

Socio-demographic and Maternal Determinants of Knowledge, Attitudes, and Practices Related to Infant and Young Child Nutrition among Mothers of Stunted Children in Penang, Malaysia

Susheela Ismail¹, Nurfarhana Diana^{2*}, Nurul Fadhilah³

¹Department of Early Childhood Education, Faculty of Human Development, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, Malaysia

²Department of Early Childhood Education, Faculty of Human Development, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, Malaysia

³Department of Sport and Health Nutrition, Faculty of Sports Science and Coaching, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, Malaysia

***Corresponding Author**

DOI: <https://doi.org/10.47772/IJRISS.2026.100700491>

Received: 22 July 2026; Accepted: 28 July 2026; Published: 05 August 2026

ABSTRACT

Childhood stunting remains a major public health concern and continues to affect a substantial proportion of children under five years of age in Malaysia. Maternal knowledge, attitudes, and practices (KAP) related to infant and young child nutrition are widely recognised as important factors influencing child growth and nutritional status. However, evidence on the factors associated with maternal KAP among mothers of stunted children remains limited in the Malaysian context. This study aimed to examine the associations between maternal socio-demographic characteristics, obstetric factors, child characteristics, anthropometric measurements, and maternal KAP related to nutrition, growth monitoring, breastfeeding, and child feeding practices.

A cross-sectional correlational study was conducted among 66 mothers of stunted children attending selected Maternal and Child Health Clinics in Penang, Malaysia. Data were collected using a structured questionnaire comprising socio-demographic information and validated KAP instruments. Descriptive statistics and Spearman's rank correlation were used to analyse the data.

Maternal income and education were significantly associated with several KAP domains, particularly breastfeeding and growth monitoring. Higher maternal income was associated with better breastfeeding knowledge ($\rho = 0.703$, $p = .005$), breastfeeding practice ($\rho = 0.500$, $p = .001$), and growth-monitoring knowledge ($\rho = 0.495$, $p = .001$). Higher maternal education was associated with better breastfeeding knowledge ($\rho = 0.492$, $p = .002$) and breastfeeding practice ($\rho = 0.362$, $p = .040$), but with lower child-feeding knowledge ($\rho = -0.348$, $p = .045$). Other significant associations involved maternal age, number of children, which child was stunted, gestational age, maternal height and weight. Overall, the findings varied across the different KAP domains.

The study highlights the importance of considering maternal socioeconomic and family characteristics when planning nutrition education and maternal and child health programmes. Tailoring interventions to the needs of mothers from different backgrounds may enhance the relevance of nutrition education, promote appropriate infant and young child feeding practices, and strengthen ongoing efforts to address childhood stunting in Malaysia.

Keywords: Childhood stunting, Maternal knowledge, attitudes, and practices, Socio-demographic factors, infant and young child nutrition

INTRODUCTION

Study objective

To determine the associations between maternal socio-demographic characteristics, child characteristics, obstetric factors, anthropometric measurements, and maternal knowledge, attitudes, and practices regarding nutrition, growth monitoring, breastfeeding, and child feeding among mothers of stunted children.

Childhood Stunting: Global and Malaysian Perspectives

Childhood stunting remains a major public health problem worldwide. According to the World Health Organization (WHO), UNICEF, and the World Bank, millions of children under five years of age are affected by stunting due to chronic undernutrition during the first 1,000 days of life (UNICEF, WHO, & World Bank, 2023). Stunting not only affects physical growth but also impairs cognitive development, educational performance, and future productivity, while increasing the risk of chronic diseases in adulthood (Galasso & Wagstaff, 2018).

In Malaysia, childhood stunting continues to be a significant nutrition concern despite improvements in healthcare and economic development. The National Health and Morbidity Survey (NHMS) 2019 reported that 21.8% of children under five years of age were stunted (Institute for Public Health, 2020). More recent findings from NHMS 2022 showed that the prevalence remained high at 21.2% (Institute for Public Health, 2023), indicating that childhood stunting continues to affect approximately one in five Malaysian children. This prevalence also remains considerably higher than the national target of reducing childhood stunting to 11% by 2025 (NCCFN, 2016).

The burden of childhood stunting also varies across Malaysia. Regional differences have been reported, with several East Coast states recording relatively high prevalence, including Kelantan (28.8%), Pahang (26.2%), and Terengganu (23.4%) (Haron et al., 2023). In Penang, where the present study was conducted, the prevalence of stunting among children under five declined from 20.3% in 2016 (Institute for Public Health, 2016) to 16.0% in 2022 (Department of Statistics Malaysia, 2022). Although this reduction reflects progress, approximately one in six children in Penang remained affected.

