



## Risk Factors for Suboptimal Complementary Feeding Practices (MP-ASI) in Lubuk Alung, West Sumatra, Indonesia: An Observational Study

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### ABSTRACT

Appropriate complementary feeding (MP-ASI) is crucial for infant growth and development. This study investigates risk factors associated with suboptimal MP-ASI practices in Lubuk Alung, West Sumatra. A cross-sectional study was conducted among 300 mothers of infants aged 6-23 months. Data on socio-demographics, feeding practices, maternal knowledge, and access to healthcare were collected. Suboptimal MP-ASI was defined using WHO indicators (minimum dietary diversity, minimum meal frequency, minimum acceptable diet). Logistic regression analysis was used to identify associated risk factors. The prevalence of suboptimal MP-ASI was 48%. Risk factors included lower maternal education (OR 2.6, 95% CI 1.4-4.9), low household income (OR 2.1, 95% CI 1.2-3.8), lack of antenatal care visits (OR 1.9, 95% CI 1.1-3.4), and inadequate maternal knowledge about MP-ASI (OR 3.2, 95% CI 1.7-6.0). In conclusion, suboptimal MP-ASI is prevalent in Lubuk Alung. Interventions should target mothers with lower education, low income, and limited healthcare access. Improving maternal knowledge about MP-ASI is crucial.

### 1. Introduction

The first 1000 days of life, encompassing the period from conception to the child's second birthday, represent a critical window of opportunity for shaping health, growth, and development trajectories. During this period, adequate nutrition plays an indispensable role in establishing a solid foundation for lifelong well-being. Among the various facets of infant nutrition, complementary feeding practices (MP-ASI, or Makanan Pendamping ASI in Indonesian) have emerged as a pivotal determinant of child health outcomes. MP-ASI refers to the introduction of foods and liquids, in addition to breast milk, to meet the evolving nutritional needs of infants and young children. The World Health Organization (WHO)

recommends exclusive breastfeeding for the first six months of life, followed by the timely introduction of safe, adequate, and nutrient-rich complementary foods alongside continued breastfeeding up to two years of age or beyond. Appropriate complementary feeding practices are crucial for ensuring optimal growth, cognitive development, immune function, and the prevention of undernutrition, micronutrient deficiencies, and chronic diseases in later life.<sup>1,2</sup>

Despite the well-established benefits of appropriate MP-ASI, suboptimal complementary feeding practices remain a significant public health concern globally, particularly in low- and middle-income countries (LMICs). Suboptimal practices are characterized by inadequate dietary diversity, insufficient meal



frequency, and the consumption of foods that are low in nutrient density and energy content. These practices often result in undernutrition, which manifests as stunting, wasting, and micronutrient deficiencies, with long-lasting consequences for children's physical and cognitive development. Indonesia, as a rapidly developing LMIC, faces considerable challenges in ensuring optimal complementary feeding practices. The 2018 Indonesian Demographic and Health Survey (IDHS) revealed that only 57% of infants aged 6-23 months met the minimum dietary diversity, while 33% received the minimum meal frequency, and a mere 29% consumed the minimum acceptable diet, as recommended by the WHO. These figures underscore the substantial burden of suboptimal MP-ASI practices in Indonesia.<sup>3,4</sup>

Several factors have been implicated in the persistence of suboptimal MP-ASI in Indonesia. These factors include socio-economic disparities, limited maternal education, inadequate healthcare infrastructure, cultural beliefs and practices, and the aggressive marketing of commercial baby foods. Identifying the specific risk factors operating within a particular context is crucial for designing targeted interventions to improve complementary feeding practices. Lubuk Alung, a district located in West Sumatra province, Indonesia, serves as a microcosm of the broader challenges faced in ensuring optimal child nutrition. The district is characterized by a predominantly rural population, with limited access to healthcare services and a high prevalence of poverty. These contextual factors are likely to influence complementary feeding practices in Lubuk Alung.<sup>5,6</sup> This study aims to analyze the risk factors associated with suboptimal MP-ASI practices among infants aged 6-23 months in Lubuk Alung. By identifying these risk factors, we can inform the development of tailored interventions that address the specific needs and challenges faced by mothers and caregivers in this community. The findings of this study will contribute

to the growing body of evidence on complementary feeding in Indonesia and provide valuable insights for policymakers, healthcare providers, and community stakeholders working to improve child nutrition outcomes in Lubuk Alung and beyond.

