Maternal knowledge and caregiver attitudes toward accurate complementary feeding according to WHO recommendations: A study at Riau, Indonesia

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ABSTRACT

The percentage of exclusive breastfeeding in Pekanbaru City in 2022 decreased compared to the previous year, thus putting babies at risk of receiving complementary foods too early, which has short-term and long-term impacts. Short-term negative impacts include babies losing nutrients from breast milk, triggering diarrhea, anemia, and reducing the baby's sucking ability. While long-term negative impacts include obesity, hypertension, allergies, and atherosclerosis. The purpose of this study was to determine the relationship between maternal knowledge and caregivers' attitudes towards providing complementary foods (MP-ASI) in the Payung Sekaki Community Health Center Work Area, Pekanbaru City, Riau. This study used a cross-sectional design, conducted from December 2023 to July 2024 in the Payung Sekaki Community Health Center Work Area, Pekanbaru City, Riau. The sample in this study were 163 mothers with babies aged 6-24 months with a sampling technique using purposive sampling. The instrument in this study was a questionnaire. The data analysis technique used univariate and bivariate analysis with Chi Square statistical test in SPSS 26. There was a relationship between maternal knowledge and caregiver attitudes towards providing complementary feeding in the Payung Sekaki Community Health Center Working Area with a p value = 0.000 (p <0.05). The better the mother's knowledge about complementary feeding, the more likely a mother will provide complementary feeding on time and respondents who have a positive attitude tend to provide complementary feeding on time.

ABSTRAK

Persentase ASI eksklusif di Kota Pekanbaru tahun 2022 mengalami penurunan dibandingkan tahun sebelumnya, sehingga berisiko bayi mendapatkan MP-ASI terlalu dini, yang memiliki dampak jangka pendek dan jangka Panjang. Dampak negatif jangka pendek meliputi bayi kehilangan nutrisi dari ASI, memicu diare, anemia dan menurunkan kemampuan daya hisap bayi. Sedangkan dampak negatif jangka panjang diantaranya obesitas, hipertensi, alergi, arterosklerosis. Tujuan penelitan ini adalah untuk mengetahui hubungan pengetahuan ibu dan sikap pengasuh terhadap pemberian makanan pendamping ASI (MP-ASI) di Wilayah Kerja Puskesmas Payung Sekaki Kota Pekanbaru, Riau. Desain penelitian ini menggunakan metode cross sectional, dilakukan pada bulan Desember 2023 – Juli 2024 di Wilayah Kerja Puskesmas Payung Sekaki Kota Pekanbaru, Riau. Sampel dalam penelitian ini adalah adalah ibu yang mempunyai bayi usia 6-24 bulan sebanyak 163 orang dengan teknik pengambilan sampel menggunakan purposive sampling. Instrumen dalam penelitian ini adalah kuesioner. Teknik analisis data menggunakan analisis univariat dan bivariat dengan uji statistik Chi Square pada SPSS 26. Ada hubungan pengetahuan ibu dan sikap pengasuh terhadap pemberian MP- ASI di Wilayah Kerja Puskesmas Payung Sekaki dengan nilai p=0,000 (p<0,05). Semakin baik pengetahuan ibu tentang MP-ASI maka seorang ibu akan memberikan MP-ASI tepat pada waktunya dan responden yang memiliki sikap postif cenderung akan memberikan MP-ASI tepat pada waktunya.

GRAPHICAL ABSTRACT

Keyword
attitude
breastfeeding
caregiver
complementary feeding
knowledge

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INTRODUCTION

The World Health Organisation recommends exclusive breastfeeding (EBF) during the initial six months of life. The information and positive attitude of mothers are crucial in the implementation of exclusive breastfeeding practices (Prince et al., 2020). The WHO advises that infants be introduced to complementary foods at six months of age, a guideline echoed by ESPGHAN, NASPGHAN, and the European Academy of Allergy and Clinical Immunology (EAACI), which recommend the introduction of complementary foods between weeks 17 and 26. Complementary feeding is the process that commences when exclusive breastfeeding or formula feeding is inadequate to fulfil the nutritional needs of newborns, necessitating the introduction of other foods and liquids alongside breast milk or formula. Complementary food (CF) is described as any solid or (semi) liquid food, except breast milk or its alternatives, such as baby or follow-on formula. This definition of supplemental food was selected due to the fact that not all infants are exclusively breastfed or are breastfed for limited durations (Kostecka et al., 2021).