Penang's performance on Sustainable Development Goal 2 further reflects the continuing nutritional challenges in the state. With an overall SDG 2 score of 57.5, Penang ranked sixth in Malaysia and was classified as facing major challenges in achieving Zero Hunger, with progress reported as stagnating in recent years (Penang Institute, 2024). These findings provide an important context for examining the maternal and child factors associated with nutrition-related knowledge, attitudes, and practices among mothers of stunted children in Penang.

Maternal Knowledge, Attitudes, and Practices (KAP)

Maternal knowledge, attitudes, and practices are widely recognised as important factors influencing infant and young child nutrition. Mothers are primarily responsible for breastfeeding, complementary feeding, growth monitoring, and healthcare-seeking behaviours, all of which play a vital role in supporting healthy child growth (World Health Organization [WHO] & United Nations Children's Fund [UNICEF], 2018). Studies have consistently shown that mothers with better nutrition knowledge are more likely to practise appropriate infant feeding behaviours and utilise preventive child health services (Mitra, 2023; Turyashemererwa et al., 2009).

Maternal KAP, however, is influenced by more than knowledge alone. Previous research has demonstrated that maternal education, household income, employment status, family support, and access to health information can affect mothers' attitudes and feeding practices (Lee et al., 2022; Mugyia et al., 2016). Obstetric factors, including parity and previous maternal experience, may also influence caregiving confidence and child-feeding decisions. Consequently, mothers with adequate knowledge may still encounter difficulties in adopting recommended practices because of socioeconomic or environmental constraints.

Although the importance of maternal KAP has been widely recognised, limited studies in Malaysia have specifically examined how maternal socio-demographic characteristics, obstetric factors, and child characteristics are associated with KAP among mothers of children who are already stunted. Understanding these relationships

is essential for developing targeted nutrition education and intervention programmes to improve child nutritional outcomes.

Socio-demographic Determinants of Maternal KAP

Recent studies have consistently identified maternal education and household income as important factors associated with maternal nutrition knowledge and child-feeding practices (Lee et al., 2022; Kamaruzaman et al., 2024). Mothers with higher educational attainment and better socioeconomic status are generally more likely to have access to nutrition information, understand recommended feeding guidelines, and adopt appropriate childcare practices. However, the associations of other factors, including maternal age, employment status, parity, obstetric history, child characteristics, and anthropometric status, with maternal KAP remain less conclusive. While some studies have reported significant associations between these characteristics and maternal KAP, others have shown that these relationships may vary according to broader socioeconomic and environmental conditions.

Overall, the existing evidence suggests that maternal KAP is associated with a combination of demographic, socioeconomic, obstetric, and child-related factors rather than a single factor. Nevertheless, limited research has examined these relationships among mothers of children who are already stunted in the Malaysian setting. A better understanding of these factors may help identify mothers who require additional support and inform more targeted nutrition education and maternal and child health interventions.

Research Gap

Although stunting among children under five years of age has been studied in Malaysia, most studies have examined its prevalence, risk factors or nutritional interventions. Less is known about the state of mothers in terms of knowledge, attitudes and daily practices once a child is identified as stunted. This group requires special attention, as many mothers are managing existing nutritional problems while also responding to household, care and healthcare demands. Therefore, examining mothers of stunted children provides clinically relevant evidence on where nutritional counselling and follow-up may need to be strengthened. The current study considered sociodemographic, obstetric, child-related and anthropometric characteristics across the KAP domains: nutrition, growth monitoring, breastfeeding and child feeding.

Conceptual Framework

The variables in this study were selected based on previous studies on maternal nutrition, infant and young child feeding, and childhood stunting, and were guided by Social Cognitive Theory (SCT). Previous studies have identified maternal education, household income, family composition, obstetric history, child characteristics, and maternal anthropometric measures as factors associated with maternal nutrition and child-feeding practices. These factors were therefore included in this study.

Social Cognitive Theory explains how personal experiences and the environment may be related to health practices (Bandura, 1986). In this study, maternal knowledge, attitudes, and practices were examined across four areas: nutrition, growth monitoring, breastfeeding, and child feeding, together with relevant maternal, family, obstetric, and child-related factors.

The study focused on mothers of stunted children because they were caring for children with an identified growth problem. Understanding the factors associated with their knowledge, attitudes, and practices may help identify their nutrition and caregiving needs and guide appropriate nutrition education, counselling, and follow-up.

