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Association of maternal immigration status with emotional eating in Taiwanese children: The mediating roles of health literacy and feeding practices

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ABSTRACT

Background: Emotional eating has been linked to childhood obesity. A variety of emotions often trigger this form of eating, which has been associated with stress-induced overeating, loss of control eating, and binge eating in children. However, research on how maternal immigration status and feeding practices influence emotional eating in children within Asian contexts is sparse. This study examines the association between maternal immigration status and emotional eating in children, exploring the mediating roles of health literacy and feeding practices.

Method: The study focused on children aged 10–11 and their mothers in Taiwan, utilizing a sample of 2308 mother-child dyads. The Child Feeding Questionnaire (CFQ) was used to assess mothers' feeding practices, while emotional eating was measured using a subscale of the Three-Factor Eating Questionnaire-Revised 18 (TFEQ-R18). Health literacy was evaluated using the Health Literacy Survey Questionnaire (HLS-EU-Q12). Confirmatory factor analysis, Pearson's correlation, and Structural Equation Models (SEMs) were employed to explore the potential pathways leading to children's emotional eating.

Results: Children of mothers with foreign nationality demonstrate higher emotional eating scores compared to those with native-born mothers (5.73 vs. 5.35, $p = 0.04$). These mothers also have significantly lower health literacy levels (35.21 vs. 38.52, $p < 0.0001$). They are more inclined to use rewarding and pressure-to-eat feeding practices while showing reduced tendencies toward monitoring and restriction. Serial mediation models suggest that maternal foreign nationality influences children's emotional eating primarily by increasing rewarding and pressure-to-eat practices alongside reduced health literacy, which ultimately lowers monitoring practices.

Conclusions: Interventions should improve maternal health literacy and promote healthy feeding practices. Future research should investigate these pathways across various geographic regions and age groups to develop targeted interventions for immigrant families.

1. Introduction

The global rise in obesity, particularly among children and adolescents, has become increasingly prevalent, with emotional eating identified as a significant contributing factor (Braden et al., 2014). Emotional eating, defined as food consumption in response to emotional states rather than physiological hunger, is often triggered by various emotions, including stress, anxiety, sadness, and boredom, leading children to seek comfort in food as a coping mechanism (Favieri et al., 2021). Moreover, it has served as a precursor to more severe disordered eating patterns, such as binge eating (Stice et al., 2002). Despite its

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List of abbreviations

CFQ	Child Feeding Questionnaire
RMSEA	Root Mean Square Error of Approximation
CFI	Comparative Fit Index
SEM	Structural Equation Modeling

significance, the body of research examining the impact of stress on children's eating behaviors remains relatively limited, predominantly conducted in small sample populations (Michels et al., 2012).

1.1. Parental influence on emotional eating

Research has identified various parental and environmental factors contributing to children's emotional eating development. According to the Environmental Model of Emotional Eating, these behaviors are learned responses to emotional stimuli shaped by the family's emotional climate and parental practices (Fisher & Birch, 1999). For example, when parents use food to reward good behavior or comfort a distressed child, they unintentionally reinforce the notion that food is an appropriate response to emotional needs. Over time, children begin to associate food with emotional relief, which can lead to emotional eating patterns (Ekim & Ocakci, 2021). These practices teach children to use food to address emotions rather than to satisfy hunger.

The family environment, particularly parental feeding practices like restriction, pressure to eat, and monitoring, measured by the Child Feeding Questionnaire (CFQ), plays a crucial role in shaping a child's relationship with food and emotional eating patterns (Powell et al., 2011). The CFQ consists of 15 questions divided into four subscales. The first subscale, Monitoring, assesses how closely mothers monitor their child's sweets, snack foods, and high-fat foods intake. The second subscale, Restriction, evaluates how mothers limit their children's consumption of sweets, high-fat foods, or favorite foods. The third subscale, Reward, is assessed by two questions regarding using sweets and favorite foods as rewards for good behavior. The final subscale, Pressure to Eat, measures efforts to encourage eating when the child is not hungry or to prevent underconsumption (Birch et al., 2001; Johnson & Birch, 1994).

Studies showed that parents who reported the use of food as a reward or restriction of food for health reasons with their children at ages 3–5 years old were more likely to have children who ate more under conditions of negative emotion at ages 5–7 years old (Farrow et al., 2015). This suggests that parents who overly control children's food intake may unintentionally teach children to rely on foods to cope with negative emotions, and children may begin to associate food with emotional regulation rather than hunger cues (Faith et al., 2004; Favieri et al., 2021).

Additionally, the overall emotional atmosphere within the family, particularly levels of stress, conflict, or lack of emotional support, also plays a critical role in the development of emotional eating habits in children (Haines et al., 2010). Children living in environments characterized by high family stress or conflict levels may turn to food as a comfort or a coping mechanism (Farrow & Blissett, 2012). This suggests that emotional eating may serve as an escape or a way to manage negative emotions stemming from the familial environment. The emotional climate within the family significantly influences children's emotional eating habits, with higher stress and conflict levels exacerbating this behavior (Haines et al., 2010).

1.2. Challenges for immigrant family and children

Parental immigration status adds a unique cultural dimension to a child's upbringing. The stress of acculturation has been proven to be a risk factor in the relationship between anxiety, emotional eating, and restrained eating (Hun et al., 2021). Systematic reviews indicated that migration status itself could often be postulated as a risk factor for children's mental condition, particularly migration in the first generation (Belhadj Kouider et al., 2014). Another systematic review reported that second-generation immigrant adolescents had more psychosomatic symptoms than native adolescents (Stevens et al., 2015). Second-generation immigrants often face the challenge of balancing their family's cultural heritage with the dominant culture of their new environment. This can lead to stress and identity issues, which might manifest as psychosomatic symptoms (Belhadj Kouider et al., 2014; Stevens et al., 2015). Recent studies indicate that second-generation adolescents from immigrant families perceive significantly less family support than their peers from native families (Chen et al., 2022). This perceived lack of support may result from cultural differences, language barriers, and the unique challenges faced by immigrant parents in adapting to a new environment. Other studies indicated that acculturative stress was associated with higher levels of emotional eating among adolescents, and yet Latino and non-Latino adolescents presented similar levels of emotional eating (Simmons & Limbers, 2019). Similarly, a study on German adolescents found no significant differences between immigrant and native children (Runge et al., 2022). In an adult sample, one study found that the prevalence of binge eating with loss of control was similar between immigrant participants (37.2%) and US-born participants (39.9%). Immigrant women, on the contrary, exhibited a lower risk of binge eating with loss of control compared to their US-born counterparts (Salas-Wright et al., 2019). These mixed findings highlight the need for further research into how immigration-related factors specifically influence emotional eating behaviors in children and adolescents.