According to the WHO, infants who receive complementary foods before the age of 6 months are 17 times more likely to experience diarrhea and three times more likely to suffer from upper respiratory tract infections (URTIs) compared to infants who are exclusively breastfed and receive complementary foods on time (Maharani, 2016). The incidence of digestive and respiratory tract infections due to the provision of complementary foods to infants aged 0-6 months is one of the causes of the high infant mortality rate in Indonesia (Kumalasari et al., 2015). The negative impacts of providing complementary foods too early can be grouped into short-term and long-term impacts. Short-term negative impacts include infants losing nutrients from breast milk, triggering diarrhea, triggering anemia, and reducing the baby's sucking ability. Meanwhile, long-term negative impacts include obesity, hypertension, allergies, and atherosclerosis (Eka Fitri, 2022).

It is stated in the SDGs in point 2, which relates to providing complementary foods to babies, namely Zero Hunger; what must be done is to provide the right food in quantity and quality to children aged 6 to 24 months to ensure optimal growth and development because good nutrition is the bedrock of child development. Encourage exclusive breastfeeding for babies under 6 months of age (UNICEF, 2025). Complementary foods represent a crucial phase in the shift from milk-based nutrition to family meals. The phase of introducing complementary foods into an infant's diet is characterised by swift growth and development. During this phase, newborns are vulnerable to both nutrient deficits and surpluses, and significant dietary alterations transpire when children encounter novel foods, flavours, and feeding experiences (Kostecka et al., 2021).

Factors related to the provision of complementary foods to infants aged 0-6 months by mothers include knowledge, maternal health and occupation, complementary foods advertising, health workers, culture, socioeconomic status, and family support. A mother's lack of knowledge about the benefits of exclusive breastfeeding is closely related to the provision of complementary foods to infants under 6 months (Ekasari, 2018). Proper nutrition during the first year of life is essential for a child's healthy growth and development. The efficacy of supplemental feeding is affected by several aspects, including the family's socioeconomic position, maternal age, home location, educational attainment, presence of older siblings, and duration of nursing (Kostecka et al., 2021). The habits of carers on breastfeeding and complementary feeding were evaluated, indicating that the majority (85.0%) commenced breastfeeding within the first hour post-delivery. This percentage exceeds that reported in a related study (Prince et al., 2020). Of the individuals who used infant formula (5%), 66.7% administered it to their youngsters after one hour, however 33.3% postponed feeding until the subsequent day. These methods are erroneous and elevate the risk of child mortality and illnesses, while also diminishing the probability of sustained breastfeeding (Raihana et al., 2021).

Psychosocial issues encountered by newborns and children during their initial supplemental feeding impact their subsequent dietary patterns. The nutritional habits and behaviours established during this era are critical for the future development of the infant and child. The primary determinant affecting behaviours during supplemental feeding is the age of the infant and toddler. (Demirel et al., 2025). Weaning, or the initiation of supplemental feeding, is a significant and pivotal phase in a child's development, impacting both the family and the infant, and it can substantially influence the child's future health. Over the years, numerous weaning methods have emerged, with baby-led weaning being the most recent; the timeframe for food introduction and the nutritional

requirements for weaning have also evolved. Moreover, the significance of diet, particularly during early life stages, in the development of subsequent non-communicable diseases, like diabetes, obesity, and coeliac disease, has been progressively emphasised. (Alvisi et al., 2015).

A mother's attitude towards providing complementary foods plays a crucial role in deciding on a course of action. A person's attitude is based on good knowledge (Lestiarini & Sulistyorini, 2020). positive attitude towards providing appropriate complementary foods to infants will result in efforts to provide them at the right time and with the right type of food for the infant's age. Meanwhile, a negative attitude is when providing complementary foods to the infant inappropriately (Darmawan & Sinta, 2015).

Based on the research from Justine A. Aga et all, showed the study identified a weak positive association between weight-for-age and employment, as well as a weak negative correlation between height-for-age and the caregiver-child relationship. This study underscores the pressing necessity for nutrition education initiatives centred on supplemental feeding to enhance the understanding and behaviours of carers. Such treatments are crucial for improving child feeding outcomes and may positively affect carers' attitudes (Aga et al., 2024).

