



Impact of Sociodemographic Factors on the Early Initiation of Complementary Feeding in Padang City, Indonesia

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ABSTRACT

The World Health Organization (WHO) recommends introducing complementary foods at six months of age, while continuing breastfeeding up to two years or beyond. However, early or delayed initiation remains common, contributing to nutritional problems in developing countries. This study aimed to assess the prevalence of timely initiation of complementary feeding (CF) and identify sociodemographic factors associated with early introduction of complementary feeding among mothers of infants aged 6–23 months in Padang, Indonesia. A cross-sectional study was conducted among 244 mothers of infants aged 6–24 months. Data were collected using structured questionnaires covering sociodemographic characteristics and the time for introduction of complementary feeding. Statistical analysis was performed using SPSS version 25, descriptive statistics described the prevalence of timely initiation, bivariate logistic regression assessed the relationship between sociodemographic factors and early initiation of CF. Most mothers (89.8%) initiated complementary feeding at the recommended age of 6–8 months, 9.0% introduced foods before six months, and 1.2% after eight months. Early initiation was significantly associated with maternal education level ($p = 0.006$), and grandmothers as source information ($p = 0.010$), where mothers with lower education were more likely to introduce foods prematurely (AOR = 3.39, 95% CI: 1.02–11.32). Mothers who received information from grandmothers were more likely to introduce CF on time (AOR = 2.73, 95% CI: 1.06–6.98). The study highlights the importance of education and family influence on infant feeding practices and recommends strengthening health education for mothers, especially those with lower education, to improve adherence to CF guidelines.

Keyword: Early weaning, Complementary feeding, Maternal educational status, Socioeconomic factors, Grandparents



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1. Introduction

Malnutrition remains a major public health issue that adversely affects children's growth and development. It arises when there is a lack, excess, or imbalance of essential nutrients and energy. The primary types of malnutrition include undernutrition, which involves conditions such as stunting, wasting, and low weight; deficiencies in micronutrients; and being overweight (WHO, 2021). In 2020, global rates of wasting, stunting, and overweight among children under five were 6.7%, 22.0%, and 5.7%, respectively. Among Southeast Asian nations, Indonesia had the highest malnutrition rates in this age group, with 31.8% of children stunted, 10.2% wasted, and 11.1% underweight (UNICEF, 2021). Despite some improvements since 2000, these numbers still surpass the global average, signaling a persistent public health challenge. According to the 2018 Basic Health

Research in West Sumatra, 28.86% of children were stunted, 13.01% wasted, and 0.8% were overweight, slightly below the national average. In Padang, stunting and wasting rates were 22.74% and 16.22%, respectively (Kemenkes RI, 2019). Some children may experience a combination of malnutrition types, such as stunting and wasting or being overweight, though data on these co-occurring conditions is currently unavailable (UNICEF, 2021).

The effects of malnutrition on children's health are severe. In the short term, it leads to higher rates of illness, death, developmental delays, and cognitive impairments. Long-term consequences include stunted growth, greater susceptibility to diseases, and disabilities (Black et al., 2020; United Nations Children's Fund, 2021; Wali et al., 2019).

Infant feeding practices play a vital role in the development of malnutrition. Infants who are not exclusively breastfed during the first six months and who lack proper nutritional support face a higher risk of malnutrition (Beal et al., 2018; Berhe et al., 2019; Damanik & Wanda, 2019; Zaragoza Cortes et al., 2018). Stunting risks increase for infants who do not receive exclusive breastfeeding, are introduced to complementary foods prematurely, do not achieve dietary diversity, fail to consume sufficient protein-rich foods, or lack proper meal frequency (Damanik & Wanda, 2019).

Improper complementary feeding can have detrimental effects on infants and young children. In a study with 1,984 mothers or primary caregivers of infants aged 6–24 months in Ghana, early complementary feeding was found to disrupt breastfeeding practices. Delaying complementary feeding may result in energy deficiencies, as breast milk alone is insufficient after six months of age (Saaka et al., 2015). This shows that timely complementary feeding can protect children from nutrition-related issues (Som et al., 2021). Furthermore, introducing complementary foods at the right age can foster healthy eating habits and help prevent obesity or non-communicable diseases in the future (UNICEF, 2021).

