The Influence of Complementary Feeding on Appetite and Growth Development in Children Aged 7-12 Months

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Abstract: Complementary feeding (MP-ASI) is crucial for meeting the nutritional needs of infants aged 7-12 months, influencing their appetite and growth. Objective: This study evaluates the effects of MP-ASI on the appetite and growth of infants aged 7-12 months in 2024. A pre-post test design with 194 respondents assessed the impact of different types of MP-ASI on appetite and growth. All respondents received the same type of MP-ASI. Data were analyzed using univariate and bivariate analyses with SPSS. There was no statistically significant relationship between the type of MP-ASI given and weight gain. However, varieties such as spinach and eggs, and chayote and eggs, showed higher compliance with recommended nutritional standards (KPSP), indicating that MP-ASI type significantly influences adherence to these standards. Diverse MP-ASI positively affects the appetite and growth of infants aged 7-12 months. The study underscores the importance of MP-ASI variety and quality in child nutrition programs. Increasing parental education on the importance of MP-ASI variety is recommended to support optimal developmental potential in children.

Keywords: Appetite; Child growth; Complementary feeding; Infants 7-12 months

Introduction

Toddlers, a term used for children aged one to four years, represent a crucial phase in early childhood development. Unlike babies, who are typically under one year old, toddlers are in a period characterized by rapid physical growth, cognitive advancement, and significant social changes. This developmental stage demands adequate care, proper nutrition, and a supportive environment to ensure optimal growth and development (Sadariah et al., 2023).

Globally, stunting remains a pressing issue affecting young children. The World Health Organization (WHO) estimated that in 2020, approximately 149.2 million children under five years old experienced stunting, a condition where a child's height is significantly below the average for their age due to chronic or repeated malnutrition. Stunting not only impacts physical growth but also has long-term implications for cognitive development and increases child mortality rates. It also underscores disparities in human development and inequality (WHO, 2023).

In Indonesia, stunting and malnutrition are persistent challenges in public health efforts, especially among children. The Indonesian Nutrition Status Survey (SSGI) revealed that stunting prevalence decreased from 24.4% in 2021 to 21.6% in 2022. Despite this progress, stunting remains a significant concern (Gebru et al., 2021; Tournier et al., 2021). Regional disparities are notable; Pandeglang Regency has a stunting rate of 37.8%, while Serang City stands at 23.4%. In contrast, Bekasi City reports a much lower rate of 7.9%, and DKI Jakarta falls in between with 14.8%.

Several factors contribute to stunting, including a lack of awareness about balanced nutrition, limited access to nutritious foods, and suboptimal practices in providing complementary foods. The WHO emphasizes the importance of timely, safe, and varied complementary foods for children's growth. In Indonesia, inadequate knowledge about proper complementary feeding and its importance can result in unbalanced diets and malnutrition. Poverty and limited access to health and sanitation services further exacerbate the problem, making it imperative to adopt a comprehensive approach involving multiple sectors and public awareness (Ferguson et al., 2019; Sirkka et al., 2022).

From birth, children undergo rapid growth, particularly between seven to twelve months of age. This period is critical for establishing healthy eating habits and ensuring optimal physical development. Complementary feeding, or MPASI (Makanan Pendamping ASI), becomes vital as children's nutritional needs become more complex after six months. MPASI introduces infants to a variety of foods, essential for their growth and development, and serves as a foundation for a diverse diet (Bocquet et al., 2022; Vázquez-Frias et al., 2023).

The WHO highlights the need for a varied diet during the MPASI phase. Providing diverse foods ensures that children receive a complete range of nutrients necessary for their growth. Variation in food types also helps familiarize children with different tastes, textures, and nutrients, promoting the development of healthy eating habits early on. Recommended MPASI foods include carrots, fish, shrimp, spinach, meat, chicken, soybeans (tempeh), broccoli, chayote, yellow pumpkin, and eggs. Carrots are rich in beta-carotene, essential for eye health and immune function, while fish and shrimp offer valuable animal protein, crucial for growth and development (Rakotomanana et al., 2020).

Recent studies underscore the importance of complementary feeding methods in shaping infant health outcomes. For instance, the baby-led weaning (BLW) approach, where infants self-feed with family foods, is linked to higher parental education and longer breastfeeding durations, which may influence better eating behaviors and lower obesity risks. However, more research is needed to fully understand BLW's long-term impact on growth (Sanjeevi et al., 2022).