Childcare also influences the provision of complementary foods. Most caregivers in the community are close relatives, such as grandmothers or other relatives, even neighbors, or household assistants (Isni & Agustina, 2020). These conditions significantly impact infant feeding patterns. Mothers' and caregivers' lack of knowledge about proper breastfeeding and complementary feeding practices leads them to simply apply what their parents taught them (Isni & Agustina, 2020).

Inadequate breastfeeding and supplemental feeding techniques are prevalent. Globally, it is estimated that merely 34.8% of newborns are exclusively breastfed throughout the initial 6 months of life, with the rest consuming other food or fluids in the early months. Complementary foods are frequently provided prematurely or belatedly, and are often nutritionally deficient and hazardous. At six months of age, an infant's demand for energy and nutrients surpasses what breast milk can supply, necessitating supplemental feeding to bridge the nutritional deficit. If supplementary foods are not introduced at this age or are administered improperly, an infant's growth may decline. In several nations, the phase of supplemental feeding from 6 to 23 months is characterised by the highest prevalence of growth faltering, nutritional deficits, and infectious diseases (WHO, 2020). At 6 to 8 months of age, complementary foods and beverages are essential to fulfil over half of an infant's requirements for vitamins B-6, D, E, thiamin, and niacin, in addition to iron, zinc, magnesium, phosphorus, manganese, and fluoride; however, this is contingent upon the quantities and combinations of human milk and infant formula consumed (Stang et al., 2024).

World Health Organization (WHO) data from 2020 shows that the global average for exclusive breastfeeding is around 44% of the WHO's 50% exclusive breastfeeding target (Yeni, 2022). The percentage of exclusive breastfeeding in Indonesia in 2021 was 69.7%. The highest exclusive breastfeeding coverage was in West Nusa Tenggara Province (86.7%), and the lowest in Papua (11.9%) (Kemenkes RI, 2021). In Riau Province, the exclusive breastfeeding coverage rate in 2022 was 45.4%, an increase compared to 39.4% in 2021. The 2022 achievement has reached the set target of 45%. The exclusive breastfeeding achievement in Pekanbaru City in 2022 (45%) decreased compared to 58% in 2021 (Dinas Kesehatan Provinsi Riau, 2022).

Data from the 2017 Indonesian Basic Health Research (Riskesdas) showed that 30.2% of infants aged 6-24 months received complementary feeding, while 69.8% received complementary feeding for infants aged 0-6 months (Widiastuti et al., 2020). According to the World Health Organization, approximately 1.5 million infants die each year due to improper and unsafe complementary feeding (Aristawati, 2021).

Research conducted by Fitriani et al. (2022) showed that maternal knowledge ($p < 0.001$), family support ($p < 0.001$), and sociocultural support ($p = 0.001$) strongly influenced the provision of early complementary foods to infants, while health workers had no influence on the provision of early complementary foods. This indicates that maternal knowledge about complementary foods will also determine the appropriate time for mothers to provide appropriate complementary foods to their babies (Fitriani et al., 2022).

Mothers are the primary decision-makers when it comes to providing complementary foods to their children, whether they will provide them before or after 6 months of age. A mother's decision to provide complementary foods is based on her own knowledge of complementary foods. Inadequate knowledge of complementary foods will influence

mothers' attitudes and actions in providing inappropriate complementary foods. Therefore, it is necessary to first improve mothers' knowledge, so that with good knowledge, it is hoped that mothers' attitudes and actions in providing complementary foods will also improve (Lestiarini & Sulistyorini, 2020). The purpose of this study was to determine the relationship between caregivers' knowledge and attitudes and the appropriateness of complementary foods.

The recent World Health Organisation (WHO) guideline seeks to furnish evidence-based advice for complementary feeding (CF) for healthy term infants and young children aged 6 to 23 months throughout low-, middle-, and high-income nations, encompassing both breastfed and non-breastfed children. This suggestion incorporated evidence from two systematic evaluations evaluating outcomes in newborns consuming either animal milk or formula milk; one focused on infants aged 6−12 months and the other on young children aged 12−23 months. In summary, based on the evidence, we believe that the recommendation to administer animal milk to infants and young children, particularly those aged 6−12 months, may inadvertently elevate the risk of overweight and obesity, including DBM. To mitigate this, we suggest that guidelines on the utilisation of animal milk in infants over six months should be contextually tailored (Fewtrell et al., 2024).