In Indonesia, many infants still do not receive optimal feeding. Almost half are given complementary foods before reaching six months, about 40% of children aged 6–23 months fail to meet minimum dietary diversity, and 28% do not get the required meal frequency. The rate of continued breastfeeding at one and two years is 77% and 55%, respectively (National Population and Family Planning Board (BKKBN) et al., 2018). These trends highlight a lack of adherence to complementary feeding guidelines, increasing the risk of stunting, cognitive delays, and infectious diseases. Therefore, there is an urgent need for strategies that promote better complementary feeding practices (UNICEF, 2021).

The timing of complementary feeding is influenced by factors such as maternal education, income, employment, and access to health information (Ahmad et al., 2018). In Ethiopia, maternal education, counseling, and knowledge were associated with the timely introduction of complementary foods (Andualem et al., 2020). Other studies found that maternal employment, access to radio, antenatal visits, place of delivery, and postnatal care were key factors affecting the timing of complementary feeding (Abate et al., 2023). Given the mixed findings and the lack of research in this area, this study aims to explore the prevalence of timely complementary feeding initiation and the sociodemographic factors that influence it in mothers in Padang, Indonesia. Specifically, the study will examine the impact of maternal education, antenatal and postnatal care, and the influence of family, particularly grandmothers, on infant feeding practices.

2. Methods

2.1. Study Design

This research, a cross-sectional study, was carried out in Padang, Indonesia, between April and September 2025. Its aim was to assess the prevalence of timely complementary feeding and investigate the sociodemographic factors linked to the early introduction of complementary feeding.

2.2. Sample and Sampling Technique

The study involved 244 mothers or primary caregivers of infants aged 6 to 23 months. A two-stage cluster sampling technique was applied. In the first stage, nine out of the 23 health centers (Puskesmas) in Padang were selected randomly. In the second stage, participants were randomly chosen from eligible mothers visiting these centers.

The sample size was determined using a two-sided test with a significance level (α) of 0.05 and a power (β) of 0.2. Based on prior research showing a 41% adherence to complementary feeding guidelines (Aber et al., 2018), the sample size was calculated at 240, with an additional 10% (264) added to account for potential data loss. The inclusion criteria required that participants (mothers or caregivers) were responsible for complementary feeding, were willing to join the study, and could communicate effectively.

2.3. Instruments

Data collection involved a structured questionnaire split into two sections. The first section included a standard patient registration form used in health facilities, gathering sociodemographic details. This part featured closed-ended questions on the child's age and gender, the mother's age, parity, education, occupation, family income, and antenatal and postnatal care visits, along with exposure to health-related media. Mothers were also asked about their primary sources of infant feeding information and the role of grandmothers in advising or making decisions regarding complementary feeding (using multiple-choice and yes/no responses).

The second part of the questionnaire focused on the timing of complementary feeding introduction and was adapted from the WHO's infant and young child feeding (IYCF) survey module. A single open-ended question was posed to mothers: "At what age (in completed months) did you first introduce any food or liquid other than breast milk to your child?" The responses were categorized as early (less than 6 months), timely (6 to 8 months), or late (more than 8 months), according to WHO guidelines. Since the sociodemographic items were taken from routinely used registration forms and the timing question was adapted from a validated WHO instrument used in numerous similar studies, formal validity and reliability testing were not redone for this study.

2.4. Data Collection Procedure

2.4.1. Participant Selection

According to data from the Padang City Health Office, there are 23 Community Health Centers in Padang, serving 15,797 infants aged 6 to 23 months. A simple random sampling method was used to select 9 of these centers. From a total of 1,220 children in the 6 to 23-month age range, 224 respondents were proportionally selected from each of the chosen centers. The random sampling process is depicted in Figure 1. Mothers who met the study criteria and attended the integrated health posts (Posyandu) at the selected health centers were approached personally and invited to participate in the study.