Link to the Present Study

Few studies in Malaysia have examined how maternal socio-demographic, obstetric, child-related, and anthropometric characteristics are associated with different KAP domains among mothers of stunted children. Therefore, this study examined the associations between these characteristics and maternal knowledge, attitudes, and practices related to nutrition, growth monitoring, breastfeeding, and child feeding among mothers of stunted children in Penang, Malaysia. These findings may help the healthcare professionals identify mothers who need more targeted nutrition education and follow-up.

RESEARCH METHODOLOGY

Study Design

This study employed a quantitative cross-sectional design using baseline data collected before implementation of the Interactive Multimedia-Based Nutrition Education Module (IMNEM). The baseline results relevant to the associations between maternal characteristics and knowledge, attitudes, and practices were included in the present study.

Study Setting and Participants

The study was carried out at selected Maternal and Child Health Clinics in Seberang Perai, Penang, Malaysia. Participants were mothers of stunted children under the age of five who attended the selected clinics during the study period. Mothers who met the eligibility criteria and agreed to participate were enrolled after providing their written informed consent. As recruitment was conducted at health clinics, mothers who did not attend the selected clinics during the data collection period were not represented in the study.

Sampling and Data Collection

The sample size was estimated using G*Power (Version 3.1.9.7), based on an effect size of 0.53 reported in an earlier study, a significance level (α) of 0.05, and a statistical power of 80%. The required sample size was 66 mothers. All 66 eligible mothers agreed to participate and completed the study, resulting in a 100% response rate with no dropouts. Data were collected using a structured self-administered questionnaire covering maternal socio-demographic characteristics, child characteristics, obstetric and illness history, anthropometric measurements, and four KAP domains: nutrition, growth monitoring, breastfeeding, and child feeding. The instruments underwent content and face validation and were pilot-tested before the main study. Anthropometric information was obtained from the Child Health Record Book.

Ethical Considerations

Ethical approval was obtained from the relevant institutional ethics committee and the Ministry of Health Malaysia prior to data collection. Written informed consent was obtained from all participants. Confidentiality, anonymity, and voluntary participation were maintained throughout the study.

Statistical Analysis

The data were analysed using IBM SPSS Statistics version 27. The participant's characteristics and KAP scores were summarised using frequencies, percentages, means, and standard deviations. Spearman's rank correlation coefficient (ρ) was used to analyse the relationship between maternal socio-demographic characteristics, child characteristics, obstetric factors, anthropometric measurements, and maternal knowledge, attitudes, and practices regarding nutrition, growth monitoring, breastfeeding, and child feeding. Statistical significance was determined at $p < 0.05$. The strength and direction of the associations were determined using the correlation coefficients.

RESULTS

Association Between Demographic Factors and Maternal Nutrition Knowledge, Attitudes, and Practices

Table 1 presents the Spearman correlation between demographic factors and maternal knowledge, attitudes, and practices related to nutrition. For knowledge, no significant correlations were observed with any of the demographic variables ($p > 0.05$). For attitude, significant negative correlations were found with mother's age ($\rho = -0.440$, $p < 0.05$), which child was stunted ($\rho = -0.450$, $p < 0.01$), and mother's weight ($\rho = -0.438$, $p < 0.05$). This indicates that higher maternal age and weight were associated with less favourable attitudes towards nutrition. The relationship involving which child was stunted also showed a significant negative correlation with nutrition attitude. No significant correlations were observed between the other demographic variables and maternal nutrition attitudes. For practice, no significant correlations were found with any of the demographic variables ($p > 0.05$).

Table 1. Correlation Between Demographic Factors and Maternal Nutrition Knowledge, Attitudes, and Practices

Variables	Spearman correlation coefficient, ρ (p-value)		
	Knowledge	Attitude	Practice
Mother's age	0.34 (0.542)	-.440* (0.045)	-0.23 (0.111)
Mother's education	0.16 (0.742)	0.11 (0.224)	0.01 (0.231)
Mother's/Household income	0.15 (0.551)	0.12 (0.320)	-0.10 (0.631)
Family members	0.26 (0.652)	-0.13 (0.741)	-0.06 (0.320)
Number of children	0.13 (0.663)	-0.30 (0.631)	-0.15 (0.742)
Child's age	0.00 (0.951)	-0.32 (0.104)	-0.18 (0.660)
Which child stunted	0.31 (0.896)	-.450** (0.002)	-0.13 (0.320)
Child's birth weight	-0.12 (0.700)	0.13 (0.104)	-0.17 (0.743)
Weeks pregnant	-0.04 (0.231)	0.07 (0.364)	0.17 (0.554)
Head circumference	0.00 (0.621)	-0.02 (0.431)	-0.10 (0.330)
Child's weight	-0.12 (0.064)	-0.08 (0.640)	0.17 (0.130)
Child's height	0.05 (0.100)	-0.08 (0.641)	0.00 (0.271)
Mother's weight	0.14 (0.321)	-.438* (0.030)	-0.29 (0.072)
Mother's height	0.16 (0.671)	0.16 (0.261)	0.10 (0.103)