The timing, composition, and methods of complementary feeding are significant for child health. Studies suggest that rather than timing alone, the quality and diversity of foods during this period affect obesity risk. High protein intake from formula, early introduction of complementary foods, and other practices also play a role (Wood et al., 2021). Research highlights the need for updated guidelines that address the diverse nutritional needs of infants during the complementary feeding phase. Emphasizing a variety of nutrient-dense foods can enhance dietary quality, support healthy growth, and potentially reduce long-term health issues such as obesity. The focus should be on a balanced approach to infant nutrition, considering diverse dietary patterns and parental backgrounds to foster optimal development.

Method

Research Design

This study employs a q uantitative research design with a cross-sectional approach to evaluate the impact of complementary feeding (MPASI) on the development and growth of children aged 7-12 months. The cross-sectional design allows for the collection and analysis of data at a single point in time, facilitating the examination of the relationships between variables.

Population and Sample

The population of this study includes all children aged 7-12 months at UPT Puskesmas Kecamatan Sukalaksana in Karawang, West Java; UPT Puskesmas Kecamatan Cipocok Jaya in Serang City, Banten; UPT Puskesmas Kecamatan Jiput in Pandeglang Regency, Banten; RSU Bella in Bekasi City, West Java; Klinik Annihayah Medika in Karawang, West Java; Klinik Pratama Duta Sehat in Bekasi City, West Java; RSUD Banten in Serang City, Banten; and UPT Puskesmas Cilincing in North Jakarta. To obtain a representative sample, a total of 196 children within this age range were selected using stratified random sampling. This method ensured that the sample was evenly distributed across different age groups, specifically 7-8 months, 9-10 months, and 11-12 months, allowing for a comprehensive analysis of the impact of complementary feeding on children's growth and development.

Research Instruments

A structured questionnaire was employed to gather demographic information and details about the type of complementary feeding provided to the children. To evaluate growth, weight measurements were recorded using a calibrated digital scale. The children's development was assessed using the Pre-Screening Development Questionnaire (KPSP), a standardized developmental screening tool commonly used in Indonesia.

Theoretical Framework

The theoretical framework of this study is based on the principles of child nutrition and developmental psychology. It posits that appropriate complementary

feeding during the critical window of 7-12 months is essential for optimal growth and development. Proper nutrition supports physical growth, cognitive

development, and overall health, while inadequate nutrition can lead to stunted growth and delayed development (See Figure 1).
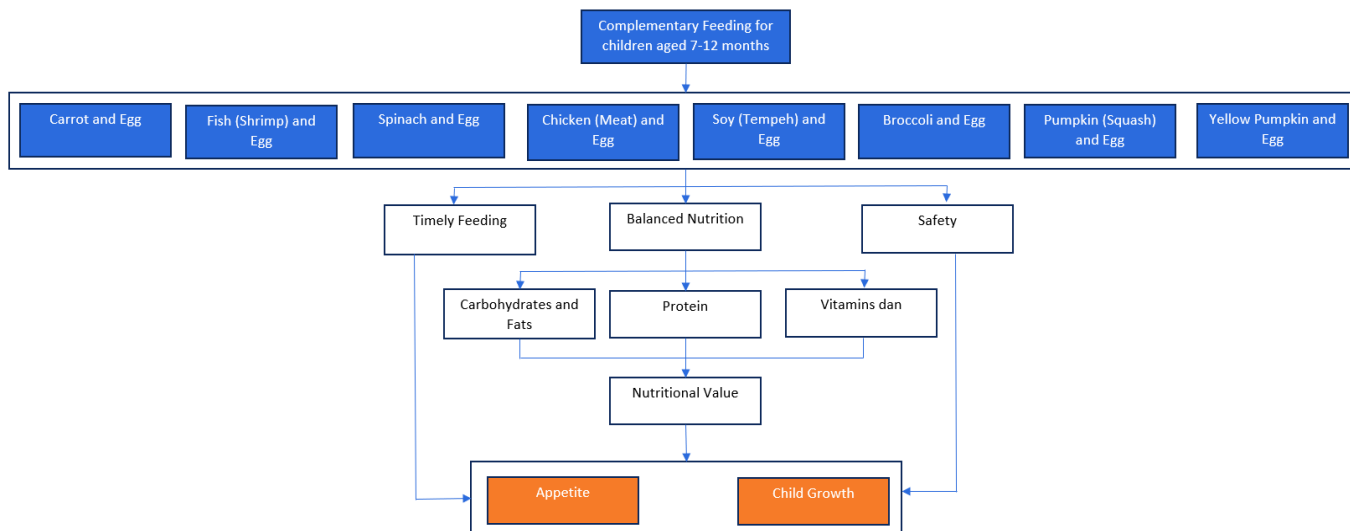