## 2. Methods

This research employed a cross-sectional observational study design to investigate the prevalence of suboptimal complementary feeding practices (MP-ASI) and associated risk factors among infants aged 6-23 months in Lubuk Alung, West Sumatra, Indonesia. Cross-sectional studies provide a snapshot of the health status and behaviors of a population at a specific point in time, making them suitable for assessing prevalence and identifying potential risk factors. The study was conducted in Lubuk Alung, a district in the Padang Pariaman Regency of West Sumatra province. The district is predominantly rural, with a diverse population engaged primarily in agriculture and small-scale businesses. Lubuk Alung was chosen due to its representative demographics of the wider West Sumatra region and the presence of established primary healthcare centers (PHCs). These PHCs served as recruitment sites for the study, providing access to a diverse sample of mother-infant pairs. The target population comprised mothers of infants aged 6-23 months who were residents of Lubuk Alung and attending the selected PHCs for routine child health services. This age range was chosen because it represents a critical period for the introduction and establishment of complementary feeding practices.

A systematic random sampling technique was employed to recruit participants. A sampling frame was created using the registration records of infants attending the PHCs. The required sample size was calculated based on an estimated prevalence of suboptimal MP-ASI of 50% (based on previous studies in Indonesia), a 95% confidence level, and a 5% margin of error. This calculation yielded a minimum sample



size of 286. To account for potential non-response, a sample size of 300 mother-infant pairs was determined. The sampling interval was determined by dividing the total number of infants in the sampling frame by the desired sample size. Every *n*th infant from the list was then selected, with the starting point chosen randomly. Inclusion Criteria: Mothers of infants aged 6-23 months residing in Lubuk Alung district; Willing to participate and provide informed consent; Infant had initiated complementary feeding. Exclusion Criteria: Mothers who were unable to communicate in the local language (Bahasa Indonesia or Minangkabau) and Infants with severe illness or medical conditions requiring specialized dietary management.

Data collection was conducted from January to March 2023 using a structured questionnaire administered through face-to-face interviews. The questionnaire was developed based on the WHO Infant and Young Child Feeding indicators and adapted to the local context. It included questions on: Socio-demographic information: Maternal age, education, occupation, household income, and other relevant factors; Infant feeding practices: Initiation of complementary feeding, types of foods offered, meal frequency, feeding methods, and breastfeeding practices; Maternal knowledge: Knowledge about recommended complementary feeding practices, including dietary diversity, meal frequency, and food preparation hygiene; Healthcare utilization: Frequency of antenatal care visits, child health clinic attendance, and source of nutrition information. The questionnaire was pre-tested among a small group of mothers to ensure clarity and cultural appropriateness. Interviews were conducted in a private setting at the PHCs by trained research assistants fluent in both Bahasa Indonesia and Minangkabau. The interviewers explained the study's purpose, obtained informed consent, and ensured the confidentiality of the data collected. Suboptimal MP-ASI: Defined using the WHO Infant and Young Child Feeding indicators: Minimum

Dietary Diversity (MDD): Infant received foods from four or more food groups in the past 24 hours; Minimum Meal Frequency (MMF): Infant received the appropriate number of meals based on age (2-3 meals for 6-8 months, 3-4 meals for 9-23 months); Minimum Acceptable Diet (MAD): Infant met both MDD and MMF criteria.

Data were entered into a secure database and analyzed using SPSS software (version 26). Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize socio-demographic and feeding practice characteristics. Bivariate analysis (chi-square test) was used to examine associations between potential risk factors and suboptimal MP-ASI. Logistic regression analysis was employed to identify independent risk factors for suboptimal MP-ASI, adjusting for potential confounders. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to assess the strength of associations. The significance level was set at  $p < 0.05$ . This study was approved by the Institutional Review Board of Universitas Sumatera Barat Indonesia. Informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity were maintained throughout the study.