Immigrant families often face unique challenges, including cultural adaptation, financial pressures, and legal uncertainties, which can exacerbate family stress and potentially influence children's emotional eating behaviors (Barry & Garner, 2001; Kalantzis et al., 2022). Additionally, the acculturative stress experienced by parents may trickle down to their children, exacerbating family tensions and leading them to seek comfort through food (Chen et al., 2023). Several family-based risk factors, such as acculturation stress, language barriers, and social isolation, have been identified (Belhadj Kouider et al., 2014, 2015). Despite improvements in social services and legal protections, immigrant mothers, especially from lower-income countries, still face discrimination, impacting their children's social inclusion and psychopathology (Kalantzis et al., 2023).

1.3. Immigrant family disadvantages in Taiwan

Since 1994, Taiwan's Southbound Policy concerning China and countries in the Association of Southeast Asian Nations has substantially increased transnational marriages in Taiwan (Lin, 2012). In 2016, the government initiated a new Southbound Policy to promote further international investments and business/trade activities between Taiwan and Southeastern countries, including Vietnam, Thailand, and others (Office of Trade Negotiations, Executive Yuan, 2011). According to the 2019 Ministry of the Interior report, 15.8% of marriages were transnational. Of those transnational marriages, about 74.1% came from Mainland China and Southeast Asian countries, and foreign brides accounted for 72% of transnational marriages (*Ministry of the Interior, n. d.*).

The influence of the Southbound Policy on transnational marriages has highlighted the socio-psychological challenges faced by immigrant mothers and their children. Marriages between local men and women from Southeast Asian countries often involve males with lower socioeconomic and educational backgrounds, including farmers, workers, or fishermen (Hsia, 2000). Many of these cross-cultural marriages are arranged through brokers, often leading to unions with fragile emotional bonds. The women, usually from economically disadvantaged

backgrounds, enter these marriages hoping to improve their family's financial situation (Hsia, 2009). Immigrant mothers also experience more discrimination than Taiwanese mothers (Wu et al., 2015; Yang et al., 2014). These new immigrant families face significant economic and educational disadvantages and are often stigmatized and discriminated against, labeled as "problematic minorities." Immigrant mothers report high levels of psychological distress (70%) and depression (24%), with their children—often referred to as second-generation immigrants—experiencing a range of physiological and psychological issues at higher rates than their peers, with both parents being Taiwanese (Lin & Hung, 2007; Yang et al., 2014).

1.4. Knowledge gap and study objectives

Immigrant populations encounter substantial health literacy challenges due to a blend of language barriers, cultural differences, and limited access to health resources, which hinders effective healthcare navigation (Pandey et al., 2021). Among immigrant mothers, low health literacy can adversely impact their children's health, potentially leading to inadequate prenatal care, feeding practices, and increased susceptibility to preventable conditions (Park et al., 2018). Studies also show that immigrant mothers make dietary choices influenced by socio-economic factors, such as financial constraints, limited nutrition education, lack of information on nutrition, portion sizes, food safety, and cultural eating habits (Bowen et al., 2023; Kavian et al., 2021). They frequently opt for affordable, calorie-dense foods out of necessity, highlighting a lack of health and nutrition literacy (Davison & Gondara, 2021; Ng & Omariba, 2014), which can impact children's growth and health outcomes. Despite these risks, research remains limited on the specific impact of low maternal health literacy on immigrant children.

Approximately 93% of foreign spouses in Taiwan are women, and the mother is primarily responsible for preparing family meals. Their cultural background may influence her feeding practices and approach this task. We decide to focus on immigrant mothers in this study. This research examines how a mother's immigration status influences emotional eating in children within Asian contexts, focusing on the potential mediating roles of health literacy and feeding practices. Studies show that health literacy is crucial for health outcomes, as it involves skills to obtain, understand, appraise, and apply health information (Nutbeam, 1998; 2008; Shahid et al., 2022; Sørensen et al., 2015). By examining these factors, the study provides insights into the complex interplay between immigration, health literacy, and child emotional eating behaviors, offering potential strategies for promoting healthier eating patterns among children in immigrant families.

2. Method

2.1. Participants and procedure

The study consisted of children attending 5th or 6th grade in elementary school in Hsinchu County, Taiwan, falling within the age bracket of 10–11 years. The anticipated effect size was predetermined at 0.1, while the desired level of statistical power was set at 0.8. It was projected that there would be about 11 latent variables and 96 observed variables at maximum in the model. The significance level, or alpha, was established at 0.01. Based on these parameters, the recommended minimum sample size was 2532 respondents (Soper, 2021). Considering an estimated questionnaire response rate of 70%, it is planned to distribute 3617 questionnaires.

A multi-stage cluster sampling method was utilized to select participants, starting with schools as the initial sampling unit, chosen based on a probability proportional to the population size of each township. An estimated 30 schools from 13 townships were targeted, reflecting the population and average class sizes of 20–25 students. Schools were stratified into high, medium, and low population densities to accommodate variations in student and class numbers across townships. Based on this stratification scheme, 80 classes in high-density, 64 in medium-density, and 18 in low-density townships were randomly selected. Finally, all students within these chosen classes were recruited for the study.

This study employed anonymous questionnaires to safeguard privacy and protect sensitive groups. Children were given a sealed envelope containing the survey for their parents and an explanatory letter about the study. Parents completed the survey, sealed the envelope, and their children returned it within two weeks. To maintain participant autonomy, those unwilling to participate could submit a blank questionnaire in a sealed envelope, ensuring anonymity. Our contact details were provided for any inquiries or concerns.