Figure 1. Theoretical framework (Aprilia, 2020)

Conceptual Framework and Hypotheses

The conceptual framework for this study is designed to explore the relationship between complementary feeding and various aspects of child development, including appetite, weight gain, and overall growth. This framework outlines how different types of complementary foods, when provided to children aged 7-12 months, can potentially impact their physical and developmental outcomes. It integrates theories of nutrition and child development to form a structured approach to understanding these effects. In this framework, complementary feeding is conceptualized as an independent variable that influences multiple dependent variables such as appetite, weight gain, and developmental milestones. By examining different types of complementary foods, we aim to determine their effectiveness in supporting optimal growth and development (See Figure 2).

Based on this framework, the following hypotheses are proposed: The study investigates the impact of complementary feeding on various aspects of early childhood development. Hypothesis 1 (H1) examines whether there is a significant relationship between the type of complementary feeding and the appetite of children aged 7-12 months, suggesting that different feeding practices might influence how much and how often these children eat. Hypothesis 2 (H2) explores whether there is a significant relationship between the type of complementary feeding and the weight gain of children in this age group, indicating that the nutritional quality of complementary foods could affect their growth patterns. Hypothesis 3 (H3) extends this investigation to assess whether there is a significant

relationship between the type of complementary feeding and the developmental progress of children aged 7-12 months, proposing that variations in feeding practices might influence their overall developmental milestones. Together, these hypotheses aim to provide a comprehensive understanding of how complementary feeding practices impact appetite, weight gain, and developmental outcomes in young children.

These hypotheses will be tested using Chi-Square analysis to determine the significance of the relationships between the variables of interest. See figure 2.
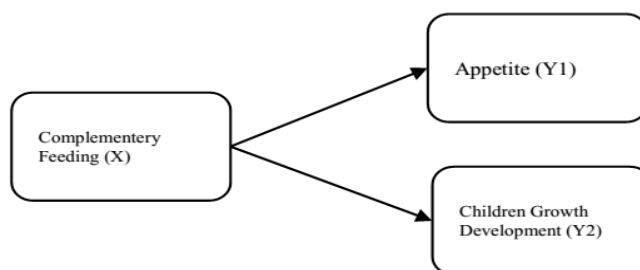

Figure 2. Conceptual Framework

Result and Discussion

Characteristics of Respondents

The respondent characteristics reveal that out of 196 participants, 56.6% are male and 43.4% are female, indicating a majority of males in the sample. Regarding age distribution, 31.1% of respondents are between 6 and 8 months old, 34.2% are between 9 and 11 months old, and 34.7% are 12 months old, showing a relatively even distribution across the different age categories.

This distribution suggests a balanced representation of both genders and a nearly equal spread of ages among the participants (see Table 1).

Table 1. Characteristics of Respondents

Variables		Frequency	Percent
	Male	111	56.6
Gender	Female	85	43.4
	Total	196	100
	6 - 8 Months	61	31.1
	9 - 11 Months	67	34.2
Age	12 Months	68	34.7
	Total	196	100

The Impact of Providing Complementary Foods on Appetite Enhancement

The Crosstab test of providing complementary foods (MPASI) on appetite enhancement provides insight into the relationship between the types of MPASI given to children and their potential improvement in appetite (see Table 2).

The Crosstab Analysis of Complementary Feeding (MPASI) and its effect on appetite reveals diverse patterns among children. In a sample of 196 children, Broccoli and Egg had the highest proportion with good appetite (8.2%), while Pumpkin (Squash) and Egg were associated with the highest poor appetite (9.7%). Carrot and Egg, as well as Fish (Shrimp) and Egg, showed balanced appetite distributions, each at 12.2%. Spinach and Egg and Yellow Pumpkin and Egg contributed to higher percentages of good appetite (7.1% and 4.1%, respectively), whereas Chicken (Meat) and Egg were linked to the highest poor appetite (8.7%). The overall percentage of children with good appetite (42.3%) was lower compared to those with poor appetite (57.7%), suggesting that MPASI types variably affect appetite. The Chi-Square test results further support a significant association between MPASI and appetite improvement, with Pearson Chi-Square and Likelihood Ratio values of approximately 15.008 and 15.194, respectively, and p-values of 0.036 and 0.034, indicating a significant impact.