** significant at the 0.01 level, * significant at the 0.05 level

Association Between Demographic Factors and Maternal Growth Monitoring Knowledge, Attitudes, and Practices

Table 2 presents the Spearman correlation results between demographic factors and maternal knowledge, attitudes, and practices related to growth monitoring. Maternal growth-monitoring knowledge was positively correlated with mother's salary ($\rho = 0.495$, $p < 0.01$) and mother's height ($\rho = 0.359$, $p < 0.05$). This suggests that mothers with higher salaries and greater height tended to have better knowledge of growth monitoring. No significant correlations were found with the other demographic factors.

No significant correlations were observed between demographic factors and maternal attitudes towards growth monitoring ($p > 0.05$). For practice, negative correlations were found with the number of children ($\rho = -0.361$, $p < 0.05$) and which child was stunted ($\rho = -0.378$, $p < 0.05$). Mother's salary was positively correlated with growth-monitoring practice ($\rho = 0.388$, $p < 0.05$). Mothers with more children tended to report lower growth-monitoring practices, while those with higher salaries tended to report better practices.

Table 2. Correlation Between Demographic Factors and Maternal Growth Monitoring Knowledge, Attitudes, and Practices

Variables	Spearman correlation coefficient, ρ (p-value)		
	Knowledge	Attitude	Practice
Mother's age	-0.01 (0.102)	-0.26 (0.311)	-0.13 (0.080)
Mother's education	0.06 (0.201)	0.20 (0.640)	0.29 (0.320)
Mother's salary	.495** (0.001)	-0.01 (0.420)	.388* (0.043)
Family members	0.16 (0.311)	0.16 (0.654)	-0.19 (0.421)
Number of children	-0.02 (0.140)	0.03 (0.120)	-.361* (0.022)
Child's age	-0.15 (0.060)	0.24 (0.114)	-0.28 (0.164)
Which child stunted	0.01 (0.071)	0.00 (0.974)	-.378* (0.015)
Child's birth weight	-0.07 (0.210)	0.33 (0.102)	0.20 (0.080)
Weeks pregnant	0.04 (0.330)	0.04 (0.090)	-0.27 (0.310)

Head circumference	-0.07 (0.965)	0.26 (0.074)	0.05 (0.164)
Child's weight	-0.22 (0.741)	0.07 (0.553)	-0.34 (0.091)
Child's height	-0.02 (0.520)	0.18 (0.420)	-0.12 (0.563)
Mother's weight	-0.03 (0.201)	-0.31 (0.450)	-0.22 (0.631)
Mother's height	0.359* (0.031)	-0.18 (0.332)	0.13 (0.871)

** significant at the 0.01 level, * significant at the 0.05 level

Association Between Demographic Factors and Maternal Breastfeeding Knowledge, Attitudes, and Practices

Table 3 presents the Spearman correlation results between demographic factors and maternal knowledge, attitudes, and practices related to breastfeeding. Breastfeeding knowledge was positively correlated with mother's education ($\rho = 0.492$, $p < 0.01$) and mother's salary ($\rho = 0.703$, $p < 0.01$), suggesting that mothers with higher education and income tended to have better breastfeeding knowledge. No significant correlations were found with the other demographic factors.

For attitude, a positive correlation was found with mother's salary ($\rho = 0.361$, $p < 0.05$), indicating that mothers with higher income tended to have more favourable attitudes towards breastfeeding. No significant correlations were observed with the other demographic factors. For practice, a significant negative correlation was found with gestational age at delivery ($\rho = -0.480$, $p < 0.01$). Child's weight was negatively correlated with breastfeeding practice ($\rho = -0.401$, $p = 0.050$). In contrast, mother's salary ($\rho = 0.500$, $p < 0.01$) and education ($\rho = 0.362$, $p < 0.05$) were positively correlated with breastfeeding practice.