Altogether, a total of 3620 questionnaires were distributed across 13 townships, 30 schools, and 162 classes, reaching 15.23% of the eligible 10 to 11-year-old children in Hsinchu County, yielding a 79.2% response rate with 2868 parents and child questionnaires collected. Including only responses where both parents participated resulted in 2507 mother-father-child triad questionnaires, representing 87.4% (2507/2868, 87.4%) of the initial responses. Additionally, questionnaires where over 50% of the responses were missing were omitted from the analysis. There are 30 children's, 255 fathers', and 204 mothers' questionnaires, with more than 50% missing responses. Altogether, we excluded 78 family questionnaire sets from our analysis. The exclusion of these 78 sets represents approximately 3.11% of our initial complete family sets (78/2507 = 3.11%). We excluded data without a mother's nationality, health literacy, and education level; the sample comprised 2038 mother-child dyad questionnaires. Please refer to Supplementary Fig. 1 for the data collection flowchart.

This study was conducted at the National Taiwan University Hospital Hsinchu Branch, following approval from the Institutional Review Board (IRB) of the National Taiwan University Hospital Hsinchu Branch (IRB approval number: 109–145F).

2.1.1. Measures

Child Feeding Practice Mother's feeding practices were assessed using the Child Feeding Questionnaire (CFQ), designed to evaluate parental behaviors, beliefs, and concerns regarding feeding their children (Birch et al., 2001; Johnson & Birch, 1994). The CFQ encompasses 15 questions and includes four subscales: 1) Monitoring: This was assessed through three questions to understand how closely mothers monitor their child's intake of sweets (such as candy, ice cream, cake, pies, and pastries), snack foods (like potato chips, Doritos, cheese puffs), and high-fat foods. 2) Restriction: It comprises seven questions and is measured by inquiries into how mothers ensure their child does not consume excessive sweets (candy, ice cream, cake, pastries), high-fat foods, or too much of their favorite foods. 3) Reward: Assessed by two items regarding using sweets (candy, ice cream, cake, pastries) and favorite foods as rewards for good behavior. 4) Pressure to Eat: It has three questions and evaluates efforts to ensure food intake, including encouraging eating when the child is not hungry and guiding their eating habits to prevent underconsumption. Each question was rated on a 5-point Likert scale, ranging from 0 (disagree or never) to 4 (agree or always). The structure and internal consistency of these items were analyzed through confirmatory factor analysis and Cronbach's alpha.

Health Literacy The mother's health literacy was measured by the Health Literacy Survey Questionnaire (HLS-EU-Q12), a condensed version of the original HLS-EU-Q47, which assessed health literacy (Finbråten et al., 2018). This tool evaluates an individual's understanding and capabilities in healthcare, disease prevention, and health promotion (Sørensen et al., 2015), focusing on their self-assessed proficiency in locating, comprehending, evaluating, and applying health information to improve their well-being. The HLS-EU-Q12 consists of 12 items, each employing a 4-point Likert scale for responses, ranging from 1 (very difficult) to 4 (very easy), indicating higher scores indicating a higher level of health literacy. We further normalized the health literacy index by using a standardized formula (Index = (mean value of each

item - 1) multiplied by (50/3)), where the minimum index value is 0, and the maximum is 50, making it convenient for comparison across different studies (Sørensen et al., 2015). The tool demonstrated strong reliability, indicating its effectiveness in measuring health literacy (Song, 2024; Vandraas et al., 2022).

Emotional Eating A Child's emotional eating is measured by utilizing the Emotional Eating items from the TFEQ-R18 scale, including three times such as "When I feel anxious, I find myself eating"; "When I feel blue, I often overeat"; "When I feel lonely, I console myself by eating," each using a 4-point Likert scale for responses, ranging from 1 (definitely false); 2 (mostly false); 3 (mostly true); and 4 (definitely true).

2.1.2. Controls

Daily exercise time This variable was measured by the average time they reported spending outdoors walking, playground activities, ball games, or other forms of exercise in a day. The answer format was presented as intervals: less than 30 min, 31–60 min, 61–90 min, and over 90 min daily. Literature indicated that strenuous physical activity has been linked to higher rates of disordered eating behaviors (Meyer et al., 2011), and exercise is especially prevalent among adolescents engaging in such behaviors (Calderón-Asenjo et al., 2022; Chen et al., 2022). We controlled this variable in the model.

The child's obesity status This variable is measured by the body mass index (BMI), adjusted for height and weight according to the WHO criteria for children and adolescents. Literature indicates a strong link between emotional eating behaviors and higher obesity rates (Dakanalis et al., 2023). We, therefore, controlled this variable in the model.

Monthly family income This variable represents family socioeconomic status, defined by monthly income brackets adjusted to a recent exchange rate of approximately 1 USD ≈32 TWD, and categorized as follows: (1) Less than USD 1000; (2) USD 1000–2999; (3) USD 3000–5999; (4) USD 6000–8999; (5) USD 9000–11,999; (6) USD 12,000–14,999; (7) USD 15,000 or more. The literature presents mixed evidence regarding the relationship between high socioeconomic status and the prevalence of eating disorders (Calderón-Asenjo et al., 2022; Huryk et al., 2021). We controlled for family income levels as reported by fathers in the model. For participants without a report from the father, the mother's report was used as a substitute.

2.2. Statistical analysis

In this study, we have adopted a robust approach based on the Weighted Least Squares Means and Variance adjusted (WLSMV) estimator due to the following three reasons: 1) the ordinal nature of our variables, 2) the pattern of non-normal distributions, and 3) The minimal proportion of missing data in our study (less than 5% across all variables). It is essential to note that when using WLSMV estimation, pairwise deletion is considered an appropriate approach (Asparouhov & Muthén, 2010).

While Full Information Maximum Likelihood (FIML) is a common approach for handling missing data in many SEM contexts (Enders, 2022), WLSMV estimation with pairwise deletion has been shown to perform well with ordered categorical data, providing accurate parameter estimates and standard errors without requiring the assumption of multivariate normality. The combination of WLSMV with pairwise deletion is well-established in the methodological literature for handling ordered categorical data in SEM (Asparouhov & Muthén, 2010; Li, 2016; Muthén & Asparouhov, 2015; Muthén & Muthén, 2019).

All SEM models were adjusted for a child's sex, obesity status, family income, and daily exercise time. The statistical analyses were executed using R version 4.4.1 (R Core Team, 2024) with the Lavaan package version 0.6–19 (Rosseel, 2012). The 95% confidence interval was estimated based on 1000 bootstrap samples.

2.3. Hypotheses

Fig. 1 illustrates the conceptual framework of a serial mediation model. It highlights the two-step process in which two mediators convey the effect of an independent variable to a dependent variable.