METHODS

This study was quantitative research, with a cross-sectional design. This study was conducted from December 2023 to July 2024 in the Payung Sekaki Community Health Center Working Area, Payung Sekaki District, Pekanbaru City, Riau. This research was conducted at the Payung Sekaki Community Health Center because the largest number of exclusive breastfeeding coverage in Pekanbaru City is at this community health center. The population in this study were 275 mothers with babies aged 6-24 months in the Payung Sekaki Community Health Center working area. The sampling method in this study was using the Slovin formula with a tolerance level of error (5%). The sample in this study were 163 mothers with babies aged 6-24 months with a sampling technique using purposive sampling.

The stages of this research began with the ethical clearance application before starting the study to ensure that this research had met the principles of respecting human dignity and not causing harm (NO. 134 / KEP-UNIVRAB / II / 2024). Next, the researchers submitted a permit application to the research institution addressed to the Payung Sekaki Health Center, Payung Sekaki District, Pekanbaru City, Riau. After that, before the informed consent was signed by all participants, the researchers explained the title of the research, its benefits for the subjects, the nature of participation (voluntary), data confidentiality, what happened during the research. This principle was stated in the informed consent.

The appropriate provision of complementary foods for breast milk is obtained through questions in the questionnaire about at what age the mother's child was given complementary foods for breast milk (MP-ASI), with 2 answer choices, namely less than 6 months or more than 6 months.

The instrument in this study was a questionnaire. This research questionnaire has been tested for validity and reliability in Tarai Bangun, Tambang District, Kampar Regency, precisely on Sukajadi street, Kubang Raya, Riau. Of the 25 statements in the maternal knowledge questionnaire, afterconducting validity and reliability tests, 11 valid statements were obtained with a significance value of <0.05 and a reliability test was carried out with reliable results obtained by a Cronbach alpha value of 0.786 (>0.7). Meanwhile, in the caregiver attitude questionnaire, out of 20 statements there were 10 valid statements with a significance value of <0.05 and a reliability test was carried out with reliable results with a Cronbach alpha value of 0.724 (>0.7). These valid statements were used in this study. The questions in the research questionnaire include the respondent's identity, namely the mother's identity including the mother's age, the baby's or child's identity including age, gender, which child; when the baby was given complementary feeding, who cared for the baby, the respondent's knowledge about complementary feeding consisting of 11 questions and the caregiver's attitude consisting of 10 questions. In this study, SPSS 26 was used to analyses the data. Univariate and bivariate analysis (Chi Square test) were applied the results of the bivariate test are said to be significant if the p value is 0.000 (<0.05). The data processing steps started from the editing, coding, entry, cleaning and processing processes.

RESULTS

Characteristic of participants

The majority of respondents in the Payung

Table 1
The characteristics of respondent

Characteristics	Frequency (f)	Percentage (%)
Age (Years)		
Less than 20	3	1.8
20 -35	128	78.5
More than 35	32	19.6
MP-ASI*		
Given less than 6 months	41	25.2
Given more than 6 months	122	74.8
Raised		
Raised by parents	145	89
Raised by grandmother	15	9.2
Raised by others	3	1.8

Note: * complementary feeding

Sekaki Community Health Center Working Area were aged 20-35 years, as many as 128 people (78.5%), and those aged over 35 years were 32 people (19.6%), and the rest were under 20 years old, as many as 3 people (1.8%). For data on the time of giving MP ASI, it was done before by us (Siagian, 2025) based on the data obtained the number of children given complementary feeding for more than 6 months was 122 people (74.8%) and children given complementary feeding for less than 6 months was 41 people (25.2%). The majority of children were cared for by their parents, as many as 145 people (89%), while those cared for by grandmothers were 15 people (9.2%), the rest were cared for by other people as many as 3 people (1.8%). The detailed information of participants is available in **Table 1.**

The level of knowledge and attitude Accurate Complementary Feeding

The results of 163 people (100%) the number of respondents who had a good level of knowledge was 143 people (87.7%) the rest had a poor level of knowledge amounting to 20 people (12.3%). Meanwhile, for the attitude of caregivers, the majority had a positive caregiver attitude, amounting to 143 people (87.7%) the minority had a negative caregiver attitude amounting to 20 people (12.3%). From the 163 respondents, 143 (100%) had good knowledge, 117 (81.8%) provided complementary feeding for more than 6 months, and 26 (18.2%) provided complementary feeding for less than 6 months. Meanwhile, 20 (100%) had poor knowledge, 15 (75%) provided complementary feeding for less than 6 months, and 5 (25%) provided complementary feeding for more than 6 months. The detailed information of the level of knowledge and attitude Accurate Complementary Feeding is available in **Table 2.**