Table 3. Correlation Between Demographic Factors and Maternal Breastfeeding Knowledge, Attitudes, and Practices

Variables	Spearman correlation coefficient, ρ (p-value)		
	Knowledge	Attitude	Practice
Mother's age	0.02 (0.311)	-0.14 (0.331)	-0.02 (0.130)
Mother's education	.492** (0.002)	0.33 (0.460)	.362* (0.040)
Mother's salary	.703** (0.005)	.361* (0.027)	.500** (0.001)
Family members	0.09 (0.103)	0.30 (0.310)	0.04 (0.220)
Number of children	0.08 (0.112)	0.18 (0.221)	-0.12 (0.130)
Child's age	0.05 (0.640)	0.12 (0.140)	-0.12 (0.150)
Which child stunted	-0.01 (0.553)	0.08 (0.060)	-0.15 (0.370)
Child's birth weight	0.01 (0.231)	0.12 (0.170)	0.12 (0.310)
Weeks pregnant	-0.22 (0.631)	-0.31 (0.080)	-.480** (0.001)
Head circumference	-0.11 (0.321)	0.09 (0.310)	-0.02 (0.063)
Child's weight	-0.08 (0.794)	-0.11 (0.550)	-.401* (0.050)
Child's height	0.12 (0.631)	0.04 (0.073)	-0.16 (0.310)
Mother's weight	0.03 (0.241)	-0.03 (0.089)	0.10 (0.420)
Mother's height	0.07 (0.741)	0.11 (0.140)	0.23 (0.271)

** significant at the 0.01 level, * significant at the 0.05 level

Association Between Demographic Factors and Maternal Child Feeding Knowledge, Attitudes, and Practices

Table 4 presents the Spearman correlation results between demographic factors and maternal knowledge, attitudes, and practices related to child feeding. Maternal education was negatively correlated with child-feeding knowledge ($\rho = -0.348$, $p < 0.05$), indicating that mothers with higher education tended to have lower child-

feeding knowledge scores. No significant correlations were found between the other demographic factors and child-feeding knowledge ($p > 0.05$). Similarly, no significant correlations were observed between demographic factors and maternal attitudes or practices related to child feeding ($p > 0.05$).

Table 4. Correlation Between Demographic Factors and Maternal Child Feeding Knowledge, Attitudes, and Practices

Variables	Spearman correlation coefficient, ρ (p-value)		
	Knowledge	Attitude	Practice
Mother's age	0.15 (0.120)	-0.29 (0.103)	-0.29 (0.321)
Mother's education	-.348* (0.045)	0.25 (0.113)	0.09 (0.441)
Mother's salary	-0.33 (0.250)	0.00 (0.876)	0.12 (0.560)
Family members	-0.03 (0.640)	0.18 (0.634)	0.14 (0.130)
Number of children	0.00 (0.870)	-0.22 (0.090)	-0.16 (0.430)
Child's age	0.04 (0.643)	-0.26 (0.130)	-0.08 (0.710)
Which child stunted	0.04 (0.521)	-0.30 (0.783)	-0.21 (0.360)
Child's birth weight	-0.24 (0.410)	0.23 (0.643)	0.10 (0.543)
Weeks pregnant	-0.13 (0.120)	0.01 (0.324)	-0.25 (0.621)
Head circumference	-0.20 (0.420)	0.29 (0.230)	-0.13 (0.640)
Child's weight	-0.13 (0.721)	-0.10 (0.476)	-0.06 (0.530)
Child's height	-0.03 (0.530)	-0.16 (0.314)	0.02 (0.410)
Mother's weight	0.06 (0.060)	-0.29 (0.360)	-0.26 (0.073)
Mother's height	0.06 (0.073)	0.27 (0.250)	-0.08 (0.169)

** significant at the 0.01 level, * significant at the 0.05 level

Summary of Findings

Overall, Spearman's rank correlation analysis revealed significant associations between selected demographic factors and maternal KAP domains. Maternal education and income were positively correlated with breastfeeding knowledge and practices, and maternal income was also positively correlated with growth monitoring knowledge and practice. Maternal age, maternal weight, maternal height, number of children, birth order of the stunted child, gestational age at delivery, and child weight all had a significant correlation with selected KAP domains. However, no single demographic factor had a significant relationship with all aspects of maternal knowledge, attitudes, and practices.

DISCUSSION

This study examined the associations between maternal socio-demographic, obstetric, child-related, and anthropometric factors and maternal KAP in mothers of stunted children. A Spearman's rank correlation analysis revealed that maternal education and income were significantly related to several aspects of breastfeeding and growth monitoring. Other maternal and child-related factors were significantly correlated with selected KAP domains and varied in the direction of their relationships.

Maternal Education

Maternal education had a positive association with breastfeeding knowledge and practice. Mothers with a higher level of education may be better able to comprehend and apply the breastfeeding advice given by healthcare professionals. Previous studies have reported similar findings, linking maternal education to improved breastfeeding and child nutrition outcomes (Abu-Saad & Fraser, 2010; Black et al., 2013; Jai et al., 2016; Victora et al., 2021).