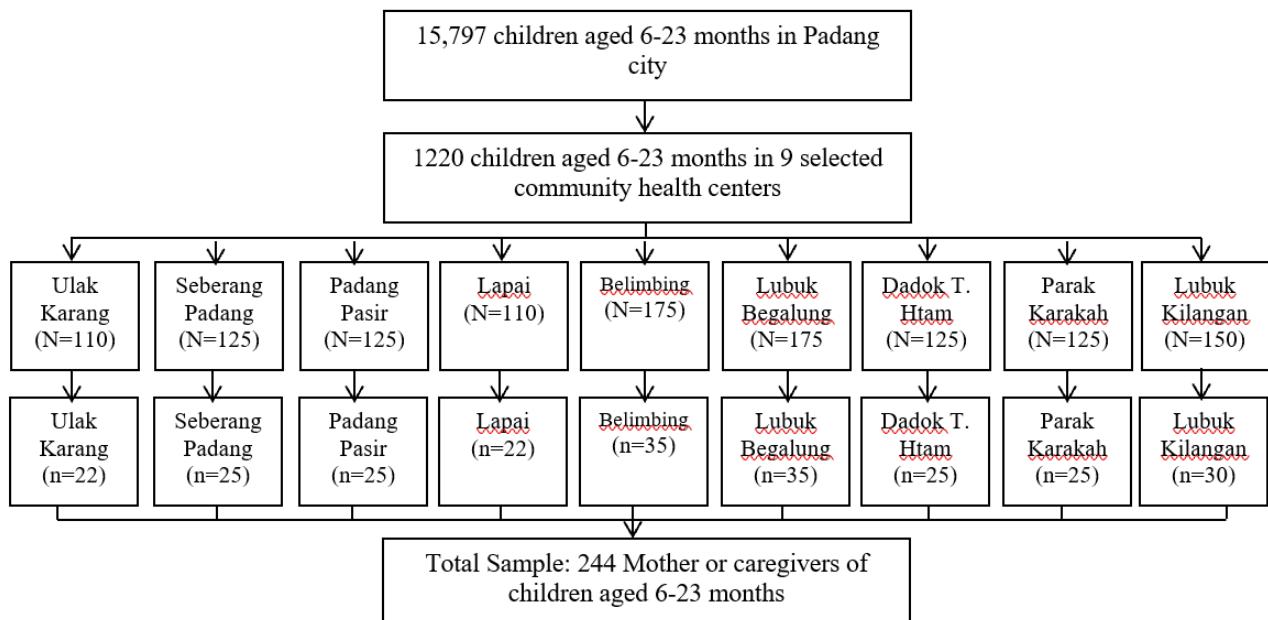


Figure 1 Flow diagram of sampling procedure in Padang City

2.4.2. Informed Consent

Prior to inquiring about their willingness to participate in the study, data collectors provided mothers with a comprehensive explanation of the research details. After the mothers fully understood the information and agreed to take part, they were asked to sign an informed consent form, confirming their decision to participate in the study.

2.4.3. Data Collection

Data collection took place at the Posyandu and lasted between 15 to 30 minutes. If the mothers had limited time, the data collector would arrange a convenient time for a home visit. The data collector ensured that the entire questionnaire was completed, reviewing it to ensure that no questions were missed. The principal investigator conducted daily reviews of the completed questionnaires to verify their accuracy and consistency, ensuring that the data collector followed the expected data collection process.

2.5. Ethical Consideration

This study received ethical approval from the Ethics Committee of the Faculty of Nursing at Universitas Andalas (No. 564a.layaketik/KEPKFKEPUNAND) and from the Head of the Health Office of Padang City (No. 400.14.4/892/DKK=PDG/2025). Ethical principles were adhered to throughout the research process, including autonomy, beneficence, justice, and respect. Autonomy was ensured by allowing participants the freedom to decide on their participation. The principle of beneficence was reflected in the study's potential to offer valuable insights for improving complementary feeding practices. Justice and respect were upheld for all participants involved in the research.

