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The association between complementary feeding practices and anthropometric status among infants aged 6-12 months in Indonesia

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Abstract

The first two years of life represent a critical period of transition from breast milk to home-cooked foods. After six months of age, breast milk alone is insufficient to meet the infant's nutritional needs, therefore, complementary feeding is required. Inappropriate complementary feeding practices may lead to nutritional problems. This study aimed to analyze the relationship between complementary feeding practices and anthropometric status of infants aged 6-12 months at the Paysandú of Buscemas Wonokusumo. This descriptive correlational study used a cross-sectional design with a total population of 333 and a minimum sample of 85 respondents was determined using consecutive sampling. Independent variables included breastfeeding and complementary feeding practices (timing, variation, texture, portion size, and frequency), while the dependent variables were anthropometric indicators: W/A, L/A, W/L, MUAC/A, and HC/A. Data were collected through questionnaires and anthropometric measurements, analyzed using Chi-Square. The findings revealed that there was a significant association between breastfeeding practices and W/A ($p = 0.002$), as well as between overall complementary feeding practices and HC/A ($p = 0.007$). Meanwhile, W/L, L/A, and MUAC/A showed no significant association with complementary feeding practices ($p > 0.05$). Most respondents demonstrated age-appropriate complementary feeding practices and showed normal anthropometric status. Breastfeeding and complementary feeding were found to influence certain aspects of infant growth, particularly W/A and HC/A.

Keywords: Complementary Feeding; Breastfeeding; Anthropometry; Infants; Nutrition; Good Health

1. Introduction

The first two years of life represents a critical period for optimal growth and development. After six months of age, breastfeed alone insufficient to meet nutritional needs, therefore nutritional intake transitions are required. Age-appropriate complementary feeding (CF) is essential to ensure adequate nutrition intake and prevent growth faltering [1]. Inappropriate feeding practices, such as early or delayed introduction, limited variation of food, inadequate texture, portion and frequency could lead to malnutrition [2].

Malnutrition, encompassing both undernutrition and overnutrition, remains as a major public health issue. In 2021, approximately 22.3% children in the world were stunted, 6.8% wasted, and 5.6% overweight [3]. In Indonesia, the prevalence of stunting is 21.6%, 7.7% wasting, and 17.1% underweight [4]. Although national and local programs have reduced the prevalence of malnutrition, urban areas such as Surabaya continue to repost suboptimal child growth cases. Malnourished children will become less productive and more susceptible to non-communicable diseases [5].

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Providing adequate nutritional intake is one way to prevent malnutrition. Infant's nutritional status reflected in anthropometric status, such as weight-for-age, length-for-age, weight-for-length, mid-upper arm circumference, and head circumference-for-age. Measurements are carried out with WHO growth standards.

In Indonesia, Kartu Ibu dan Anak (KIA) book serves as a tool to monitor child development. It contains essential information on maternal and child health, including proper complementary feeding practices to support optimal child growth and development [6].

This study aimed to analyze the relationship between complementary feeding practices and anthropometric status among infants aged 6–12 months attending Posyandu in the working area of Puskesmas Wonokusumo, Surabaya. Understanding this association is essential for guiding maternal education, enhancing community-based nutrition initiatives, and averting early-life malnutrition.

2. Material and methods

This study uses a descriptive correlational design with a cross-sectional approach. The population consisted of infants aged 6-12 months that registered at the posyandu within the working area of Buscemas Lookism and visited January 2025. The sample size was 85 respondents and participants were recruited using a consecutive sampling technique until the minimum sample requirement was met. Infants aged 6-12 months whose mothers or primary caregivers provided informed consent were included in this study. Exclusion criteria consisted of premature and infants with congenital abnormalities or those who were ill during data collection period.

The independent variable of this study was breastfeeding practice, practice of complementary feeding, which encompassed timing of complementary food introduction, food variety, food texture, portion size, and feeding frequency. The dependent variable was the anthropometric status of the infants, assessed using five indicators, weight-for-age (W/A), length-for-age (L/A), weight-for-length (W/L), mid-upper arm circumference-for-age (MUAC/A), and head circumference-for-age (HC/A). The data were analyzed using the Chi-square test with Fisher's Exact Test as an alternative. A p-value of less than 0.05 was considered significant.