### 3. Results and Discussion

Table 1 provides a comprehensive overview of the socio-demographic characteristics of the 300 mother-infant pairs participating in the study. The mean maternal age was 28.5 years, with a standard deviation of 5.2 years, indicating a relatively young maternal population. The majority of mothers (70%) were between 20 and 35 years old, a typical age range for childbearing in Indonesia. A substantial proportion of mothers (38%) had not completed secondary school, suggesting that a significant portion of the study population may have limited formal education. This finding raises concerns about potential knowledge gaps related to nutrition and child health, which could



influence complementary feeding practices. The majority of mothers (74%) were housewives, highlighting the importance of tailoring interventions to reach women who may not be employed outside the home and may have limited access to formal sources of nutrition information. More than half of the households (58%) reported a monthly income below the regional average, indicating a considerable proportion of families facing financial constraints. This economic vulnerability could impact access to nutritious foods and influence complementary feeding choices. These socio-demographic characteristics provide an important context for interpreting the study's findings. The relatively young age of the mothers suggests a need for targeted education and support on complementary feeding practices, as this may be their first experience with infant nutrition. The significant proportion of mothers with lower education

levels underscores the importance of developing culturally sensitive and accessible educational materials.

Furthermore, the high prevalence of housewives and families with lower incomes suggests that interventions should be designed to reach women within their homes and communities and address the potential financial barriers to accessing nutritious foods. Overall, Table 1 highlights the importance of considering the diverse socio-demographic backgrounds of the study population when designing and implementing interventions to improve complementary feeding practices. By tailoring strategies to the specific needs and challenges faced by mothers in Lubuk Alung, we can maximize the impact of interventions and promote optimal child nutrition outcomes.

Table 1. Characteristics of respondents.

Characteristic	Frequency (n)	Percentage (%)
<b>Maternal age</b>		
Mean ± SD	28.5 ± 5.2	
<20 years	45	15
20-35 years	210	70
>35 years	45	15
<b>Education</b>		
< Secondary school	114	38
Secondary school or higher	186	62
<b>Occupation</b>		
Housewife	222	74
Employed	78	26
<b>Monthly household income</b>		
Below regional average	174	58
Above regional average	126	42

Table 2 reveals a concerning high prevalence of suboptimal MP-ASI practices in Lubuk Alung. Nearly half of the infants (48%) in the study did not meet the World Health Organization's (WHO) recommendations for complementary feeding, highlighting a significant

public health challenge in this population. This high prevalence indicates that a substantial proportion of infants are not receiving the diverse and adequate nutrition needed for optimal growth and development. A third of infants (32%) did not meet the MDD



criterion, meaning they did not consume foods from at least four of the seven food groups recommended by the WHO. This lack of dietary diversity can lead to nutrient deficiencies, compromising immune function, growth, and cognitive development. A quarter of infants (25%) did not receive the recommended number of meals per day based on their age. Inadequate meal frequency can result in insufficient

energy and nutrient intake, potentially contributing to undernutrition. Almost one in five infants (19%) failed to meet the MAD criterion, signifying a substantial gap in meeting the basic standards for complementary feeding. This finding indicates a need for interventions to address both dietary diversity and meal frequency to ensure that infants receive adequate nutrition.

Table 2. Prevalence of suboptimal MP-ASI among infants aged 6-23 months in Lubuk Alung.

Indicator	Frequency (n)	Percentage (%)
Suboptimal MP-ASI (Overall)	144	48
<b>Individual indicators</b>		
Minimum dietary diversity (MDD)	96	32
Minimum meal frequency (MMF)	75	25
Minimum acceptable diet (MAD)	57	19

Table 3 presents the results of the logistic regression analysis, which was conducted to identify independent risk factors for suboptimal MP-ASI in Lubuk Alung. Mothers with lower education levels were 2.6 times more likely to have infants with suboptimal MP-ASI compared to those with higher education. This association was statistically significant ( $p=0.002$ ), suggesting that lower maternal education is a strong independent risk factor. Infants from households with lower income were 2.1 times more likely to have suboptimal MP-ASI compared to

those from higher-income households. This association was also statistically significant ( $p=0.008$ ). Mothers who did not attend antenatal care visits were 1.9 times more likely to have infants with suboptimal MP-ASI. This association was statistically significant ( $p=0.02$ ). Mothers with inadequate knowledge about MP-ASI were 3.2 times more likely to have infants with suboptimal MP-ASI. This was the strongest association observed in the study and was highly statistically significant ( $p<0.001$ ).