H1 (direct effect hypothesis): The mother's foreign nationality (X) is directly associated with the child's emotional eating behaviors (Y). It is hypothesized children of foreign mothers may display different emotional eating behaviors than those of native mothers.

H2 (Serial mediation effect hypothesis (through M1 and M2)): The mother's foreign nationality (X) affects a child's emotional eating behaviors (Y) through a sequential mediation process. First, it influences the mother's health literacy (M1), which then influences her feeding practices (M2), which in turn affects the child's emotional eating behaviors (Y).

3. Results

3.1. Participant characteristics

Table 1 summarizes the key characteristics of the 2038 participants. The gender distribution shows that 50.88% were girls and 49.12% were boys. Approximately 6.7% (n = 134) of the participants had mothers of foreign nationality, a figure comparable to the national proportion. Regarding age groups, 53.19% of the participants were 11, while 46.81% were 12. Regarding daily time spent in outdoor exercise, around 26% of the students spent less than 30 min, 43.86% spent 31–60 min, 13.94% spent 61–90 min, and 11.4% spent over 90 min. Additionally, about 11.4% of the students were classified as obese. There are no significant differences between native and immigrant children concerning these variables. The average score on the emotional eating scale is 5.37 (ranging from 3 to 12). However, children with mothers of foreign nationality score higher on this scale than native children (5.73 vs. 5.35, $p = .04$) (see Table 1).

Mothers of foreign nationality exhibit lower health literacy levels than native mothers (35.21 vs. 38.52, $p < .0001$). Additionally, they have lower educational attainment; only 27.61% of immigrant mothers are college graduates, compared to 65.02% of native mothers. About only 18.2% of immigrant mothers, have reported a monthly family income between USD 3000 and 5,999, compared to 49.8% of native mothers ($p < .0001$).

Regarding maternal feeding practice patterns, there were notable differences between mothers of foreign nationalities and native mothers. Foreign mothers demonstrated significantly lower levels of monitoring, restriction feeding practices and higher levels of reward, pressure-to-eat feeding practices compared to their native counterparts (1.98 vs. 2.19 for monitoring, $p < .01$; 2.73 vs. 2.99 for restriction, $p < .001$, 2.30 vs. 1.93 for reward, $p < .001$; 2.44 vs. 2.17, $p < .01$).

3.2. Serial mediation model

First, we examine the direct association between maternal foreign nationality and a child's emotional eating behaviors while controlling for variables such as sex, obesity status, family income, and daily exercise time. Analysis revealed that children with immigrant mothers exhibited significantly elevated levels of emotional eating in comparison to their counterparts with native mothers ($B = 0.382$, $p < .045$).

Second, we propose a serial mediation model, suggesting that maternal foreign nationality may influence a child's emotional eating through a two-step process: initially through maternal health literacy, followed by the mother's feeding practices, as depicted in Fig. 1. Fig. 2 illustrates the B coefficients for the distinct pathways through which maternal foreign nationality sequentially influences a child's emotional eating through health literacy and maternal feeding practices, highlighting the stepwise effects on children's emotional eating behaviors.

The results showed that the association between maternal foreign

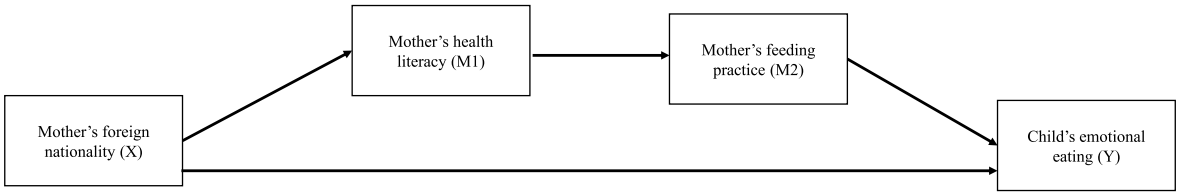

Fig. 1. Proposed model of mother's foreign nationality, mother's health literacy, mother's feeding practices and child's emotional eating.

Table 1
Characteristics of the study respondents (N = 2038).

	Total childern		Native mothers/childern (n = 1904, 93.4%)		Immigrant mothers/childern (n = 134, 6.6%)		X^2/F	p-value
	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD		
Sex								
Girls	1037	50.88	977	51.31	60	44.78	0.76	0.42
Boys	1001	49.12	927	48.69	74	55.22		
Age								
11	1084	53.19	1016	53.36	68	50.74	0.34	0.31
12	954	46.81	888	46.64	66	49.25		
Daily exercise time								
Less than 0.5 h	530	26.00	490	25.73	40	26.86	5.17	0.16
0.5 h–1 h	894	43.86	847	44.49	47	36.07		
1 h–1.5 h	284	13.94	269	14.13	25	18.66		
More than 1.5 h	320	15.70	298	15.65	22	16.41		
Children's obese status	232	11.4	216	11.30	16	11.90	0.04	0.78
Childern's emotional eating behaviors (3-12)	5.37	2.14	5.35	2.12	5.73	2.41	4.05	0.04
Monthly family income								
Less than USD 1000	96	4.70	78	4.10	18	13.40	59.08	<0.0001
USD 1000-2999	1028	50.40	935	49.10	93	69.40		
USD 3000-5999	982	33.50	666	35.00	16	11.90		
USD 6000-8000	90	4.40	89	4.70	1	0.70		
USD 9000-11999	19	0.90	18	0.90	1	0.70		
USD 12,000-14999	16	0.80	15	0.80	1	0.70		
USD 15,000 or more	107	5.30	103	5.40	4	3.00		
Mothers' education level								
Junior high school and below	15	0.73	9	0.47	6	4.48	296.60	<0.0001
High school	79	3.96	43	2.26	36	26.87		
Five-year junior college program	423	20.76	368	19.32	55	41.04		
College graduates	1275	62.56	1238	65.02	37	27.61		
Graduate degree or above	246	12.07	246	12.92	0	0.00		
Mothers' health literacy	38.31	6.99	38.52	6.89	35.21	7.62	28.54	<0.0001
Mothers' feeding practices								
Monitoring (0–4)	2.18	0.91	2.19	0.91	1.98	0.94	7.11	0.01
Restriction (0–4)	2.97	0.91	2.99	0.90	2.73	0.92	10.20	0.001
Reward (0–4)	1.93	1.28	1.93	1.28	2.30	1.26	12.05	0.001
Pressure to eat (0–4)	2.19	1.06	2.17	1.07	2.44	0.98	7.85	0.01

nationality and a child's emotional eating became statistically insignificant (B = 0.051, p = .512). Furthermore, maternal foreign nationality is indirectly associated with a child's emotional eating through several pathways. First, it influences emotional eating through the mother's reward-feeding practices (B = 0.309, p < .000), which are linked to the child's emotional eating (B = 0.099, p < .000). This pathway (calculation: 0.309 × 0.099 = 0.031, p < .019) highlights the role of reward feeding in shaping emotional eating behaviors. Second, maternal foreign nationality is connected to emotional eating through the mother's pressure-to-eat feeding practices (B = 0.202, p < .000), which also contributes to the child's emotional eating (B = 0.087, p < .000). This pathway (calculation: 0.202 × 0.087 = 0.018, p < .049) emphasizes the influence of pressure-to-eat feeding on emotional eating behaviors (see Table 2).