3. Results and discussion

Table 1 Distribution Characteristics

Variable	**N**	**%**
Age (month)		
6	13	15.3
7	14	16.5
8	18	21.2
9	9	10.6
10	8	9.4
11	8	9.4
12	15	17.6
Gender		
Male	43	50.6
Female	42	49.4
Exclusive breastfeeding		
Yes	47	55.3
No	38	44.7
W/A		
Severely underweight	2	2.4
Underweight	18	21.2
Normal	61	71.8

Risk of overweight	4	4.7
Obese	0	0
L/A		
Severely stunted	4	4.7
Stunted	14	16.5
Normal	65	76.5
Tall	2	2.4
W/L		
Severely wasted	4	4.7
Wasted	12	14.1
Normal	62	72.9
Risk of overweight	5	5.9
Overweight	2	2.4
Obese	0	0
MUAC		
Severe Acute Malnutrition	0	0
Moderate Acute Malnutrition	5	5.9
Normal	80	94.1
HC/A		
Microcephaly	12	14.2
Normal	66	77.6
Macrocephaly	7	8.2

A total of 85 respondents participated in this study. The majority of infants were aged 8 months (21.2%) and predominantly by male (50.6%). Most infants showed normal growth patterns. Based on growth indicators, 71.8% had normal weight-for-age (W/A), 76.5% had normal length-for-age (L/A), and 72.9% were categorized as well-nourished according to weight-for-length (W/L). Meanwhile, 94.1% had normal mid-upper arm circumference-for-age (MUAC/A), and 77.6% had normal head circumference-for-age (HC/A).

Table 2 Distribution of breastfeed and complementary feeding practices

Variable	**N**	**%**
Breastfeeding		
Yes	54	63.5
No	31	36.5
Complementary food		
Yes	83	97.6
No	2	3.5
CF variation		
Appropriate	76	89.4
Inappropriate	9	10.6
CF texture		
Appropriate	69	81.2
Inappropriate	16	18.8
CF portion		
Appropriate	60	70.6
Inappropriate	25	29.4

CF frequency		
Appropriate	65	76.5
Inappropriate	20	23.5
Overall CF practices		
Appropriate	27	31.8
Inappropriate	58	68.2

According to the data nearly all respondents had introduced complementary feeding (97.6%) and continued breastfeeding (63.5%). The majority of mothers demonstrated appropriate complementary feeding practices in specific components, including food variety (89.4%), appropriate texture (81.2%), portion size (70.6%), and feeding frequency (76.5%). However, when assessed as a whole, only 31.8% (27 out of 85 respondents) met all complementary feeding criteria according to the 2023 Kartu Ibu dan Anak (KIA).

Table 3 The association between complementary feeding practices and anthropometric status based on weight-for-age (W/A)

CF practices	**Category**	**Severely underweight**		**Underweight**		**Normal**		**Risk of overweight**		**Obese**		**Total**		**p-value**
		n	%	n	%	n	%	n	%	n	%	n	%	
Breastfeeding	Yes	2	2.4	5	5.9	44	51.8	3	3.5	0	0.0	54	63.5	0.002
	No	0	0.0	13	15.3	17	20.0	1	1.2	0	0.0	31	36.5	
Complementary food	Yes	2	2.4	18	21.2	59	69.4	4	4.7	0	0.0	83	97.6	1
	No	0	0.0	0	0.0	2	2.4	0	0.0	0	0.0	2	2.4	
CF variation	Appropriate	2	2.4	14	16.5	56	65.9	4	4.7	0	0.0	76	89.4	0.393
	Inappropriate	0	0.0	4	4.7	5	5.9	0	0.0	0	0.0	9	10.6	
CF texture	Appropriate	1	1.2	17	20.0	48	56.5	3	3.5	0	0.0	69	81.2	0.187
	Inappropriate	1	1.2	1	1.2	13	15.3	1	1.2	0	0.0	16	18.8	
CF portion	Appropriate	0	0.0	15	17.6	42	49.4	3	3.5	0	0.0	60	70.6	0.104
	Inappropriate	2	2.4	3	3.5	19	22.4	1	1.2	0	0.0	25	29.4	
CF frequency	Appropriate	2	2.4	13	15.3	48	56.5	2	2.4	0	0.0	65	76.5	0.437
	Inappropriate	0	0.0	5	5.9	13	15.3	2	2.4	0	0.0	20	23.5	
Overall CF practices	Appropriate	0	0.0	3	3.5	23	27.1	1	1.2	0	0.0	27	31.8	0.328
	Inappropriate	2	2.4	15	17.6	38	44.7	3	3.5	0	0.0	58	68.2	