2.6. Data Analysis

Data analysis was conducted using SPSS version 25, with all data coded prior to analysis. Descriptive statistics, such as the mean, standard deviation, and range, were computed for each variable. Categorical data were reported as frequencies and percentages. The chi-square test was applied to identify factors related to the early introduction of complementary feeding, while multiple logistic regression was used to determine the factors influencing early complementary feeding.

3. Results

3.1. Characteristics of Respondents

Table 1 presents the demographic characteristics of the respondents. The average age of the children was 14.56 months (SD = 5.59). Among the children, 36.5% were infants aged 6 to 11 months, and 63.5% were children aged 12 to 23 months. The average age of the mothers was 31.01 years (SD = 4.83), with 90.2% being over the age of 25. Regarding educational attainment, 92.2% of the mothers had completed higher education, and 75.8% were not employed. Most mothers (99.2%) had attended at least four antenatal care visits, and 58.2% had attended postnatal check-ups four or more times.

Table 1 Characteristic of respondents (n=244)

Characteristics	Frequency (f)	Percent (%)
Children's age		
Mean (SD)	14.56 (5.59)	
Infant (6-11 months)	89	36.5
Young children (12-23 months)	155	63.5
Mother's age		
Mean (SD)	31.01 (4.83)	
Young mother (≤ 25 years)	24	9.8
Older mother (>25 years)	220	90.2
Parity of mother		
Primipara	76	31.3
Multipara	157	64.3
Grand multipara	11	4.5
Antenatal care visit		
2-3 times	2	0.8
4 times or more	242	99.2

Table 1 Continued

Characteristics	Frequency (f)	Percent (%)
Postnatal check-up		
Never	1	0.4
1 time	2	0.8
2-3 times	99	40.6
4 times or more	142	58.2
Education level		
Lower education	19	7.8
Higher education	225	92.2
Occupation		
Unemployed	185	75.8
Working mother	59	24.2
Family income		
Low income	147	60.2
High income	97	39.8
Exposure to media		
Television	45	18.4
Radio	2	0.8
Book, newspaper and magazine	85	34.5
Online sources	234	95.9
Mobile application	9	3.7
Source of information		
Grandmother	156	83.9
Husband	43	17.6
Relatives	155	63.5
Friends	127	52.0
Health professional	157	64.3
Community leaders	1	0.4
Cadre	103	42.2

3.2. Univariate Analysis

The timing of complementary feeding initiation is summarized in Table 2. The findings showed that 9.0% of mothers introduced complementary foods before the age of 6 months. In contrast, 89.8% followed the recommended timing, introducing complementary feeding between 6 to 8 months, while 1.2% delayed the introduction until after 8 months.

Table 2 Complementary feeding indicators (n=244)

Characteristics	Frequency (f)	Percent (%)
Time to introduction solid, semi-solid and soft foods		
Early (< 6 months)	22	9.0
Timely (6-8 months)	219	89.8
Late (>8 months)	3	1.2
Early Introduction of Complementary Feeding		
Yes	22	9.0
No	222	91.0

3.3. Bivariate Analysis

Table 3 displays the analysis of how sociodemographic factors relate to the early introduction of complementary feeding in infants. The bivariate analysis identified significant correlations between maternal education level and the timing of complementary feeding ($p = 0.006$), suggesting that mothers with higher education are more likely to introduce complementary foods at the recommended age. Furthermore, the involvement of grandmothers as a source of information was also significantly associated with early introduction ($p = 0.010$). However, other factors such as the mother's age, parity, antenatal care (ANC), postnatal check-ups (PNC), employment, income, and exposure to online media or the internet were not significantly associated.