Relationship between maternal knowledge and attitude and the provision of complementary foods

After conducting a statistical test using the Chi Square Test, $p < 0.001$ ($p < 0.05$) was obtained, so there is a relationship between maternal knowledge and the provision of complementary foods (MP-ASI) in the Payung Sekaki Community Health Center Working Area, Payung Sekaki District, Pekanbaru City in 2024, with an Odds Ratio value of 13.5, which means that mothers who have poor knowledge will have a 13.5 times greater risk of providing MP-ASI to babies under 6 months old compared to mothers who

Table 2
Frequency distribution of mothers' knowledge level and caregivers' attitudes towards providing complementary foods

Category	Frequency (f)	Percentage (%)
Mother's knowledge		
Not good	20	12.3
Good	143	87.7
Caregiver attitude		
Negative	20	12.3
Positive	143	87.7

Table 3
The relationship between mothers' knowledge and providing complementary foods

Mother's knowledge	Providing complementary foods				Total		P Value	OR (95% CI)
	Given < 6 months		Given ≥ than 6 months					
	F	%	F	%	F	%		
Not good	15	75	5	25	20	12.3	0.000	13.500
Good	26	18.2	117	81.8	143	87.7		(4.504-40.464)
Total	41	25.2	122	74.8	163	100		

Note: F: Frequency; CI: Confidence Interval; * significance level (p<0.05); The test used is the chi-square test.

have good knowledge (see Table 3).

Based on the results of the study from 163 respondents, mothers who had a positive parenti ng attitude were 143 people (100%), those who provided complementary feeding for more than 6 months were 119 people (83.2%) and those who provided complementary feeding for less than 6 months were 24 (16.8%). Meanwhile, as many as 20 people (100%) of mothers had a negative parenting attitude, those who provided complementary feeding for less than 6 months were 17 people (85%) and those who provided complementary feeding for more than 6 months were 3 (15%).

After conducting a statistical test using the Chi Square Test, p = 0.000 (p <0.05) was obtained, so there is a relationship between the caregiver's attitude towards providing complementary foods for breast milk (MP-ASI) in the Payung Sekaki Community Health Center Working Area, Payung Sekaki District, Pekanbaru City in 2024, with an Odds Ratio value of 28.097, which means that mothers who have negative caregiver attitudes will be 28.097 times more at risk of providing complementary foods for breast milk to babies under 6 months old compared to mothers who have positive caregiver attitudes (see Table 4).

DISCUSSION

Complementary foods are essential for nutritional and developmental purposes, representing a crucial phase in the transition from milk feeding to family foods. The complementary feeding period is characterised by rapid growth and development, during which infants are vulnerable to nutrient deficits and excesses, and significant dietary changes occur when they are introduced to new foods, flavours, and eating experiences. The restricted scientific evidence basis is seen in significant discrepancies in complementary feeding guidelines and practices both within and within nations. (Fewtrell et al., 2024). Mothers' knowledge and practices regarding providing complementary foods are important determinants of children's nutrition and health (Gemede et al., 2025). Complementary feeding approaches can offer a nutritionally adequate diet while also fostering healthy food-related behaviours and skills (Boswell, 2021).

The World Health Organisation (WHO) advocates for exclusive breastfeeding for the first 6 months of life, followed by continuous breastfeeding alongside suitable complementary foods until at least 2 years of age or longer. According to the WHO guidelines, complementary feeding should be started at 6 months of age, while continuing breastfeeding up to 2 years or more (Shrestha et al., 2020). Breastfeeding and complementary feeding practices differ based on the demands of the mother and infant, as well as cultural, educational, and economic influences (Šiško, 2022). Consumption of nutritionally adequate complementary foods is essential for optimal growth and development of infants and toddlers, including those in developing

Table 4
The relationship between caregivers' attitudes to providing complementary foods

Caregiver attitude	Providing complementary foods				Total		P Value	OR (95% CI)
	Given < 6 months		Given ≥ than 6 months					
	*F	%	F	%	F	%		
Negative	17	85	3	15	20	12.3	0.000	28.097
Positive	24	16.8	119	83.2	143	87.7		(7.632 – 103.446)
Total	41	25.2	122	74.8	163	100		