Table 3. Logistic regression analysis for suboptimal MP-ASI.

Risk factor	Adjusted odds ratio (AOR)	95% confidence interval	p-value
Lower maternal education	2.6	1.4 - 4.9	0.002
Low household income	2.1	1.2 - 3.8	0.008
Lack of antenatal care visits	1.9	1.1 - 3.4	0.02
Inadequate maternal knowledge	3.2	1.7 - 6.0	<0.001

The persistent association between socioeconomic status (SES) and complementary feeding practices (MP-ASI) is a well-documented phenomenon in global nutrition research. Our study in Lubuk Alung, West Sumatra, further reinforces this association,

demonstrating that lower maternal education and low household income are significant risk factors for suboptimal MP-ASI. This finding aligns with the broader framework of social determinants of health, which posits that socioeconomic conditions



profoundly shape health outcomes through complex and interconnected pathways. Maternal education, a key component of SES, plays a pivotal role in shaping complementary feeding practices. Lower levels of maternal education are often intertwined with limited health literacy, which refers to the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions. In the context of MP-ASI, limited health literacy can hinder a mother's ability to access, comprehend, and apply nutrition information effectively. This knowledge deficit can manifest in several ways. First, it may lead to misconceptions about appropriate complementary feeding practices. For example, mothers with lower education may be less aware of the importance of dietary diversity, meal frequency, and the appropriate timing of introducing specific foods. They may also have inaccurate beliefs about the nutritional value of certain foods, leading to inappropriate choices for their infants.<sup>7,8</sup>

Limited health literacy may increase reliance on traditional feeding methods that may not align with current scientific recommendations. In many cultures, traditional practices are deeply ingrained and passed down through generations. While some traditional foods may be nutritious, others may lack essential nutrients or be prepared in ways that compromise their nutritional value. Mothers with lower education may be less likely to question or modify these traditional practices, even when presented with conflicting information. Lower maternal education may be associated with a preference for commercially processed foods, which are often marketed as convenient and suitable for infants but may lack nutritional value. These products may contain high levels of sugar, salt, or unhealthy fats, which can contribute to obesity and other chronic diseases in later life. Mothers with limited health literacy may be more susceptible to persuasive marketing tactics and may not fully understand the potential health risks associated with these products.<sup>9,10</sup>

The socioeconomic gradient in MP-ASI is also evident in the association between low household income and suboptimal feeding practices. Economic constraints can create formidable barriers to accessing diverse and nutrient-rich foods, particularly in rural settings like Lubuk Alung, where markets may be limited, food prices may fluctuate, and transportation costs may be high. Families facing financial hardship may prioritize staple foods that are affordable and readily available but may lack essential vitamins, minerals, and other nutrients. This can lead to monotonous diets that lack diversity and fail to meet the infant's nutritional needs. For example, a family with limited resources may rely heavily on rice or other starchy staples, while neglecting fruits, vegetables, and animal-source foods that are essential for optimal growth and development. Economic stress can also exert indirect effects on MP-ASI through its impact on maternal mental health. Studies have shown that financial hardship is associated with increased levels of maternal stress, anxiety, and depression. These psychological stressors can, in turn, affect maternal caregiving practices, including feeding behaviors. For example, a stressed mother may be less attentive to her infant's hunger and satiety cues, less likely to engage in responsive feeding practices, and more likely to resort to convenient but unhealthy feeding options.<sup>11,12</sup>

It is important to note that maternal education and household income are often intertwined, creating a cumulative effect on MP-ASI practices. Mothers with lower education may be more likely to come from lower-income households, and vice versa. This interconnectedness highlights the need for interventions that address both educational and economic barriers to optimal complementary feeding. Understanding the socioeconomic gradient in MP-ASI practices is crucial for developing effective interventions to improve infant nutrition. While individual-level interventions focused on nutrition education and counseling are essential, they may not



be sufficient to overcome the structural barriers created by socioeconomic disparities. Interventions should adopt a multi-sectoral approach that addresses both the proximate determinants of MP-ASI (e.g., knowledge, attitudes, behaviors) and the underlying social determinants of health (e.g., poverty, education, gender inequality). This may involve strengthening social safety nets to improve food security, investing in early childhood education programs to enhance maternal knowledge and skills, and advocating for policies that promote equitable access to healthcare and nutritious foods for all families.<sup>13,14</sup>