Lastly, maternal foreign nationality is linked to a child's emotional eating through a two-step sequential mediation process. First, maternal foreign nationality negatively affects maternal health literacy (B = −0.399, p < .000), which then influences the mother's monitoring feeding practices (B = 0.235, p < .000), ultimately impacting the child's emotional eating (B = −0.067, p < .000). This pathway (calculation: −0.399 × 0.235 × −0.067 = 0.006, p < .016) suggests that lower health literacy among foreign-national mothers leads to decreased monitoring, which may slightly increase the risk of emotional eating in children. Although this pathway is small, it underscores the importance of health literacy in fostering effective feeding practices (see Table 2). This model fits the data well (RMSEA = 0.060, CFI = 0.959, χ^2 = 3366.908 (410), p < .001, χ^2/df = 8.21).

4. Discussion

This study investigates how maternal foreign nationality influences a child's emotional eating behaviors. By analyzing cultural, behavioral, and educational factors, it reveals the multifaceted effects of maternal foreign nationality on children's emotional eating behaviors. Using a serial mediation model, the study identifies direct and indirect pathways that shape these behaviors, primarily involving maternal health literacy and feeding practices.

4.1. Hypothesis testing and model findings

The serial mediation model tested two primary hypotheses regarding the impact of maternal foreign nationality on children's emotional

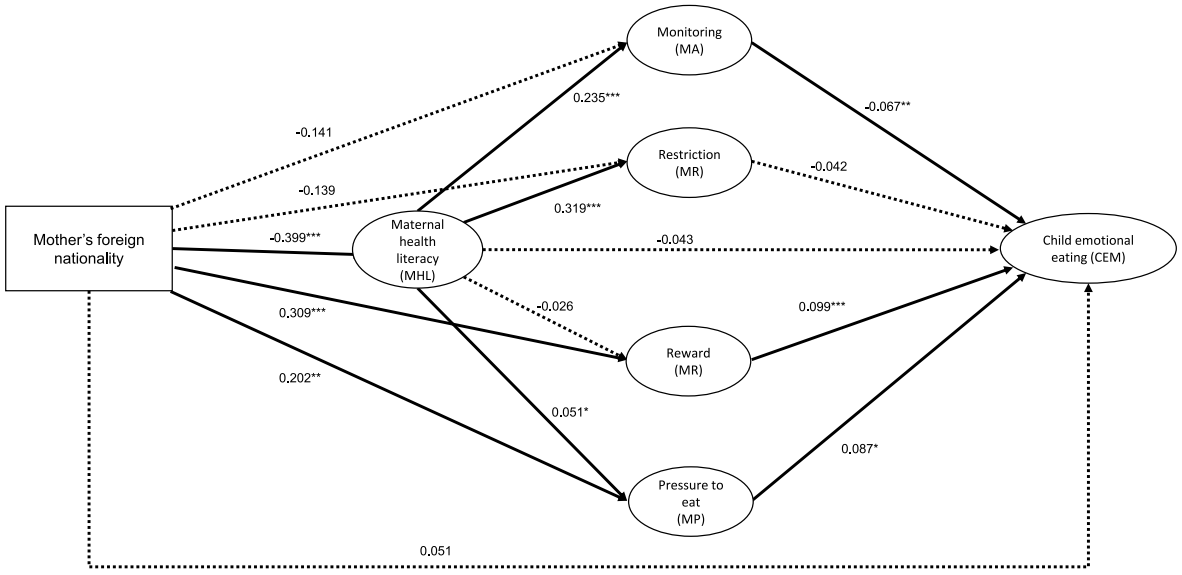

Fig. 2. Unstandardized coefficients were reported. *P < 0.05, ** P < 0.01, *** P < 0.001 Model fitness index RMSEA = 0.060, CFI = 0.959, Chi = 3366.908 (410), p < 0.001. chi/df = 8.21 This model has controlled **children's sex, obesity, family income, and daily exercise time.**

Table 2
Results from serial mediation model (N = 2038).