Note: F: Frequency; CI: Confidence Interval; * significance level (p<0.05); The test used is the chi-square test.

countries (Jacquier et al., 2020). Complementary feeding denotes the practice of augmenting breastfeeding by providing a diverse array of foods to children aged 6 to 24 months. The interval between 6 to 24 months of age represents a phase of nutritional susceptibility, as the nutrients, particularly micronutrients and energy derived solely from breast milk, will be inadequate to fulfil the child's needs. Ensuring sufficient nutrition during the interval of 6 to 24 months of age is a significant worldwide health priority (Forsido et al., 2019).

The WHO defines optimal complementary feeding as the introduction of safe, age-appropriate, and nutritionally sufficient meals alongside breastfeeding for infants at 6 months of age. Inadequate complementary feeding methods correlate with a significant incidence of malnutrition and mortality in babies (Abiyu & Belachew, 2020).

This study shows that there is a relationship between maternal knowledge and the provision of complementary feeding in the Payung Sekaki Community Health Center Working Area, Payung Sekaki District, Pekanbaru City in 2024. The results of this study are in line with Petricka, et al. (2022) with the results of the study p value 0.00, CI 95% which shows that there is a relationship between the level of maternal knowledge and the provision of complementary feeding in infants aged 0-6 months. This can be interpreted that mothers with less knowledge about complementary feeding have the opportunity to practice early complementary feeding.

Everyone has different levels of knowledge, some with good knowledge and some with less. Knowledge level is influenced by many factors, including age, education, and occupation. However, these factors are not always the determining factor in acquiring knowledge because information can be obtained from anywhere (Istikhomah et al., 2022). This is supported by research Arlis (2024) which states that in this modern era, information is obtained not only through formal education but also through electronic media, print media, and even the currently rapidly developing social media.

According to the researchers' assumptions, a mother's knowledge about complementary feeding can influence her decision to provide complementary feeding. The better a mother's knowledge of complementary feeding, the more likely she is to provide complementary feeding on time until her baby is six months old and to exclusively breastfeed before the baby is six months old. Conversely, the lesser the mother's knowledge about complementary feeding practices, the more likely she is to provide complementary feeding early, thus preventing exclusive breastfeeding. Based on the research results, it also shows that mothers who have good knowledge about complementary feeding provide complementary feeding according to WHO recommendations, namely at the age of 6 months (81.8%), and conversely, mothers who do not have good knowledge tend to provide complementary feeding at the age of less than 6 months (75%).

This aligns with WHO recommendations that supplemental foods must be nutritionally sufficient, safe, and properly administered to fulfil the energy and nutrient requirements of young children. Complementary feeding frequently encounters issues, such as foods being too diluted, insufficiently administered, provided in inadequate quantities, or substituting breast milk with lesser quality alternatives. Both diet and feeding habits affect the quality of supplemental feeding, necessitating help for women and families to implement effective complementary feeding (PAHO/WHO, 2002).

Complementary foods for breast milk (MP-ASI) might contribute to diarrhoea, as premature introduction may facilitate the onset of many disorders. Complementary feeding commences at six months of age, since the digestive system has begun to grow but is not yet capable of protein absorption. The hygiene of the food consumed by the infant, along with the MP-ASI, is not determined by the infant's age, such as providing instant meal intended for 2-year-olds to infants under 1 year old. The extension is a dynamic process necessitating interaction between the extension worker and the individual to initiate a behaviour modification process (Anggraeni et al., 2022).

Breastfeeding is a physiological procedure that delivers appropriate nutrition to newborns. Quality nutrition in early childhood is of paramount importance. Maternal milk is an excellent food for promoting the health, growth, and development of infants. Infants are advised to be exclusively breastfed during the initial six months of life. Infants that are exclusively breastfed experience optimal protection against illness throughout the initial months of life. The prolonged duration of breastfeeding enhances the protective impact against several disorders, including diarrhoea (Anggraeni et al., 2022).