Table 3 Bivariate analysis of sociodemographic factors associated with early introduction of complementary feeding

Variables	Early Introduction of Complementary Feeding				P value
	Yes n	%	No n	%	
Mother's age					
Young mother (≤ 25 years)	3	12.5	21	87.5	0.530
Older mother (>25 years)	19	8.6	201	91.4	
Parity of mother					
Primipara	4	5.3	72	94.7	0.256
Multipara	18	10.7	150	89.3	
Antenatal care visit					
2-3 times	0	0	2	100.0	0.655
4 times or more	22	9.1	220	90.9	
Postnatal check-up					
2-3 times	12	11.8	90	88.2	0.29
4 times or more	10	7.0	132	93.0	
Education level					
Lower education	5	26.3	14	73.3	0.006*
Higher education	17	7.6	208	92.4	
Occupation					
Unemployed	20	10.8	165	89.2	0.141
Working mother	2	3.4	57	96.6	
Family income					
Low income	17	11.6	130	88.4	0.138
High income	5	5.2	92	94.8	
Exposure to online media/ internet					
No exposure	1	10.0	9	90.0	0.912
Expose to media	21	9.0	213	91.0	
Grandmother as source of information					
No	14	15.9	74	84.1	0.010*
Yes	8	5.1	148	94.9	

3.4. Multivariate Analysis

Table 4 outlines the factors associated with the early introduction of complementary feeding, based on both bivariate and multivariate analyses. The multivariate analysis revealed that maternal education is the most significant predictor of timely complementary feeding. Mothers with higher education levels were found to have significantly greater odds (AOR=3.39, 95% CI: 1.02–11.32) of introducing complementary feeding at the recommended age. In addition, the influence of grandmothers as a source of information was also significant (AOR = 2.73, 95% CI: 1.06–6.98).

Table 4 Multivariate analysis of factors associated with early introduction of complementary feeding

Variable	Early Introduction of Complementary Feeding		COR (95% CI)	AOR (95% CI)
	No	Yes		
Postnatal check-up				
2-3 times	90 (88.2%)	12 (11.8%)	1	1
4 times or more	132 (93.0%)	10 (7.0 %)	1.760 (0.729 – 4.247)	1.764 (0.694 – 4.484)
Education				
Low	14 (73.3%)	5 (26.3)	1	1
High	208 (92.4)	17 (7.6%)	4.370 (1.405 – 13.588)	3.399 (1.020 – 11.324) *
Occupation				
Unemployed	165 (89.2%)	20 (10.8%)	1	1
Working mother	57 (96.6%)	2 (3.4%)	3.189 (0.768 – 13.243)	2.626 (0.556 – 12.400)

Table 4 Continued

Variable	Early Introduction of Complementary Feeding		COR (95% CI)	AOR (95% CI)
	No	Yes		
Family income				
Low income	130 (88.4%)	17 (11.6%)	1	1
High income	92 (94.8%)	5 (5.2%)	2.406 (0.856 – 5.881)	1.519 (0.506 – 4.560)
Grandmother as source of information				
No	74 (84.1%)	14 (15.9%)	3.500 (1.405 – 8.716)1.	2.730 (1.068 – 6.981) *
Yes	148 (94.4%)	8 (5.1%)		

4. Discussion

4.1. Main Study

This study found that most mothers (89.8%) followed the recommended timing for introducing complementary feeding (CF), which is higher than figures from studies in Ethiopia (52.2%) (Ahmed et al., 2022), Nigeria (72.3%) (Ariyo et al., 2021), India (50.3%) (Jose et al., 2021) and two studies in Indonesia, Aceh (49.7%) and Central Java (34.6%) (Ahmad et al., 2018; Barati et al., 2018). It also slightly surpasses a national survey in Indonesia, which reported that 86% of children aged 6–8 months were introduced to solid, semi-solid, or soft foods (BKKBN et al., 2018). This study indicates better adherence to CF guidelines compared to similar studies. The likely reasons for this higher adherence include improvements in maternal health services, such as antenatal and postnatal care, and better access to healthcare during childbirth in the study area. Additionally, efforts by health extension workers (HEWs) in educating mothers about CF guidelines likely contributed to increased maternal awareness and compliance. Socio-cultural factors and variations in timing may also influence these outcomes..