Table 4 The association between complementary feeding practices and anthropometric status based on length-for-age (L/A)

CF practices	Category	Severely stunted		Stunted		Normal		Tall		Total		p-value
		n	%	n	%	n	%	n	%	n	%	
Breastfeeding	Yes	1	1.2	6	7.1	45	52.9	2	2.4	54	63.5	0.059
	No	3	3.5	8	9.4	20	23.5	0	0.0	31	36.5	
Complementary food	Yes	4	4.7	14	16.5	63	74.1	2	2.4	83	97.6	1
	No	0	0.0	0	0.0	2	2.4	0	0.0	2	2.4	
CF variation	Appropriate	3	3.5	14	16.5	57	67.1	2	2.4	76	89.4	0.356
	Inappropriate	1	1.2	0	0.0	8	9.4	0	0.0	9	10.6	
CF texture	Appropriate	3	3.5	13	15.3	51	60.0	2	2.4	69	81.2	0.606
	Inappropriate	1	1.2	1	1.2	14	16.5	0	0.0	16	18.8	
CF portion	Appropriate	3	3.5	11	12.9	45	52.9	1	1.2	60	70.6	0.817
	Inappropriate	1	1.2	3	3.5	20	23.5	1	1.2	25	29.4	
CF frequency	Appropriate	3	3.5	10	11.8	50	58.8	2	2.4	65	76.5	0.933
	Inappropriate	1	1.2	4	4.7	15	17.6	0	0.0	20	23.5	
Overall CF practices	Appropriate	1	1.2	3	3.5	22	25.9	1	1.2	27	31.8	0.793
	Inappropriate	3	3.5	11	12.9	43	50.6	1	1.2	58	68.2	

Table 5 The association between complementary feeding practices and anthropometric status based on weight-for-length (W/L)

CF practices	**Category**	**Severely wasted**		**Wasted**		**Normal**		**Risk of overweight**		**Overweight**		**Obese**		**Total**		**p-value**
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Breastfeeding	Yes	2	2.4	6	7.1	20	23.5	2	2.4	2	2.4	0	0.0	54	63.5	0.393
	No	2	2.4	6	7.1	42	49.4	3	3.5	0	0.0	0	0.0	31	36.5	
Complementary food	Yes	4	4.7	12	14.1	60	70.6	5	5.9	2	2.4	0	0.0	83	97.6	1
	No	0	0.0	0	0.0	2	2.4	0	0.0	0	0.0	0	0.0	2	2.4	
CF variation	Appropriate	3	3.5	9	10.6	58	68.2	4	4.7	2	2.4	0	0.0	76	89.4	0.094
	Inappropriate	1	1.2	3	3.5	4	4.7	1	1.2	0	0.0	0	0.0	9	10.6	
CF texture	Appropriate	2	2.4	10	11.8	52	61.2	4	4.7	1	1.2	0	0.0	69	81.2	0.263
	Inappropriate	2	2.4	2	2.4	10	11.8	1	1.2	1	1.2	0	0.0	16	18.8	
CF portion	Appropriate	1	1.2	10	11.8	44	51.8	3	3.5	2	2.4	0	0.0	60	70.6	0.214
	Inappropriate	3	3.5	2	2.4	18	21.2	2	2.4	0	0.0	0	0.0	25	29.4	
CF frequency	Appropriate	3	3.5	10	11.8	48	56.5	3	3.5	1	1.2	0	0.0	65	76.5	0.613
	Inappropriate	1	1.2	2	2.4	14	16.5	2	2.4	1	1.2	0	0.0	20	23.5	
Overall CF practices	Appropriate	1	1.2	1	1.2	24	28.2	1	1.2	0	0.0	0	0.0	27	31.8	0.209
	Inappropriate	3	3.5	11	12.9	38	44.7	4	4.7	2	2.4	0	0.0	58	68.2	

Table 6 The association between complementary feeding practices and anthropometric status based on mid-upper arm circumference-for-age (MUAC/A)