According to studies by Halima and Samuel (2021), suitable supplemental feeding practices led to a decrease in stunting, wasting, and underweight in children aged 6 to 23 months in Malawi. We advocate

for the sustained provision of suitable supplemental foods to infants and young children to guarantee that their diet meets essential nutritional requirements for optimal growth (Halima & Samuel., 2021). A systematic review of complementary feeding education interventions in food insecure contexts found an average 62% compliance to imparted messages and a significant association with lower stunting and wasting prevalence among targeted children (Gardner, 2025).

This demonstrates the importance of timely introduction of complementary feeding. Malnutrition is directly or indirectly responsible for more than fifty percent of all childhood fatalities. Approximately 45% of paediatric mortality is linked to malnutrition. Undernutrition continues to be the primary risk factor in sub-Saharan Africa and the fourth in South Asia. After six months of age, when breast milk alone fails to provide all nutritional requirements, supplemental feeding must commence; infants and young children face an elevated risk of malnutrition (Pokharel et al., 2017).

Nutritional inadequacy resulting from an imbalanced diet is a significant factor contributing to stunting and the emergence of comorbidities in babies. Poverty, ignorance on supplemental feeding (CF) schedules, and limited access to information are significant factors influencing nutritional status. 55.96% of carers exhibited suitable CF practices. Simultaneously, 77.89% and 77.55% possessed sufficient knowledge and attitudes regarding CF. A significantly significant correlation ($p < 0.05$) was identified between nutritional diagnosis and mother knowledge, attitudes, and practices regarding CF (Sinai et al., 2024).

This study also shows that there is a relationship between caregivers' attitudes towards providing complementary feeding in the Payung Sekaki Community Health Center Working Area, Payung Sekaki District, Pekanbaru City in 2024. The results of this study are in line with the results of Azizah et al. (2022) research which obtained a p value = <0.001 so that it can be concluded that there is a significant relationship between mothers' attitudes and the accuracy of providing complementary feeding. OR value: 39.600, meaning that respondents who have a positive attitude have a 39.600 times tendency to provide complementary feeding at the right time compared to respondents who have a negative attitude.

Carers should provide suitable complementary food a fair number of times daily. Literature indicates that the frequency should be structured to minimise the retention of prepared food between meals and the danger of microbiological contamination, while optimising the time and effort expended by carers in food preparation. The homemade supplemental foods mostly served as an extension of family meals. Despite the mothers' and carers' adequate understanding of fundamental supplementary feeding practices, the children's net daily intake of energy, calcium, iron, and zinc did not meet the projected daily nutrient requirements from complementary meals. Their functional stomach capacity was significantly diminished (Abeshu et al., 2016a).

Breastfeeding offers optimal nutrition during the initial six months of life. Complementary feeding commences when breast milk alone is inadequate, typically targeting the age range of 6 to 23 months. The disparity between nutritional needs and the quantity derived from breast milk widens with age. Complementary foods are anticipated to provide 200, 300, and 550 kcal per day at 6-8, 9-11, and 12-23 months, respectively. Furthermore, the supplementary foods must supply substantial amounts of micronutrients, including iron, zinc, phosphorus, magnesium, calcium, and vitamin B6 (Abeshu et al., 2016b).

A study in Indonesia sought to evaluate supplementary feeding habits and identify potential risk factors linked to inadequate supplemental feeding for a nationally representative sample of newborns from 2004 to 2007. The findings indicated that public health initiatives aimed at enhancing complementary feeding must consider individual, home, and community-level characteristics that substantially affect the initiation of complementary feeding (Kingsley et al., 2012; Pokharel et al., 2017).

Recently, both the World Health Organisation (WHO) and the American Academy of Paediatrics (AAP) have advocated for responsive feeding (RF) as the standard caregiver-child relational approach to be implemented during child feeding, from the initial phases of breastfeeding or formula feeding through the complementary feeding period and beyond. RF has been identified as a potential catalyst for the execution of health promotion initiatives in industrialised nations, where the nearly unrestricted access to food may predispose youngsters to the risk of non-communicable diseases (NCDs) (Bergamini et al., 2022).

Respondents with positive attitudes tend to provide complementary foods to their babies appropriately after exclusive breastfeeding. The

knowledge and support obtained will encourage respondents to have a positive attitude towards providing complementary foods, which is then translated into action, namely providing complementary foods to babies over 6 months of age. However, this study also found respondents with positive attitudes who provided inappropriate complementary foods to their babies, this is because attitudes do not necessarily translate into action. The realization of attitudes to become actions is influenced by work factors, support from certain parties, such as health workers, family, or people close to the respondent. (Azizah et al., 2022).

