childhood educators and parents. Simple interventions involving playful approaches can significantly change children's attitudes and eating habits. These results can be used to develop a more comprehensive feeding education programme in the school or home environment.

CONCLUSIONS

This study showed a significant improvement in children's eating behaviour after the intervention, indicated by an increase in the frequency of eating, the portion of food consumed, and a change in attitude from refusing to being more enthusiastic. The paired sample t-test results proved that the difference between pretest and posttest was significant. These findings support that the right approach can effectively improve early childhood feeding skills.

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