Variable/Effect	Unstandardized B	Bootrap 95% CI	Standardized β	P-value	
Direct paths					
Mother's foreign nationality (Foreign)					
Foreign→MM	−0.141	(-0.309, 0.026)	−0.038	0.099	
Foreign→MR	−0.139	(-0.310, −0.032)	−0.042	0.068	
Foreign→MA	**0.309**	**(0.139, 0.479)**	**0.079**	**0.002**	**
Foreign→MP	**0.202**	**(0.069, 0.336)**	**0.074**	**0.004**	**
Foreign→MHL	**−0.399**	**(-0.543, -0.256)**	**−0.127**	**0.002**	**
Foreign→CEM	0.051	(-0.102, −0.205)	0.017	0.512	
Mother's health literacy (MHL)					
MHL→MM	**0.235**	**(0.182, 0.288)**	**0.208**	**<0.001**	**
MHL→MR	**0.319**	**(0.265, 0.374)**	**0.272**	**<0.001**	**
MHL→MA	−0.026	(-0.344, 0.054)	−0.025	0.110	
MHL→MP	**0.051**	**(0.007, 0.094)**	**0.062**	**0.022**	*
MHL→CEM	−0.043	(-0.099, 0.013)	−0.005	0.134	
Mother's feeding practices					
MM→CEM	**−0.067**	**(-0.114, -0.020)**	**−0.081**	**0.012**	**
MR→CEM	−0.042	(-0.089, 0.005)	−0.053	0.083	
MA→CEM	**0.099**	**(0.046, 0.152)**	**0.112**	**0.004**	**
MP→CEM	**0.087**	**(0.018, 0.156)**	**0.076**	**0.013**	*
Indirect paths (via Mother's health literacy)					
Foreign→MHL→CEM	0.017	(-0.006, 0.040)	0.006	0.145	
Indirect paths (via Mother's feeding pracctices)					
Foreign→MM→CEM	0.009	(-0.004, 0.022)	0.003	0.229	
Foreign→MR→CEM	0.006	(-0.004, 0.016)	0.002	0.262	
Foreign→MA→CEM	**0.031**	**(0.009, 0.053)**	**0.010**	**0.019**	*
Foreign→MP→CEM	**0.018**	**(0.001 0.036)**	**0.006**	**0.049**	*
Indirect paths (via Mother's health literacy and feeding pracctices)					
Foregin→MHL→MM→CEM	**0.006**	**(0.001, 0.011)**	**0.001**	**0.016**	*
Foreign→MHL→MS→CEM	0.005	(-0.000,0.012)	0.001	0.098	
Foreign→MHL→MA→CEM	0.001	(-0.001, 0.003)	0.001	0.350	
Foreign→MHL→MP→CEM	−0.002	(-0.004, 0.071)	−0.001	0.113	
Controls					
Gender→CEM	−0.009	(-0.088, 0.071)	−0.006	0.832	
Obesity→CEM	0.169	(0.049, 0.290)	0.070	0.006	**
Daily exercise time→CEM	−0.019	(-0.049, 0.019)	−0.025	0.329	
Family income→CEM	−0.005	(-0.037, 0.028)	−0.007	0.788	
Total indirect paths	**0.092**	**(0.052, 0.131)**	**0.030**	**<0001**	*
Total paths	**0.143**	**(-0.007, 0.293)**	**0.046**	**0.061**	

Bootstrap resample size = 1000.
CEM: Children Emotional Eating; MM: Mother's Monitoring Feeding Practice; MR: Mother's Restriction Feeding Practice; MA: Mother's Rewarding Feeding Practice, MP: Mother's Pressure-to-eat Feeding Practice.

eating. Hypothesis 1 proposed a direct relationship between maternal foreign nationality and children's emotional eating behaviors. However, this relationship became statistically insignificant when maternal health literacy and feeding practices were controlled for. This suggests that cultural and educational factors associated with maternal health literacy and feeding practices may substantially influence children's emotional eating behaviors than maternal nationality alone. These findings align with previous research emphasizing the critical role of health literacy and culturally informed feeding practices in shaping children's dietary behaviors (Ng & Omariba, 2014; C. Park et al., 2022).

Hypothesis 2 proposed a sequential mediation pathway, outlining a two-step process: maternal foreign nationality first influences maternal health literacy, affecting feeding practices—such as monitoring, restriction, reward, and pressure to eat—that ultimately shape children's emotional eating behaviors.

The results reveal three key pathways. First, maternal foreign nationality impacts emotional eating through reward-based feeding practices ($B = 0.309$, $p < .000$), which are linked to children's emotional eating ($B = 0.099$, $p < .000$). This pathway ($B = 0.031$, $p < .019$) underscores the role of reward feeding in fostering emotional eating behaviors. Second, maternal foreign nationality is associated with emotional eating via pressure-to-eat practices ($B = 0.202$, $p < .000$), which also contributes to children's emotional eating ($B = 0.087$, $p < .000$). This pathway ($B = 0.018$, $p < .049$) highlights the influence of pressure-to-eat feeding on emotional eating behaviors.

Lastly, maternal foreign nationality is negatively associated with health literacy ($B = -0.399$, $p < .000$), which then affects maternal monitoring feeding practices ($B = 0.235$, $p < .000$) and, subsequently, children's emotional eating ($B = -0.067$, $p < .000$). This pathway ($B = 0.006$, $p < .016$) suggests that lower health literacy among foreign-national mothers may reduce monitoring practices, slightly increasing the risk of emotional eating in children.

4.2. Reward and pressure-to-eat feeding practices

This study found that reward-based and pressure-to-eat feeding approaches are associated with emotional eating, particularly among socio-economically challenged immigrant families. Immigrant families often experience unique stressors that can amplify food-related challenges, including pressures from adapting to a new culture, financial constraints, and food insecurity. Studies suggested that children are more likely to engage in emotional eating when parents use food to manage emotions in response to adverse situations like stress (Birch & Fisher, 1998; Fisher & Birch, 1999; Stone, Blisset, et al., 2022; Stone, Haycraft, et al., 2022). Furthermore, elevated levels of parenting stress are associated with increased reliance on food rewards and the use of food for emotion regulation, both of which contribute to children's emotional eating behaviors (González et al., 2022). Reward-based feeding, where parents offer food as a reward, often leads to a higher intake of ultra-processed foods associated with emotional eating patterns (Dolwick & Persky, 2021). Using food as a reward fosters a higher food-reward response in children, meaning they are more likely to eat in response to emotional triggers (Toh et al., 2021). Pressure-to-eat practices also increase the likelihood of emotional eating in children, particularly when the child has poor emotion regulation skills (Klosowska et al., 2022). This finding suggests that parents pressuring children to eat can interfere with their self-regulating ability, promoting emotional eating as a coping mechanism. Fernandes et al. (2021) also highlight that unsupportive parental responses, including pressure to eat, are linked to nonresponsive feeding practices and are positively associated with emotional eating (Fernandes et al., 2021).

Thus, the study underscores immigrant families' reward-based and pressure-to-eat feeding practices contribute significantly to emotional eating. These feeding behaviors, rooted in the family's attempts to manage scarcity and provide comfort, may inadvertently promote emotional dependencies on food as a coping mechanism for stress and uncertainty. These findings also underscore the importance of fostering awareness among parents about their influence on children's emotional eating behaviors and the potential long-term impacts (Brantley et al., 2023).