CF practices	**Category**	***Severe acute malnutrition***		***Moderate acute malnutrition***		**Normal**		**Total**		**p-value**
		n	%	n	%	n	%	n	%	
Breastfeeding	Yes	0	0.0	3	3.5	51	60.0	54	63.5	1
	No	0	0.0	1	1.2	30	35.3	31	36.5	
Complementary food	Yes	0	0.0	4	4.7	79	92.9	83	97.6	1
	No	0	0.0	0	0.0	2	2.4	2	2.4	
CF variation	Appropriate	0	0.0	4	4.7	72	84.7	76	89.4	1
	Inappropriate	0	0.0	0	0.0	9	10.6	9	10.6	
CF texture	Appropriate	0	0.0	3	3.5	66	77.6	69	81.2	0.573
	Inappropriate	0	0.0	1	1.2	15	17.6	16	18.8	
CF portion	Appropriate	0	0.0	1	1.2	59	69.4	60	70.6	0.74
	Inappropriate	0	0.0	3	3.5	22	25.9	25	29.4	
CF frequency	Appropriate	0	0.0	3	3.5	62	72.9	65	76.5	1
	Inappropriate	0	0.0	1	1.2	19	22.4	20	23.5	
Overall CF practices	Appropriate	0	0.0	1	1.2	26	30.6	27	31.8	1
	Inappropriate	0	0.0	3	3.5	55	64.7	58	68.2	

Tabel 7 The association between complementary feeding practices and anthropometric status based on head circumference-for-age (HC/A)

CF practices	**Category**	***Microcephaly***		**Normal**		***Macrocephaly***		**Total**		**p-value**
		n	%	n	%	n	%	n	%	
Breastfeeding	Yes	7	8.2	40	47.1	7	8.2	54	63.5	0.111
	No	5	5.9	26	30.6	0	0.0	31	36.5	
Complementary food	Yes	12	14.1	64	75.3	7	8.2	83	97.6	1
	No	0	0.0	2	2.4	0	0.0	2	2.4	
CF variation	Appropriate	11	12.9	58	68.2	7	8.2	76	89.4	1
	Inappropriate	1	1.2	8	9.4	0	0.0	9	10.6	
CF texture	Appropriate	11	12.9	52	61.2	6	7.1	69	81.2	0.697
	Inappropriate	1	1.2	14	16.5	1	1.2	16	18.8	
CF portion	Appropriate	9	10.6	44	51.8	7	8.2	60	70.6	0.194
	Inappropriate	3	3.5	22	25.9	0	0.0	25	29.4	
CF frequency	Appropriate	8	9.4	50	58.8	7	8.2	65	76.5	0.252
	Inappropriate	4	4.7	16	18.8	0	0.0	20	23.5	
Overall CF practices	Appropriate	3	3.5	18	21.2	6	7.1	27	31.8	0.007
	Inappropriate	9	10.6	48	56.5	1	1.2	58	68.2	

The bivariate analysis revealed a significant association between breastfeeding practice and weight-for-age (p = 0.002) in table 3, as well as between overall complementary feeding practice and head circumference-for-age (p = 0.007) in table 7. No significant associations were found between complementary feeding practices and other anthropometric indicators, including L/A, W/L, or MUAC/A (p > 0.05).

The results of this study showed that most of the respondents had introduced complementary feeding and continued breastfeeding. Although most respondents demonstrated adequate complementary feeding practices in terms of timing of complementary food introduction, food variety, food texture, portion size, and feeding frequency, only a small 27 out 0f 58 respondents fulfilled all of the age-appropriate complementary feeding practices. This results in line with research conducted by Mirania that showed higher percentage at complementary food texture (76.2%), frequency (74.6%), and variety (74.6%) [7]. However, research conducted by Kopa showed a different result with only 28.3% respondents demonstrated appropriate complementary food texture [8]. Based on Wahyuni research, mother's knowledge about complementary feeding plays a role as one of the factors that contributes to inappropriate complementary feeding practices [9]. Rosdiana reported significant improved complementary feeding after educational interventions suggesting continuous health education and supervision are crucial [10]. Environmental and socioeconomic factors also play an important role. Limited time, work responsibilities, and financial constraints may lead mothers to prepare low-quality or less diverse complementary foods [9].