However, there was a negative correlation between maternal education and child-feeding knowledge ($\rho = -0.348$, $p = 0.045$). This was an unexpected finding, given that higher education is typically associated with greater access to health and nutrition information. The correlation was relatively weak, with a statistical significance near the 0.05 level. It should therefore be interpreted cautiously. One possible explanation is that formal education may not always reflect the specific knowledge and skills needed to feed young children. Mothers may also obtain child-feeding information from various sources or rely on prior caregiving experience. The finding could also be explained by the small size of the study sample. Since these factors were not investigated, the cause of the negative correlation could not be identified. More studies with larger and more diverse samples are required to confirm this finding.

Household Income

Household income was positively associated with growth monitoring knowledge and practice, as well as breastfeeding knowledge, attitudes, and practices. Mothers from higher-income households may have greater access to healthcare services, transportation, educational materials, and professional health advice, enabling better utilisation of child health services. Previous Malaysian studies have similarly reported socioeconomic status as an important factor associated with child nutrition and preventive healthcare utilisation (How et al., 2020; Wan Muda et al., 2019). Household income also influences food security, dietary diversity, and the ability to provide nutritious foods for young children, all of which contribute to improved child growth and development (Black et al., 2013; de Onis & Branca, 2016). These findings highlight the need to prioritise nutrition support programmes for low-income families to reduce disparities in maternal knowledge and health practices.

Maternal Age and Family Characteristics

Maternal age was negatively correlated with nutrition attitude ($\rho = -0.440$, $p = 0.045$), while the number of children was negatively correlated with growth-monitoring practice ($\rho = -0.361$, $p = 0.022$). These correlations were limited to specific KAP domains, with no obvious trend observed across the other domains. The findings should therefore be interpreted with caution. Differences in personal experience and exposure to nutrition information may help to explain the maternal age relationship. Similarly, mothers with multiple children may face increased caregiving demands, affecting their growth-monitoring practices. However, these explanations are still tentative because the factors underlying the observed correlations were not investigated in this study.

Maternal Anthropometric Characteristics

Maternal weight was negatively correlated with nutrition attitude ($\rho = -0.438$, $p = 0.030$), while maternal height was positively correlated with growth-monitoring knowledge ($\rho = 0.359$, $p = 0.031$). These correlations were limited to specific KAP domains and thus should be interpreted with caution. Previous research has linked maternal anthropometric characteristics, specifically maternal height, to child growth and nutritional outcomes (Addo et al., 2013; Manchala, 2018). However, there is limited evidence to show how maternal weight or height relate to maternal nutrition attitudes and growth-monitoring knowledge. The reasons for the relationships observed in this study are unclear and require further investigation.

Child Characteristics

The birth order of stunted children was negatively correlated with maternal nutrition attitudes ($\rho = -0.450$, $p = 0.002$) and growth-monitoring practices ($\rho = -0.378$, $p = 0.015$). This variable referred to the child's position among siblings, not the severity of stunting. The findings could be attributed to differences in family size, prior caregiving experience, or the responsibilities that come with caring for multiple children. However, these factors were not investigated in the current study, and the reasons for the observed correlations are unclear. As a result, the findings should be interpreted with caution and supported by further research.

Gestational age at delivery was negatively correlated with breastfeeding practice ($\rho = -0.480$, $p = 0.001$). Child weight also showed a negative correlation with breastfeeding practice ($\rho = -0.401$, $p = 0.050$), although this finding did not meet the predefined level of statistical significance. The reasons for these relationships remain unclear and require further investigation.

Overall Implications of The Associations

The Spearman correlation results revealed that maternal KAP was associated with specific socioeconomic, family, obstetric, maternal, and child characteristics. However, the relationships varied across the KAP domains, and no single factor was consistently associated with knowledge, attitudes, or practices. The findings indicate that maternal KAP is associated with mothers' diverse backgrounds and family circumstances. Nonetheless, correlations should be interpreted with caution, especially when the relationships are weak or limited to a single domain.

The findings may help Maternal and Child Health Clinics identify mothers who need more targeted nutrition education and follow-up. Lower-income mothers may benefit from practical breastfeeding, child feeding, and growth monitoring advice, as well as information on nutrition and social support options. Mothers with multiple children may require flexible follow-up arrangements that consider their caregiving responsibilities. Nutrition education should thus combine clear information with practical advice that can be applied within the mother's family and household circumstances.

STRENGTHS AND LIMITATIONS

A strength of this study was the assessment of maternal KAP across four areas of infant and young child nutrition among mothers of stunted children. Several limitations should be taken into account when interpreting the results. Because the study was cross-sectional, it could detect correlations between maternal characteristics and KAP but could not determine the direction of these relationships or establish cause and effect. The study included 66 mothers who visited various Maternal and Child Health Clinics in Seberang Perai, Penang. All participants completed the study, yielding a 100% response rate with no dropouts. Nonetheless, the small sample size and recruitment from specific clinics may limit the findings' applicability to mothers in other settings. Mothers who did not attend these clinics during the study period were excluded, and their backgrounds and experiences may have differed.