Mothers often introduce CF earlier than recommended due to reasons such as interpreting signs of hunger in the baby, working outside the home, insufficient breast milk, and advice from grandmothers (Yeni et al., 2023). Inappropriate CF practices can increase the risk of stunting in infants through two main processes: first, early introduction can reduce exclusive breastfeeding, making children more vulnerable to infections like diarrhea and respiratory illnesses; second, delayed CF can result in children requiring more energy and nutrients for growth and development, which can make them reluctant to accept firmer food textures, leading to a monotonous diet (Sirkka et al., 2022).

The study found no significant correlation between maternal age and the early introduction of CF. This contrasts with studies in Saudi Arabia, Malawi, Nigeria, and the Netherlands (Alzaheb, 2016; Nkoka et al., 2018; Okafoagu et al., 2017) which indicated that younger mothers are more likely to introduce CF early due to lack of knowledge and experience. However, this study did not observe such an association. It is still recommended that healthcare providers emphasize the importance of introducing complementary foods at six months, especially for younger mothers during antenatal and postnatal visits.

While frequent antenatal care (ANC) visits were associated with a higher likelihood of timely CF introduction, no significant statistical relationship was found in this study. This is in contrast to findings from Ethiopia, where more ANC visits were linked to better CF practices (Ahmed et al., 2022). The discrepancy may be due to healthcare providers in the study area focusing more on maternal care than on CF education. Despite the high ANC visit rate (99.2%), the lack of significant findings suggests the need for greater emphasis on infant feeding education during these visits.

Regarding postnatal care (PNC), no significant relationship with early CF introduction was observed. This differs from studies in Ghana, Pakistan, Tanzania, and Sri Lanka, where PNC visits were associated with improved CF practices (Na et al., 2017; Nkoka et al., 2018; Ogbo et al., 2018; Senarath et al., 2012). The lack of difference in CF timing between mothers with regular PNC visits and those without underscores the need for focused education on feeding practices during these visits.

In terms of socio-cultural factors, maternal education level was significantly related to the early introduction of CF. Mothers with secondary education or higher were more likely to follow CF guidelines compared to those with lower education. This finding aligns with studies conducted in Uganda, India, Nepal, Bangladesh, and Tanzania (Aber et al., 2018; Dhami et al., 2019; Joshi et al., 2012; Na et al., 2018; Ogbo et al., 2018). A study in Southern Ethiopia found that mothers with higher secondary education had an 86%

chance of preventing inappropriate CF timing (Mamo et al., 2022). Education improves mothers' understanding, enabling them to better grasp and apply CF recommendations during health visits. Furthermore, educated mothers are more likely to engage with healthcare providers and have access to communication media and educational resources, which boosts their decision-making regarding infant nutrition (Dagne et al., 2019). Prior research in Indonesia also shows that highly educated mothers tend to have better knowledge of nutrition for all family members, including infants, and are more likely to provide a varied diet for their children (Herman et al., 2023; Herman et al., 2024).

The study identified maternal education as the strongest factor influencing timely CF introduction. Educated mothers are more likely to follow health guidelines, supporting previous research on the impact of maternal education on improving CF practices (Aber et al., 2018). These findings suggest that primary healthcare programs should focus on empowering mothers, particularly those with less education, through targeted health education and counseling on the timely introduction of CF. These programs should also promote the use of locally available food resources to ensure a diverse and nutritious diet for infants, thus improving adherence to CF guidelines.

Maternal employment did not appear to affect the early introduction of CF. A study in Indonesia found that employed mothers were less likely to continue breastfeeding and often introduced low-cost fast food into their children's diets (Fitri & Panjaitan, 2020). This may be because employed mothers often leave their children with others who may not have the knowledge to provide appropriate CF (Reynolds et al., 2021). On the other hand, a study in Ethiopia found that non-working mothers had more time to engage with their children and provide a varied diet (Yesuf et al., 2021).