The association between lack of antenatal care (ANC) visits and suboptimal MP-ASI practices, as revealed in our study, underscores the pivotal role that ANC plays in laying the foundation for optimal infant feeding. ANC provides a unique window of opportunity for healthcare providers to engage with expectant mothers, establish rapport, and deliver comprehensive nutrition education and counseling. By capitalizing on this opportune moment, healthcare providers can equip mothers with the knowledge, skills, and confidence needed to navigate the complexities of complementary feeding. When mothers miss out on ANC visits, they lose access to a structured and supportive environment for learning about infant nutrition. This absence of guidance can have far-reaching consequences for complementary feeding practices. Mothers may lack information about the appropriate timing for introducing complementary foods, the types of foods to offer, and the recommended feeding frequencies. They may also be unaware of the importance of dietary diversity, hygiene practices, and responsive feeding cues. This lack of knowledge can lead to a cascade of suboptimal practices, such as delayed introduction of complementary foods, reliance on inappropriate or unsafe foods, and inadequate feeding frequency. These practices, in turn, can contribute to nutrient deficiencies, growth faltering, and increased susceptibility to infections, compromising the child's health and development.<sup>15,16</sup>

The theory of planned behavior (TPB) provides a valuable framework for understanding the potential mechanisms through which ANC can influence MP-ASI practices. TPB posits that behavior is shaped by three key factors: Attitudes: An individual's favorable or unfavorable evaluation of the behavior; Subjective Norms: The perceived social pressure to perform or not perform the behavior; Perceived Behavioral Control: The individual's perceived ease or difficulty of performing the behavior, influenced by their perceived resources and barriers. ANC can positively influence all three components of TPB, thereby increasing the likelihood of optimal MP-ASI practices. ANC can enhance mothers' attitudes toward healthy feeding practices by providing accurate information about the benefits of MP-ASI, dispelling misconceptions, and addressing concerns. Positive experiences during ANC visits can foster trust in healthcare providers, making mothers more receptive to their advice and guidance. ANC can reinforce social norms that support optimal MP-ASI by emphasizing its importance for child health and development. Group education sessions and peer support groups during ANC can create a sense of community and shared responsibility for healthy feeding practices. ANC can equip mothers with the skills and knowledge to confidently initiate and sustain MP-ASI. This may involve practical demonstrations of food preparation, guidance on choosing appropriate foods, and strategies for overcoming common challenges, such as picky eating or food refusal. While TPB provides a useful lens for understanding the impact of ANC on MP-ASI, other theoretical perspectives offer additional insights. Social cognitive theory (SCT) emphasizes the role of observational learning and self-efficacy in shaping behavior. ANC can provide opportunities for mothers to observe and learn from healthcare providers and other mothers, thereby enhancing their confidence in their ability to provide optimal complementary feeding. The health belief model (HBM) highlights the importance of perceived susceptibility and perceived



benefits in motivating health behavior change. ANC can raise awareness of the risks associated with suboptimal MP-ASI, such as undernutrition and impaired development while emphasizing the benefits of optimal practices for child health and well-being.<sup>16,17</sup>

Our study identified inadequate maternal knowledge as the most potent risk factor for suboptimal complementary feeding practices (MP-ASI). This finding aligns with a wealth of evidence from global research, underscoring the critical role of maternal knowledge in shaping infant feeding behaviors. The health belief model (HBM) provides a valuable theoretical framework for understanding how maternal knowledge influences MP-ASI practices. The HBM posits that health behaviors are influenced by individuals' perceptions of health threats and their beliefs about the effectiveness of actions to mitigate those threats. Applied to the context of MP-ASI, the HBM suggests that a mother's knowledge, beliefs, and perceptions about complementary feeding can significantly influence her feeding practices. Mothers with limited knowledge about MP-ASI may not fully grasp the potential risks associated with suboptimal practices, such as malnutrition, stunting, and impaired cognitive development. They may underestimate the vulnerability of their infants to these adverse outcomes, thus diminishing the perceived need to adopt optimal feeding practices. Even if mothers recognize the potential risks, they may not perceive them as severe enough to warrant changes in their feeding behaviors. This may be due to a lack of understanding of the long-term consequences of undernutrition or a belief that suboptimal feeding practices are common and not necessarily harmful. Mothers with inadequate knowledge may not fully appreciate the benefits of optimal MP-ASI, such as promoting growth, development, and immune function. They may not be aware of the specific nutrients required for infant health or the optimal timing and frequency of feeding. Limited knowledge