The study did not look into several factors that could be related to maternal KAP, such as employment, family support, food security, access to health information, and healthcare. Their potential influence on the reported correlations cannot be ruled out. Several Spearman correlation tests were conducted across the KAP domains. Findings with p-values close to 0.05 should be treated with caution, as some may have occurred by chance. Furthermore, the KAP data were collected using a self-administered questionnaire, which may have been influenced by recall or the desire to provide socially acceptable responses. Studies involving larger and more diverse groups of mothers from various parts of Malaysia could help determine whether similar relationships exist in other settings.

CONCLUSION

A Spearman's rank correlation analysis revealed that maternal education and income were positively correlated with several aspects of breastfeeding and growth monitoring. Other maternal, obstetric, family, and child-related characteristics were associated with specific KAP domains, but no single factor was consistently linked to all domains. The negative relationship between maternal education and child-feeding knowledge was unexpected and warrants further investigation. It should not be interpreted as evidence that higher education leads to poorer child-feeding knowledge.

The findings suggest that nutrition education for mothers should be tailored to their specific needs and family circumstances. Maternal and Child Health Clinics could offer more practical advice on breastfeeding, child feeding, and growth monitoring, especially for mothers from low-income families. Mothers who have multiple children may benefit from flexible counselling and follow-up arrangements that acknowledge their caregiving responsibilities. The small, cross-sectional, clinic-based sample should be taken into account when interpreting these findings. Further research with larger and more diverse groups of mothers is needed to determine whether similar relationships exist in other Malaysian settings.

DECLARATIONS

Acknowledgements

The authors would like to express their sincere appreciation to the National Child Development Research Centre (NCDRC), Universiti Pendidikan Sultan Idris (UPSI), the participating health clinics, and all mothers who voluntarily participated in this study. The authors also acknowledge the healthcare personnel and research assistants who assisted with data collection.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethical Approval

Ethical approval for this study was obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia, and the Human Research Ethics Committee, Universiti Pendidikan Sultan Idris (UPSI), prior to data collection. Written informed consent was obtained from all participants before enrolment in the study. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

Informed Consent

Written informed consent was obtained from all participants prior to their participation in the study.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Corresponding Author

Dr. Nurfarhana Diana

Faculty of Human Development, Universiti Pendidikan Sultan Idris (UPSI), Tanjong Malim, Perak, Malaysia

Email: farhanadiana@fpm.upsi.edu.my

REFERENCES

1. Abu-Saad, K., & Fraser, D. (2010). Maternal nutrition and birth outcomes. *Epidemiologic Reviews*, 32(1), 5–25. <https://doi.org/10.1093/epirev/mxq001>
2. Addo, O. Y., Stein, A. D., Fall, C. H., Gigante, D. P., Guntupalli, A. M., Horta, B. L., Kuzawa, C. W., Lee, N., Norris, S. A., Prabhakaran, P., Richter, L. M., Sachdev, H. S., & Martorell, R. (2013). Maternal height and child growth patterns. *The Journal of Pediatrics*, 163(2), 549–553. <https://doi.org/10.1016/j.jpeds.2013.02.002>
3. Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.
4. Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and