Table 2. Crosstab Test of Complementary Feeding (MPASI) on Appetite Improvement

Variable			Good Appetite	Appetite Category Poor Appetite	Appetite Category
Complementary	Carrot and Egg	Count	13	11	24
Feeding		% of Total	6.6%	5.6%	12.2%
	Fish (Shrimp)	Count	9	15	24
	and Egg	% of Total	4.6%	7.7%	12.2%
	Spinach and Egg	Count	14	11	25
		% of Total	7.1%	5.6%	12.8%
	Chicken (Meat)	Count	9	17	26
	and Egg	% of Total	4.6%	8.7%	13.3%
	Soy (Tempeh)	Count	8	16	24
	and Egg	% of Total	4.1%	8.2%	12.2%
	Broccoli and Egg	Count	16	8	24
		% of Total	8.2%	4.1%	12.2%
	Pumpkin	Count	6	19	25
	(Squash) and	% of Total	3.1%	9.7%	12.8%
	Egg				
	Yellow Pumpkin	Count	8	16	24
	and Egg	% of Total	4.1%	8.2%	12.2%
Total		Count	83	113	196
		% of Total	42.3%	57.7%	100.0%

Table 3. Chi-Square Test of Complementary Feeding (MPASI) on Appetite Improvement

Variable	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.008[a]	7	.036
Likelihood Ratio	15.194	7	.034
Linear-by-Linear Association	2.029	1	.154
N of Valid Cases	196		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.16.			

Complementary Feeding (MPASI) and Child Growth Weight Gain

The Crosstab analysis of Complementary Feeding (MPASI) and child growth, particularly weight gain, investigates how different MPASI types influence children's weight categories. Among the eight MPASI combinations studied, "Chicken and Egg" is most associated with the "Good" weight category (9.2%), while "Broccoli and Egg" is most associated with the "Less Good" category (6.6%). Overall, 58.2% of children

fall into the "Good" weight gain category, suggesting a generally positive effect of MPASI on weight gain. However, the Chi-Square test results indicate no significant relationship between MPASI types and weight gain, with a Pearson Chi-Square value of 4.406, degrees of freedom (df) of 7, and an asymptotic significance of 0.732. Similarly, the Likelihood Ratio test, with a value of 4.418 and a significance of 0.731, supports this conclusion, showing that the relationship is not statistically significant.

Table 4. Crosstab Test of Complementary Feeding (MPASI) on Weight Gain

Variable			Weight Categories		Total
			Good	Less Good	
Complementary Feeding	Carrot and Egg	Count	14	10	24
		% of Total	7.1%	5.1%	12.2%
	Fish (Shrimp) and Egg	Count	14	10	24
		% of Total	7.1%	5.1%	12.2%
	Spinach and Egg	Count	16	9	25
		% of Total	8.2%	4.6%	12.8%
	Chicken (Meat) and Egg	Count	18	8	26
		% of Total	9.2%	4.1%	13.3%
	Soy (Tempeh) and Egg	Count	15	9	24
		% of Total	7.7%	4.6%	12.2%
	Broccoli and Egg	Count	11	13	24
		% of Total	5.6%	6.6%	12.2%
	Pumpkin (Squash) and Egg	Count	12	13	25
		% of Total	6.1%	6.6%	12.8%
	Yellow Pumpkin and Egg	Count	14	10	24
	Carrot and Egg	Count	7.1%	5.1%	12.2%
Total		Count	114	82	196
		% of Total	58.2%	41.8%	100.0%

Table 5. Chi-Square Test of Complementary Feeding on Weight Gain

Variable	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.406[a]	7	.732
Likelihood Ratio	4.418	7	.731
Linear-by-Linear Association	.788	1	.375
N of Valid Cases	196		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.04.			

Child Development

The Crosstab Analysis of Complementary Feeding (MPASI) on child development examines how different types of complementary foods affect various aspects of development, including physical growth, overall health, and potentially cognitive and social development. The analysis reveals that MPASI types yield different outcomes in terms of development conformity and deviation. For instance, Carrot and Egg, and Fish (Shrimp) and Egg each account for 4.6% conformity and 7.7% deviation. Spinach and Egg result in 5.6% conformity and 7.1% deviation, while Chicken (Meat) and Egg show a balanced impact with 7.1% conformity and 6.1% deviation. Soy (Tempeh) and Egg have 5.6% conformity and 6.6% deviation, whereas Broccoli and Egg lead with 8.2% conformity and 4.1% deviation.