In this study it showed the predominance of normal anthropometric indicators across weight-for-age (W/A), length-for-age (L/A), weight-for-length (W/L), mid-upper arm circumference-for-age (MUAC/A), and head circumference-for-age (HC/A) suggests that most infants had normal nutritional status. These findings are aligned with those reported by Suci with most respondent indicated that 75% of infants had normal nutritional status with length-for-age (L/A) as the indicator [11]. Similar outcomes also reported by Kopa and Mirania that 70% and 84.1% of children, respectively, demonstrated normal nutritional status according to the weight-for-age (W/A) indicators [7,8]. However, a small proportion of infants demonstrated malnutrition based on different anthropometric indicators. This can be influenced by direct factors, include inadequate food intake, and indirect factors, such as socioeconomic status, morbidity, and caregiving practices [12].

Anthropometric assessment is used to evaluate nutritional status and identifying imbalances in protein and energy intake [13]. This study found a significant association between breastfeeding and anthropometric status with weight-for-age indicators (p=0.002), this result indicated that infants who continued receive breastmilk more likely to have normal weight-for-age than those who no longer received breastmilk. Continued breastfeeding up to two years contributes to infant's energy and nutrient needs. It also essential to helps reduce the risk of malnutrition and metabolic disease in the later life [14]. This results consistent with Pinantitj results that reported relationship between breastfeeding duration and nutritional status based on weight-for-age anthropometric indicator [15].

The overall assessment of complementary feeding practices in this study represents significant association with head circumference-for-age anthropometric indicator (p=0.007). Head circumference is an indicator for brain growth and neurological development [13]. Malnutrition could lead to morphological changes in brain that reduce intellectual potential and overall brain size [16]. The use of local supplementary foods as complementary foods has proven contain digestible proteins that support tissue formation, growth, and metabolism [17]. Research that conducted by Susanti exhibit improvements in head circumference following nutritional supplements and education interventions, emphasizing the importance of balanced, diverse, and age-appropriate complementary feeding [18].

No significant association were found between complementary feeding practices and other anthropometric indicators (p>0.05). This suggests that most anthropometric indicators in this study were not directly influenced by specific complementary feeding practices. Rahmawati exhibit similar report with no significant association between complementary feeding practices, including age of introduction, frequency, amount, and texture) and stunting among infants aged 6-24 months [19]. Differences in study results may be attributed to variations in age distribution. Most respondents in the present study were aged 6–8 months, representing the early stage of the complementary feeding transition. In contrast, studies by Mirania and Kopa, which predominantly involved respondents aged 12–24 months, reported significant associations between complementary feeding frequency and nutritional status and between complementary food texture and nutritional status [7], [8]. At this later age, complementary foods contribute a larger proportion of total nutrient intake (approximately 70%) compared to breast milk (around 30%), which may explain the stronger associations observed in those studies.

Maulidya reported that malnutrition among children was influenced by a lot of factors, such as incomplete antenatal care, low birth weight, inadequate consumption of protein, and incomplete immunization. Maternal iron

supplementation and sufficient vitamin A intake were also associated with improved child growth. Infants born with low birth weight have lower initial energy and protein reserves, making them more vulnerable to growth failure [20].

This study provides community-based evidence on the relationship between complementary feeding practices and infant anthropometric status using multiple growth indicators. However, its cross-sectional design limits causal interpretation, and self-reported feeding data may have introduced recall bias. Further research needs to be conducted to obtain more detailed nutrition content of complementary feeding and examine child growth trends.

4. Conclusion

This study demonstrated that most mothers practiced complementary feeding appropriately in individual aspects, although only about one-third fulfilled all recommended practices according to the 2023 Kartu Ibu dan Anak (KIA) guidelines. The majority of infants exhibited normal anthropometric status, indicating generally adequate growth patterns. Significant associations were identified between breastfeeding practice and weight-for-age, and between overall complementary feeding practice and head circumference-for-age.

Compliance with ethical standards

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Disclosure of conflict of interest

All Authors have no conflict of interest.

Statement of ethical approval

This research has obtained ethical approval from the Ethics Committee of the Faculty of Medicine, Universitas Airlangga with reference number 130/EC/KEPK/FKUA/2024 on October 16th, 2024.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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