- overweight in low-income and middle-income countries. *The Lancet*, **382**(9890), 427–451. [https://doi.org/10.1016/S0140-6736\(13\)60937-X](https://doi.org/10.1016/S0140-6736(13)60937-X)
5. de Onis, M., & Branca, F. (2016). Childhood stunting: A global perspective. *Maternal & Child Nutrition*, **12**(Suppl. 1), 12–26. <https://doi.org/10.1111/mcn.12231>
6. Department of Statistics Malaysia. (2022). *National Health and Morbidity Survey (NHMS) 2022: Maternal and child health*. Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia.
7. Galasso, E., & Wagstaff, A. (2018). *The aggregate income losses from childhood stunting and the returns to a nutrition intervention aimed at reducing stunting* (Policy Research Working Paper No. 8536). World Bank Group.
8. Haron, M. Z., Rohana, A. J., Hamid, N. A. A., Omar, M. A., & Abdullah, N. H. (2023). Stunting and its associated factors among children below 5 years old on the East Coast of Peninsular Malaysia: Evidence from the National Health and Morbidity Survey. *Malaysian Journal of Medical Sciences*, **30**(5), 155. <https://doi.org/10.21315/mjms2023.30.5.13>
9. How, E. T. C., Shahar, S., Robinson, F., Manah, A. M., Ibrahim, M. Y., Jeffree, M. S., Rahim, S. S. S. A., & Yusuff, A. S. M. (2020). Risk factors for undernutrition in children under five years of age in Tenom, Sabah, Malaysia. *Malaysian Journal of Public Health Medicine*, **20**(1), 71–81.
10. Institute for Public Health. (2016). *National Health and Morbidity Survey 2016: Maternal and child health (Volume 2: Maternal and child health findings)*. Ministry of Health Malaysia.
11. Institute for Public Health. (2020). *National Health and Morbidity Survey (NHMS) 2019: Non-communicable diseases, healthcare demand, and health literacy—Key findings*. Ministry of Health Malaysia.
12. Institute for Public Health. (2023). *National Health and Morbidity Survey (NHMS) 2022: Maternal and child health*. Ministry of Health Malaysia.
13. Jai, A. N., Kassim, A. B. M., Samad, A. A., Baharuddin, A., Rosman, A., Naidu, B. M., Ying, C. Y., Man, C. S., Siew, C. Y., Paiwai, F., Bakar, F. A., Othman, F., Hamid, H. A. A., Gua, H. T., & Zulkifli, Z. A. (2016). *National Health and Morbidity Survey 2016: Maternal and child health (MCH)*. Kementerian Kesihatan Malaysia.
14. Kamaruzaman, N. A., Musa, N., Pasi, H., & Osman, I. F. (2024). Stunting and its association with feeding problem among under-five children: A case-control study in Kuantan District, Malaysia. *Medical Journal of Malaysia*, **79**(4), 514–520.
15. Lee, W. S., Jalaludin, M. Y., Khoh, K. M., Kok, J. L., Nadarajaw, T., Soosai, A. P., ... & Cheang, H. K. (2022). Prevalence of undernutrition and associated factors in young children in Malaysia: A nationwide survey. *Frontiers in Pediatrics*, **10**, 913850. <https://doi.org/10.3389/fped.2022.913850>
16. Manchala, S. (2018). Influence of maternal short stature on the stunting levels of infants and toddlers: A case study of urban slums in Chennai. *Review of Development and Change*, **23**(1), 151–180. <https://doi.org/10.1177/0972266120180107>
17. Mitra, M., Lita, L., Mardeni, M., & Nurlisis, N. (2023). Evaluation of the effectiveness of the Stunting Education and Anticipation System on improving knowledge, attitudes, and practice about the stunting of Pekanbaru City mothers. *Health Education and Health Promotion*, **11**(2), **195–201**.
18. Mugyia, A. S. N., Tanya, A. N. K., Njotang, P. N., & Ndombo, P. K. (2016). Knowledge and attitudes of pregnant mothers towards maternal dietary practices during pregnancy at the Etoug-Ebe Baptist Hospital, Yaounde. *Health Sciences and Disease*, **17**(2), 24–29.
19. National Coordinating Committee on Food and Nutrition. (2016). *Recommended nutrient intakes for Malaysia: A report of the Technical Working Group on Nutritional Guidelines*. Ministry of Health Malaysia.
20. Penang Institute. (2024). Penang’s progress towards the sustainable development goals by 2030 (Monograph). Penang Institute. <https://penanginstitute.org/wp-content/uploads/2024/02/Penangs-Progress-towards-the-Sustainable-Development-Goals-by-2030.pdf>
21. Turyashemerwa, F. M., Kikafunda, J. K., & Agaba, E. (2009). Prevalence of early childhood malnutrition and influencing factors in peri-urban areas of Kabarole District, western Uganda. *African Journal of Food, Agriculture, Nutrition and Development*, **9**(4).

22. United Nations Children's Fund, World Health Organization, & World Bank. (2023). *Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group joint child malnutrition estimates—Key findings of the 2023 edition*. World Health Organization.
23. Victora, C. G., Christian, P., Vdaletti, L. P., Gatica-Domínguez, G., Menon, P., & Black, R. E. (2021). Revisiting maternal and child undernutrition in low-income and middle-income countries: Variable progress towards an unfinished agenda. *The Lancet*, **397**(10282), 1388–1399.
24. Wan Muda, W. M., Sundaram, J. K., & Tan, Z. G. (2019). Addressing malnutrition in Malaysia. Khazanah Research Institute.
25. World Health Organization, & United Nations Children's Fund. (2018). *Baby-friendly hospital initiative: Ten steps to successful breastfeeding*. World Health Organization. <https://www.who.int/activities/promoting-baby-friendly-hospitals/ten-steps-to-successful-breastfeeding>