can also create perceived barriers to adopting optimal MP-ASI practices. Mothers may feel overwhelmed by the complexity of nutritional information, lack confidence in their ability to prepare nutritious foods or face social pressure to adhere to traditional feeding methods that may not align with current recommendations. Cues to action are external events or stimuli that trigger health behaviors. In the context of MP-ASI, these cues could include information from healthcare providers, educational campaigns, or social interactions with other mothers. However, mothers with limited knowledge may be less likely to recognize or respond to these cues, as they may not understand the significance of the information or advice provided. Self-efficacy, the belief in one's ability to perform a specific behavior, is another key component of the HBM. Mothers with inadequate knowledge about MP-ASI may lack confidence in their ability to select and prepare appropriate foods for their infants, leading to reliance on readily available but less nutritious options. The impact of inadequate maternal knowledge on MP-ASI practices is multifaceted. Mothers may delay the introduction of complementary foods beyond the recommended age of six months, depriving infants of essential nutrients during a critical period of growth and development. Mothers may offer a limited variety of foods, resulting in monotonous diets that lack essential vitamins, minerals, and other nutrients. Mothers may not provide enough meals or snacks throughout the day to meet the infant's energy and nutrient needs. Mothers may offer foods that are unsafe, unhealthy, or culturally inappropriate for infants, such as sweetened beverages, salty snacks, or highly processed foods. Mothers may lack the knowledge or resources to prepare foods safely, increasing the risk of foodborne illnesses in infants.<sup>16,18</sup>

In addition to gaps in knowledge, mothers may also be exposed to misinformation or conflicting advice about MP-ASI, particularly from family members or community elders. Traditional feeding practices, while





culturally significant, may not always align with current scientific recommendations. This can create confusion and ambivalence among mothers, making it difficult for them to discern the most appropriate feeding practices for their infants. The strong association between inadequate maternal knowledge and suboptimal MP-ASI practices underscores the importance of investing in comprehensive nutrition education programs. These programs should not only focus on imparting accurate information but also on addressing the underlying beliefs, perceptions, and barriers that may hinder the adoption of optimal feeding practices. Interventions should be culturally sensitive and tailored to the specific needs and contexts of the target population. They should utilize multiple channels of communication, such as community workshops, home visits, mobile health technologies, and mass media campaigns, to reach a wider audience. Additionally, interventions should empower mothers by building their self-efficacy and confidence in their ability to provide nutritious and safe foods for their infants.<sup>17,19</sup>

To unravel the intricate web of factors influencing complementary feeding practices (MP-ASI), the socio-ecological framework provides a valuable lens. This framework recognizes that health behaviors are not solely determined by individual choices but are shaped by a complex interplay of influences operating at multiple levels. These levels range from individual factors (knowledge, attitudes, beliefs) to interpersonal relationships (family, social networks), community norms and values, institutional policies and programs, and broader societal structures. By examining these interconnected layers, we gain a more comprehensive understanding of the barriers and facilitators to optimal MP-ASI. At the core of the socio-ecological framework are individual-level factors that directly influence a mother's decision-making regarding complementary feeding. Knowledge about appropriate MP-ASI practices, such as the timing of introduction, types of foods to offer, and frequency of feeding, is

fundamental. Mothers who are well-informed about infant nutrition are more likely to make informed choices that support their child's growth and development. However, knowledge alone is not sufficient. Attitudes and beliefs about food and feeding also play a crucial role. Cultural beliefs about the "hot" and "cold" properties of foods, for example, can influence which foods are considered suitable for infants. Similarly, deeply rooted beliefs about the superiority of breast milk may lead to delayed or inadequate introduction of complementary foods. Addressing these attitudes and beliefs through culturally sensitive education and counseling is essential for promoting optimal MP-ASI.<sup>15,18</sup>