4.3. Socio-economic constraints on feeding practices

The study found that reward-based and pressure-to-eat feeding approaches are closely linked to emotional eating, especially within immigrant families facing socioeconomic challenges. These practices may become more pronounced due to the additional pressures of food insecurity and financial hardship, which can foster food conservation behaviors. For immigrant families in economically disadvantaged situations, food insecurity often necessitates strict management of resources, leading to feeding approaches that prioritize maximizing food intake and minimizing waste, and often lead to pressure-to-eat feeding behaviors to prevent waste and ensure adequate nourishment (Gundersen & Ziliak, 2015; Casey et al., 2001; Jansen et al., 2012). Additionally, cultural traditions may involve food as a reward or emphasize finishing meals, potentially reinforcing emotional eating tendencies among children (Powell et al., 2011). In our study sample, about 18.2% of immigrant mothers reported a monthly family income more than USD 3,000, compared to 49.8% of native mothers ($p < .0001$). Financial insecurity in these families may lead to psychological distress, prompting coping strategies such as pressure-to-eat behaviors to conserve food and avoid waste—a typical response among immigrant parents facing economic hardship and limited access to resources (Leung et al., 2023).

In addition, children in food-insecure households often display increased sensitivity to food cues and enjoyment of eating, tendencies that heighten their risk for emotional eating and obesity (Berge et al., 2020). Parents in these households may respond by using food as a reward or adopting pressure-to-eat strategies, reinforcing children's heightened focus on food (Schneider-Worthington et al., 2022). This approach can unintentionally promote unhealthy relationships with food as children associate eating with comfort or reward rather than hunger or satiety cues (Schneider-Worthington et al., 2022). The cycle of reward-based feeding and pressure-to-eat, often adopted to prevent food waste, underscores the complex interactions between food insecurity and emotional eating. The emotional distress associated with food insecurity may further disrupt children's natural hunger signals (Keenan et al., 2022). McCurdy et al. (2022) indicate that food insecurity often leads to stress, which can prompt parents to adopt coping strategies such as using food as a reward or pressuring children to eat. These practices may inadvertently increase the risk of emotional and unhealthy eating behaviors (McCurdy et al., 2022). These findings illustrate how economic constraints intersect with cultural and familial feeding practices among immigrant mothers. This highlights the need for interventions that address food security alongside culturally relevant feeding education within immigrant communities.

Public health efforts that discourage reward-based feeding and instead encourage responsive, balanced feeding could improve children's eating behaviors. Additionally, training health professionals in cultural competency will enable them to meet immigrant families' unique needs more effectively, supporting healthier and more culturally sensitive dietary practices.

4.4. Health literacy and emotional eating

The study identifies a significant relationship between lower health literacy among immigrant mothers and reduced monitoring of feeding practices, contributing to increased emotional eating in children. Health literacy plays a crucial role in enabling informed health decisions. Limited health literacy may hinder mothers from fully understanding the negative impacts of specific feeding practices, such as reward-based or pressure-to-eat approaches (Nutbeam, 2008; Chong et al., 2016;

Shahid et al., 2022). Maternal health literacy is often tied to socioeconomic factors, with lower socioeconomic status frequently linked to reduced health literacy (Sántha, 2021). Ahmadi and Karamitanha (2023) show that mothers with low health literacy are more prone to unhealthy feeding practices, potentially encouraging emotional eating in children (Ahmadi & Karamitanha, 2023). Education level is crucial in health literacy, significantly influencing individuals' abilities to understand health information and make informed decisions (Ahmadi & Karamitanha, 2023). In this study sample, notable educational disparities exist between native and immigrant mothers, with only 27.61% holding college degrees, compared to 77.94% of native mothers ($p < .0001$). This educational disparity highlights the need for accessible, culturally tailored health education to support immigrant mothers in understanding and adopting beneficial feeding practices for their families.

4.5. Public health interventions to improve health literacy

While increasing educational attainment directly is challenging, public health interventions can target health literacy in immigrant communities. Programs designed to provide culturally tailored nutritional guidance could empower immigrant mothers with the knowledge to make healthy dietary choices for their children, ultimately reducing emotional eating. These initiatives should address the health literacy gap by focusing on practical, culturally relevant guidance on feeding practices (Larson & Story, 2009). Studies found that parents with higher health and nutrition literacy engage in more beneficial feeding practices, positively impacting children's eating behaviors (Costarelli et al., 2021; Pervanidou et al., 2023). These findings highlight the need for interventions that combine health literacy enhancement with healthy feeding practices to mitigate emotional eating in children, providing a holistic approach to promoting better health outcomes.

4.6. Conclusion and limitations

This study examines how maternal foreign nationality influences children's emotional eating behaviors through direct and indirect pathways, with health literacy and feeding practices identified as critical mediators. Culturally sensitive interventions targeting these mediators could support immigrant families in fostering healthier feeding practices and emotional well-being for children. Addressing these disparities through tailored approaches may help immigrant mothers improve feeding practices and reduce emotional eating in children. Policymakers can leverage these findings to develop public health initiatives that prevent childhood obesity and encourage healthy eating behaviors.

This study has several limitations that may impact its findings. First, immigrant children make up only 6.7% of the participants, so future studies should aim to include more diverse populations to enhance the generalizability of the results. Second, further research should explore acculturation levels and family dynamics to inform more targeted interventions. Third, longitudinal studies would provide deeper insights into the effects of feeding practices and socio-economic factors on children's health over time. Lastly, the minimal effect of maternal foreign nationality, health literacy, and feeding practices on children's emotional eating behaviors underscores the need for further research into immigrant-related stressors—such as language barriers, economic instability, and acculturation pressures, which were not assessed in this study—that may affect maternal mental health and, in turn, influence maternal approaches to feeding and interactions with their children around food. Therefore, more research is needed to isolate these variables and understand how maternal nationality, in combination with other social, cultural, and economic factors, may contribute to children's emotional eating tendencies.

Furthermore, when assessing measurement invariance for cross-group comparisons, results indicated that the health literacy scale achieved configural, metric, and scalar invariance, supporting comparability between native and immigrant mothers. However, the feeding practice scale demonstrated only configural and metric invariance, suggesting that cultural factors may influence interpretations of feeding practices. This non-invariance indicates that comparisons of feeding practices across groups should be approached cautiously, as cultural differences may shape how these practices are understood. The observed non-invariance in feeding practices suggests that cultural factors, rather than language barriers, may affect maternal responses to feeding practice items. Future research should explore these cultural distinctions to inform the design of culturally sensitive interventions, ultimately supporting improved maternal behaviors and health outcomes for immigrant families.

CRediT authorship contribution statement

Duan-Rung Chen: Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **An-Kuo Chou:** Writing – review & editing, Resources, Investigation, Data curation. **Tung-Sung Tseng:** Writing – review & editing.