Pumpkin (Squash) and Egg show 7.7% conformity and 5.1% deviation, and Yellow Pumpkin and Egg have the highest conformity at 9.7% with 2.6% deviation. Overall, 53.1% of children show developmental conformity, indicating that most children receiving these complementary foods meet developmental expectations. The Chi-Square analysis further supports this, with Pearson's Chi-Square and Likelihood Ratio tests revealing significant differences (p-values of 0.038 and 0.031, respectively) between groups that received MPASI and those that did not. The Linear-by-Linear Association test confirms a strong linear relationship with a very low significance value (p = 0.000), highlighting the significant impact of complementary feeding on child development for children aged 7-12 months.

Table 6. Crosstab Test of of Complementary Feeding (MPASI) on Child Development

Variable			KPSP Categories		Total
			Conformity	Deviation	
Complementary	Carrot and Egg	Count	9	15	24
Feeding		% of Total	4.6%	7.7%	12.2%
	Fish (Shrimp) and Egg	Count	9	15	24
		% of Total	4.6%	7.7%	12.2%
	Spinach and Egg	Count	11	14	25
		% of Total	5.6%	7.1%	12.8%
	Chicken (Meat) and Egg	Count	14	12	26
		% of Total	7.1%	6.1%	13.3%
	Soy (Tempeh) and Egg	Count	11	13	24
		% of Total	5.6%	6.6%	12.2%
	Broccoli and Egg	Count	16	8	24
		% of Total	8.2%	4.1%	12.2%
	Pumpkin (Squash) and Egg	Count	15	10	25
		% of Total	7.7%	5.1%	12.8%
	Yellow Pumpkin and Egg	Count	19	5	24
	Carrot and Egg	% of Total	9.7%	2.6%	12.2%
Total		Count	104	92	196
		% of Total	53.1%	46.9%	100.0%

Table 7. Chi-Square Test of Complementary Feeding on Child Development

Variable	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.835[a]	7	.038
Likelihood Ratio	15.411	7	.031
Linear-by-Linear Association	12.318	1	.000
N of Valid Cases	196		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.27.			

Discussion
Impact of Complementary Feeding on Appetite Enhancement

The Crosstab and Chi-Square tests conducted, as shown in Tables 2 and 3, provide valuable insights into the relationship between the types of complementary feeding (CF) given to children and their appetite improvements. Table 2 illustrates the distribution of good versus poor appetite based on the type of CF provided. Among the 196 children observed, 42.3% had a good appetite while 57.7% had a poor appetite. Specifically, types of CF like broccoli and eggs were associated with a higher proportion of good appetite (8.2% of the total), whereas types like chayote and eggs were more frequently linked with poor appetite (9.7% of the total).

The Chi-Square test results in Table 3 confirm a significant relationship between the types of CF and increased appetite in children. The Chi-Square Pearson and Likelihood Ratio statistics were 15.008 and 15.194, with degrees of freedom at 7, and p-values of 0.036 and 0.034, respectively. These p-values, being less than 0.05, indicate that the observed relationship is statistically significant and not due to chance, highlighting a strong association between the type of CF and children's appetite responses. This finding aligns with previous research, such as Scaglioni et al. (2018), which identified that variations in CF types and composition affect children's food acceptance and subsequent growth and development. Similarly, Masztalerz-Kozubek et al. (2022) emphasized the importance of proper nutrition in supporting children's eating behaviors (Brunet et al., 2021; Kininmonth et al., 2023). These findings have practical implications for designing effective CF programs, suggesting that tailoring food choices to individual children's needs can enhance their appetite and promote healthy eating patterns and optimal growth.

Impact of Complementary Feeding on Child Growth
Weight Gain

Analysis from Tables 4 and 5 provides insights into the relationship between the types of complementary feeding (CF) provided to children and their growth, specifically measured through weight. Table 4illustrates variations in children's weight categories based on the CF types consumed. Among the 196 children observed, 58.2% had good weight while 41.8% had poor weight. The most commonly provided CFs were chicken and eggs, which had 9.2% of children with good weight. In contrast, CF types like broccoli and eggs, as well as chayote and eggs, were associated with a higher percentage of children with poor weight, at 6.6%.