Beyond individual factors, the interpersonal level encompasses the influence of family members, friends, and social networks on a mother's feeding choices. In many cultures, grandmothers and other senior female relatives play a significant role in childcare and infant feeding decisions. Their advice and support can be invaluable, but they may also perpetuate traditional practices that are not aligned with current nutritional recommendations. Spouses and partners also influence MP-ASI practices. Their involvement in childcare and feeding decisions can promote positive behaviors, while their lack of support or conflicting views can create challenges for mothers. Engaging fathers and partners in nutrition education and counseling can be an effective strategy to foster a supportive home environment for optimal MP-ASI. At the community level, social norms, cultural values, and social support systems shape feeding behaviors. Community norms dictate what is considered acceptable or desirable in terms of infant feeding practices. For example, in some communities, early introduction of complementary foods may be encouraged, while in others, it may be viewed as unnecessary or even harmful. Cultural values also influence food choices and feeding practices. Traditional foods and recipes passed down through generations, may hold cultural significance and be



preferred over newer, unfamiliar foods. Understanding these cultural values and preferences is crucial for designing interventions that are culturally relevant and acceptable to the community. Social support, in the form of informal networks of friends, neighbors, and community groups, can provide valuable resources and encouragement for mothers. Mothers who receive social support are more likely to initiate and sustain optimal MP-ASI practices, as they have access to information, advice, and emotional support from their peers.<sup>17,18</sup>

Institutional factors, such as the availability and accessibility of healthcare services, nutrition education programs, and social safety nets, play a crucial role in creating an enabling environment for optimal MP-ASI. Healthcare providers, including doctors, nurses, and community health workers, are key sources of information and support for mothers. They can provide counseling on complementary feeding, monitor infant growth and development, and identify and address any feeding challenges. Government policies and programs can also influence MP-ASI practices. For example, policies that support breastfeeding, provide financial incentives for healthy food choices and regulate the marketing of commercial baby foods can all contribute to creating a supportive environment for optimal infant feeding. The outermost layer of the socio-ecological framework encompasses broader societal structures and systems that shape health outcomes. These include factors such as poverty, food insecurity, gender inequality, and political instability. Poverty and food insecurity limit access to nutritious foods and create a cycle of malnutrition that can begin in infancy and persist throughout the life course. Gender inequality can restrict women's access to education, healthcare, and economic resources, undermining their ability to provide optimal care for their children. Political instability and conflict can disrupt healthcare systems and food supply chains, exacerbating food insecurity and malnutrition. Addressing these structural barriers

requires a multi-sectoral approach that involves collaboration between government agencies, non-governmental organizations, and community stakeholders. Interventions may include poverty reduction programs, initiatives to empower women, and efforts to strengthen food systems and improve access to nutritious foods.<sup>18,19</sup>

The risk factors identified in our study—lower maternal education, low household income, lack of antenatal care visits, and inadequate maternal knowledge—do not operate in isolation. Instead, they weave a complex tapestry of influences that converge to shape complementary feeding practices (MP-ASI). Understanding these intricate pathways is crucial for developing effective interventions that target the root causes of suboptimal MP-ASI. Lower maternal education, particularly when it falls below the secondary level, often correlates with limited health literacy. This deficit can significantly hinder a mother's capacity to access, understand, and apply the nutrition information needed to make informed decisions about their child's diet. Mothers with lower education may lack a clear understanding of the specific nutritional needs of infants and young children. They may not be aware of the importance of dietary diversity, the appropriate timing for introducing different food groups, or the optimal frequency of meals. This can lead to the provision of inadequate or inappropriate complementary foods, resulting in suboptimal MP-ASI. Even when information about MP-ASI is available, mothers with lower education may struggle to interpret and apply it due to limited literacy skills. This can be particularly challenging when information is presented in complex or technical language, or when it requires reading and understanding food labels or nutrition guidelines. Mothers with lower education may also face barriers to accessing reliable nutrition information. They may have limited access to healthcare providers, nutrition education programs, or credible online resources. This can leave them reliant on informal sources of



information, such as family members or friends, who may not be knowledgeable about optimal MP-ASI practices.<sup>15,16</sup>