Sources of information, especially from grandmothers, were significantly associated with the early introduction of CF. Grandmothers played a key role in influencing feeding practices, which is consistent with other studies highlighting the impact of extended family, particularly grandmothers, in child-rearing (Doğan et al., 2019). In Madagascar, a study also confirmed this finding, showing that positive relationships with healthcare professionals facilitated optimal CF practices (Rakotomanana et al., 2020). In Western Kenya, healthcare professionals were the main source of information for mothers, although some mothers encountered inconsistencies among providers, leading to the acceptance of incorrect information (Reynolds et al., 2021). Therefore, it is essential for healthcare professionals, as primary sources of information for mothers, to enhance their knowledge through relevant training and to strengthen their understanding of proper complementary feeding guidelines. This will ensure the information they provide is consistent and comprehensible for mothers.

The study also highlighted that grandmothers played a significant role in providing CF information. The influence of grandmothers as role models in child-rearing has been widely documented (Doğan et al., 2019; Kuswara et al., 2016). Given the substantial impact of grandmothers on mothers' feeding decisions, healthcare professionals should involve them in educational activities related to CF. Inviting grandmothers to group counseling sessions or community nutrition classes can help align traditional practices with current guidelines, ensuring consistent messages across both formal and informal sources. This approach would likely increase the cultural acceptance of CF interventions and support long-term behavior change within households.

4.2. Strength and Limitation

One of the key strengths of this study is its use of thorough analytical methods, including both bivariate and multivariate analyses. This methodology not only helps identify the connections between sociodemographic factors and the early introduction of complementary feeding but also accounts for confounding variables, offering a deeper insight into the factors that influence the timely initiation of complementary feeding practices. Additionally, the findings can inform the development of more effective educational programs aimed at enhancing maternal knowledge and awareness of complementary feeding guidelines, ultimately encouraging positive changes in children's dietary habits. Another strength of the study is its focus on the role of healthcare services, including antenatal and postnatal care, which are essential for promoting better complementary feeding practices. However, this study has limitations, primarily due to its cross-sectional design, which limits the ability to establish causal relationships between sociodemographic factors and early complementary feeding. Furthermore, the sample was taken from specific areas, which may not fully represent the general population, thus limiting the broader applicability of the results. Additionally, relying on maternal self-reports to determine the timing of complementary feeding may introduce recall and social desirability bias, where mothers may misremember events or exaggerate their adherence to the recommended guidelines. This bias could lead to either an underestimation of early or delayed introduction of complementary feeding. Future studies could address this limitation by using validated questionnaires, asking

caregivers to keep feeding diaries, conducting repeated dietary recalls, and, when possible, directly observing feeding practices or cross-referencing the information with child health records.

5. Conclusion

The majority of mothers with children aged 6 to 23 months (89.9%) initiate complementary feeding at the recommended time. This study highlights the importance of sociodemographic factors in the timely introduction of complementary foods. The findings indicate that maternal education and the involvement of grandmothers as sources of information are significantly associated with the early introduction of complementary feeding. This is consistent with previous research that emphasizes the role of maternal knowledge and support networks in improving infant feeding practices. While no significant relationships were found between factors such as maternal age, antenatal care visits, and media exposure, the study suggests that healthcare providers and family support may play an essential role in promoting appropriate complementary feeding practices. The research also indicates that the early introduction of complementary feeding, when done correctly, can help reduce the risks of stunting and undernutrition and establish healthy eating habits that can prevent future health issues. The results suggest that improving maternal education, especially for younger or less educated mothers, and involving grandmothers in the educational process can positively influence complementary feeding practices. Moreover, enhancing healthcare services with a focus on both antenatal and postnatal care can support the timely and appropriate introduction of complementary feeding. The study calls for ongoing efforts to empower mothers, particularly those with lower education levels, by providing accessible information and healthcare interventions to improve their children's nutritional outcomes. Future research should include a well-structured longitudinal study to explore the factors that predict the timely introduction of complementary feeding.

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