The Chi-Square test results in Table 5 indicate no statistically significant relationship between the type of

CF and children's weight gain. The Pearson Chi-Square, Likelihood Ratio, and Linear-by-Linear Association values were 4.406, 4.418, and 0.788 respectively, with significance levels exceeding 0.05 (0.732, 0.731, and 0.375). These findings suggest that there is insufficient evidence to reject the null hypothesis, implying that no strong or significant relationship exists between CF types and weight gain in the observed population. This result aligns with previous literature, which indicates that factors such as genetics, physical activity, and environmental influences may have a greater impact on weight gain than specific types of CF. Studies by Bergamini et al. (2022) underscore the importance of these factors in regulating child growth, highlighting that nutrition is only one of many factors affecting overall weight and physical development.

Child Development

Analysis from Tables 6 and 7 offers a deeper understanding of how different CF types impact child development, particularly in relation to the KPSP (Pre-Screening Development Questionnaire) standards. Table 6 displays the distribution of children based on the CF types they received and their alignment with KPSP standards. Of the 196 children observed, 53.1% met KPSP standards, reflecting success in providing CF that meets recommended nutritional criteria. The most commonly provided CFs were pumpkin and eggs (9.7% of the total), followed by broccoli and eggs (8.2%). CFs such as spinach and eggs and chayote and eggs had relatively high compliance with KPSP standards, whereas CFs like fish or shrimp and eggs and chicken and eggs showed lower compliance (Campbell et al., 2016; Wang et al., 2021).

The Chi-Square test results reinforce these findings by demonstrating a significant impact of CF on child development, particularly in relation to KPSP standards. The Chi-Square Pearson, Likelihood Ratio, and Linear-by-Linear Association values were 0.038, 0.031, and 0.000 respectively, indicating significant differences from expected values if no relationship existed between CF types and compliance with nutritional standards. This emphasizes that the type of CF provided significantly influences children's adherence to established nutritional guidelines. Previous studies by Apriani et al. (2024) and Comerford et al. (2024) support these findings, showing that variations in CF types can affect various aspects of child development, including physical growth, general health, and even cognitive and social development (Komninou et al., 2019; Urkia-Susin et al., 2024). These results highlight the importance of carefully selecting and structuring CF to ensure children receive adequate nutrition appropriate to their developmental stage, reinforcing the need for a holistic approach to complementary feeding.

T-Test Analysis and Its Implications

This study makes a significant contribution to the existing body of research on the effects of complementary feeding (CF) on early childhood development. The finding that CF significantly improves eating frequency, weight gain, and developmental scores aligns with previous research highlighting the critical role of additional nutrition during key growth stages. Earlier studies have also indicated that dietary patterns during this period not only affect physical health but also cognitive and social abilities. Specifically, the results of this study support previous findings that CF plays a crucial role in enhancing the nutritional intake necessary for optimal growth (Apriani & Dewi, 2024; Lawson et al., 2024; Masztalerz-Kozubek et al., 2022). This is consistent with literature emphasizing the importance of variety in complementary feeding options to meet children's nutritional needs during this critical period (Gurang et al., 2023; Sari et al., 2022; Tina et al., 2023). Thus, this research not only confirms but also strengthens previous evidence of the positive relationship between CF and child development (Spyreli et al., 2021).

Furthermore, the results from the t-test, which show significant improvements in appetite, weight, and developmental scores, have profound practical implications. These findings can be utilized to refine guidelines and recommendations regarding CF for parents and child health professionals. They underscore the importance of a holistic approach to nutritional strategy, one that considers not just physical aspects but also cognitive and social development. This study extends our understanding of the impact of CF on child development and emphasizes the need for continued research in this area to further optimize child health care. Integrating these findings with previous literature illustrates that CF is not only about meeting basic nutritional needs but also about ensuring children have a solid foundation for their growth and development (Marfuah et al., 2022; Osendarp et al., 2016; WHO, 2023).

Conclusion

The research highlights that diverse practices in complementary feeding (CF) in Indonesia demonstrate a strong inclination among parents to introduce a variety of foods, particularly chicken and eggs. This approach significantly enhances children's appetite, as indicated by increased eating frequency and notable weight gain. Improvements in developmental outcomes are also evident from higher Pre-Screening Development Questionnaire (KPSP) scores. Specific CF types, such as broccoli and eggs, were particularly effective in boosting appetite, emphasizing the importance of selecting nutrient-dense foods for optimal benefits.

Recommendations for advancing CF practices include conducting longitudinal studies to explore its effects in various contexts, developing precise evaluation tools, and improving parent education on balanced diets. Healthcare institutions should focus on targeted nutritional interventions and regular monitoring, while community initiatives should promote healthy CF practices and nutrition literacy to ensure children's well-being.

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