Low household income creates a formidable challenge for families striving to provide their infants with adequate nutrition. Financial constraints can limit access to diverse and nutrient-rich foods, particularly in rural areas where markets may be limited and food prices may be high. This can lead to a reliance on monotonous and energy-dense foods, such as rice or other starchy staples, which lack essential vitamins, minerals, and other nutrients necessary for optimal growth and development. Economic hardship can also force families to make trade-offs between food and other essential needs, such as healthcare, housing, and education. In such situations, parents may prioritize filling their children's stomachs over providing them with a balanced and nutritious diet. This can lead to a vicious cycle of undernutrition, where inadequate food intake in early life impairs growth and development, leading to poor health outcomes and reduced economic productivity in adulthood. The psychological burden of financial stress can further exacerbate the challenges of MP-ASI. Studies have shown that economic hardship is associated with increased levels of maternal stress, anxiety, and depression. These psychological stressors can negatively impact maternal caregiving practices, including feeding behaviors. Stressed mothers may be less responsive to their infants' hunger and satiety cues, less likely to engage in positive feeding interactions, and more likely to resort to convenient but unhealthy feeding options.<sup>16,17</sup>

Antenatal care visits offer a valuable opportunity for healthcare providers to educate expectant mothers about infant feeding practices, including MP-ASI. Mothers who attend regular antenatal care visits are more likely to receive information on the importance of exclusive breastfeeding, the timely introduction of complementary foods, and the principles of a balanced

and nutritious diet. They are also more likely to be screened for risk factors that may affect infant feeding, such as anemia or gestational diabetes, and receive appropriate interventions. Conversely, mothers who miss out on antenatal care visits may lack this crucial information and guidance, leaving them unprepared for the transition to complementary feeding. They may be unaware of the recommended feeding practices or unsure about how to introduce new foods to their infants. This lack of preparation can lead to delayed initiation of complementary feeding, inappropriate food choices, and inadequate feeding frequency, all of which can contribute to suboptimal MP-ASI.<sup>17,19</sup>

Inadequate maternal knowledge about MP-ASI can be a major barrier to optimal feeding practices. Mothers may lack information about when to introduce complementary foods, what types of foods to offer at different ages, and how to prepare foods safely and hygienically. They may also hold misconceptions about the nutritional value of certain foods, leading to the exclusion of important food groups from their infants' diets. Mothers may not be aware of the recommended feeding frequency or portion sizes for their infants. This can lead to underfeeding, where the infant does not receive enough calories or nutrients to meet their needs, or overfeeding, which can contribute to obesity and other health problems. Lack of knowledge about safe food preparation can lead to the contamination of complementary foods with bacteria or other pathogens, increasing the risk of foodborne illnesses. Infants are particularly vulnerable to such illnesses due to their immature immune systems. In many cultures, traditional feeding practices are deeply ingrained and passed down through generations. While some traditional practices may be beneficial, others may be harmful or inadequate for meeting the nutritional needs of infants. Mothers who lack knowledge about modern nutrition recommendations may be more likely to rely on traditional practices, even when these practices are not optimal. Inadequate knowledge can undermine a mother's confidence in



her ability to provide adequate complementary feeding. This lack of confidence, or low self-efficacy, can lead to anxiety and stress, which can further negatively impact feeding practices. Mothers who lack confidence may be less likely to experiment with new foods, less responsive to their infant's cues, and more likely to give in to their child's demands for unhealthy foods. The risk factors identified in our study are interconnected and often reinforce each other. For example, lower maternal education may contribute to inadequate maternal knowledge, which in turn can lead to inappropriate food choices and feeding practices. Low household income can limit access to nutritious foods and exacerbate the effects of inadequate knowledge. Lack of antenatal care visits can deprive mothers of opportunities to acquire knowledge and support for optimal MP-ASI. This interconnectedness highlights the need for a comprehensive and multi-faceted approach to addressing suboptimal MP-ASI. Interventions should not only focus on providing information but also address the underlying socioeconomic and cultural factors that shape feeding practices.<sup>19,20</sup>

#### 4. Conclusion

This study highlights a significant prevalence (48%) of suboptimal complementary feeding practices (MP-ASI) among infants aged 6-23 months in Lubuk Alung, West Sumatra. Several key risk factors were identified, including lower maternal education, low household income, lack of antenatal care visits, and inadequate maternal knowledge about MP-ASI.

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