Complementary feeding represents a crucial "critical period" in human development; the timing and methods of introducing solid foods into an infant's diet constitute a significant window during which, according to Barker's hypothesis, both positive and negative influences can have substantial epigenetic repercussions, thereby shaping the individual's future life outcomes. Parents, carers, and paediatricians must navigate and integrate tradition, innovation, and occasionally erroneous views when addressing complementary feeding (Aga et al., 2024).

Furthermore, the WHO advocates for the sufficient intake of iron-rich foods and a varied diet adhering to minimum suggested frequencies. Complementary food, when substituting breastmilk, can result in micronutrient deficit and a heightened occurrence of diarrhoea if it possesses low nutrient density, especially in children aged 6 to 12 months. Furthermore, treatments aimed at enhancing food intake post two years of age do not exhibit a meaningful correlation with nutritional outcomes. Although the WHO's guidelines are relevant for all nations, they hold particular significance for low-income countries characterised by significant food insecurity and malnutrition rates. Adhering to WHO's criteria for minimal food requirements during the first two years of a child's life in low-income countries can decrease the child mortality rate by approximately twenty percent. Adhering to the WHO's criteria for a minimum tolerable diet contributes to the mitigation of obesogenic eating behaviours and facilitates natural and healthy weight increase (Ali et al., 2021)

Optimal child complementary feeding practices are crucial for nutritional status, growth, development and health, and ultimately affect child survival (Owen et al., 2018). Inadequate supplemental nutrition of children aged 6–23 months contributes to the adverse growth trends and mortality rates found in emerging nations. Evidence indicates that the adoption of suitable supplemental feeding methods diminishes the prevalence of stunting and results in improved health and growth outcomes. This study aims to evaluate the present practices of supplemental feeding and the associated characteristics among mothers of children aged 6 to 23 months (Pokharel et al., 2017).

The strength of this study is that it has a fairly large sample size and also explores the attitudes of caregivers towards the appropriateness of providing complementary feeding. The limitation of this study is that excluding other factors that can influence the accuracy of providing complementary feeding such as socio-cultural aspects, sources of knowledge obtained by mothers and caregivers. Despite the limitation, by gathering large sample size and exploring factors that influence the accuracy of providing complementary feeding can be beneficial for this study.

CONCLUSIONS

There is a significant relationship between maternal knowledge and caregivers' attitudes toward complementary feeding practices. Mothers with poor knowledge were 13.5 times more likely to introduce complementary foods to infants younger than six months compared to those with adequate knowledge. Caregiver attitudes also influenced the timeliness of complementary feeding initiation. These findings underscore the critical role of maternal knowledge and caregiver attitudes in ensuring appropriate and timely complementary feeding. Strengthening nutrition education and behavior change interventions within maternal and child health programs is therefore essential. Primary Health Centers should intensify counseling on appropriate complementary feeding during antenatal, postnatal, and child health services, while community health volunteers (Posyandu cadres) should consistently deliver evidence-based nutrition messages and provide regular monitoring and support at the community level.

Mothers of infants aged 6–24 months are encouraged to improve their knowledge of complementary feeding through reliable information sources, particularly regarding balanced nutrient composition and infant readiness. Consultation with health workers before initiating complementary feeding is strongly recommended. Future research should further explore factors associated with the appropriateness of complementary feeding practices. Health workers play a pivotal role in community education, especially through integrated health post activities. Notably, maternal knowledge regarding the consequences of early complementary feeding

requires improvement, as premature introduction may reduce exclusive breastfeeding rates and increase the risk of stunting and common infant illnesses such as diarrhea.

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AUTHORS' CONTRIBUTIONS
Dewi S. Siagian conceived and designed the study, formulated the research concept, and led the writing and critical revision of the manuscript. Siti Khuzaiyah contributed to the review and approval of the final manuscript. Nasri Devi participated in participant enrollment, data collection, data acquisition, and data analysis. Rini H. Ratih was responsible for participant enrollment, data collection, data acquisition, and data analysis. Imelda Fitri contributed to data analysis and interpretation of the results. All authors read and approved the final manuscript.

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COMPETING INTERESTS
The authors confirm that all of the text, figures, and tables in the submitted manuscript work are original work created by the authors and that there are no competing professional, financial, or personal interests from other parties.

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