Ethical statement

This study adhered to the ethical principles set forth in the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the National Taiwan University Hospital Hsinchu Branch (IRB approval number: 109–145F). To prioritize personal privacy and protect a sensitive population, we utilized an anonymous, single-use questionnaire, thereby eliminating the need to store identifiable participant information. Given that our methodology did not involve direct, individualized interactions with participants, the Research Ethics Committee at National Taiwan University Hospital Hsin-Chu Branch approved a waiver of written informed consent. All collected data were anonymized, with identifying information removed prior to analysis, and securely stored with access limited to the research team. The authors declare no competing interests that could have influenced the study's outcomes.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2024.107771.

Data availability

Data will be made available on request.

References

Ahmadi, F., & Karamitanha, F. (2023). Health literacy and nutrition literacy among mother with preschool children: What factors are effective? *Preventive Medicine Reports, 35*, Article 102323.

Asparouhov, T., & Muthén, B. (2010). Weighted least squares estimation with missing data. *Mplus Technical Appendix, 2010*(1–10), 5. http://www.statmodel.com/download/GstrucMissingRevision.pdf.

Barry, D. T., & Garner, D. M. (2001). Eating concerns in East Asian immigrants: Relationships between acculturation, self-construal, ethnic identity, gender, psychological functioning and eating concerns. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 6*(2), 90–98. https://doi.org/10.1007/BF03339757

Belhadj Kouider, E., Koglin, U., & Petermann, F. (2014). Emotional and behavioral problems in migrant children and adolescents in europe: A systematic review. *European Child & Adolescent Psychiatry, 23*(6), 373–391. https://doi.org/10.1007/s00787-013-0485-8

Belhadj Kouider, E., Koglin, U., & Petermann, F. (2015). Emotional and behavioral problems in migrant children and adolescents in American countries: A systematic review. *Journal of Immigrant and Minority Health, 17*(4), 1240–1258. https://doi.org/10.1007/s10903-014-0039-2

Berge, J. M., Fertig, A. R., Trofholz, A., Neumark-Sztainer, D., Rogers, E., & Loth, K. (2020). Associations between parental stress, parent feeding practices, and child eating behaviors within the context of food insecurity. *Preventive Medicine Reports, 19*, Article 101146. https://doi.org/10.1016/j.pmedr.2020.101146

Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics, 101*(Supplement_2), 539–549.

Birch, L. L., Fisher, J. O., Grimm-Thomas, K., Markey, C. N., Sawyer, R., & Johnson, S. L. (2001). Confirmatory factor analysis of the child feeding questionnaire: A measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite, 36*(3), 201–210.

Bowen, S., Hardison-Moody, A., Cordero Oceguera, E., & Elliott, S. (2023). Beyond dietary acculturation: How latina immigrants navigate exclusionary systems to feed their families. *Social Problems*, Article spad013.

Braden, A., Rhee, K., Peterson, C. B., Rydell, S. A., Zucker, N., & Boutelle, K. (2014). Associations between child emotional eating and general parenting style, feeding practices, and parent psychopathology. *Appetite, 80*, 35–40.

Brantley, C., Knol, L. L., & Douglas, J. W. (2023). Parental mindful eating practices and mindful eating interventions are associated with child emotional eating. *Nutrition Research, 111*, 34–43.

Calderón-Asenjo, R. E., Jalk-Muñoz, M. C., Calizaya-Milla, Y. E., Calizaya-Milla, S. E., Ramos-Vera, C., & Saintila, J. (2022). Association between emotional eating, sociodemographic characteristics, physical activity, sleep duration, and mental and physical health in young adults. *Journal of Multidisciplinary Healthcare, 15*, 2845–2859. https://doi.org/10.2147/JMDH.S391752

Casey, P. H., Szeto, K., Lensing, S., Bogle, M., & Weber, J. (2001). Children in food-insufficient, low-income families: Prevalence, health, and nutrition status. *Archives of Pediatrics & Adolescent Medicine, 155*(4), 508–514.

Chen, D.-R., Lin, L.-Y., & Levin, B. (2023). Differential pathways to disordered eating for immigrant and native adolescents in Taiwan. *Journal of Eating Disorders, 11*(1), 1–14.

Chen, D.-R., Sun, G., & Levin, B. (2022). Gender-specific responses to multifaceted factors associated with disordered eating among adolescents of 7th to 9th grade. *Journal of Eating Disorders, 10*(1), 1–15.

Chong, M. F., Ayob, M. N., Chong, K. J., Tai, E. S., Khoo, C. M., Leow, M. K., Lee, Y. S., Tham, K. W., Venkataraman, K., Meaney, M. J., Wee, H. L., & Khoo, E. Y. (2016). Psychometric analysis of an eating behaviour questionnaire for an overweight and obese Chinese population in Singapore. *Appetite, 101*, 119–124. https://doi.org/10.1016/j.appet.2016.03.005

Costarelli, V., Michou, M., Panagiotakos, D. B., & Lionis, C. (2021). Adherence to the Mediterranean diet and weight status in children: The role of parental feeding practices. *International Journal of Food Sciences & Nutrition, 72*(1), 112–122. https://doi.org/10.1080/09637486.2020.1765151

Dakanalis, A., Mentzelou, M., Papadopoulou, S. K., Papandreou, D., Spanoudaki, M., Vasios, G. K., Pavlidou, E., Mantzorou, M., & Giaginis, C. (2023). The association of emotional eating with overweight/obesity, depression, anxiety/stress, and dietary patterns: A review of the current clinical evidence. *Nutrients, 15*(5), 1173.

Davison, K. M., & Gondara, L. (2021). A comparison of mental health, food insecurity, and diet quality indicators between foreign-born immigrants of Canada and native-born Canadians. *Journal of Hunger & Environmental Nutrition, 16*(1), 109–132. https://doi.org/10.1080/19320248.2019.1672601

Dolwick, A. P., & Persky, S. (2021). Parental reward-based eating drive predicts parents' feeding behaviors and Children's ultra-processed food intake. *Appetite, 164*, Article 105241. https://doi.org/10.1016/j.appet.2021.105241

Ekim, A., & Ocakci, A. F. (2021). Emotional eating: Really hungry or just angry? *Journal of Child Health Care, 25*(4), 562–572.

Enders, C. K. (2022). *Applied missing data analysis*. Guilford Publications. https://www.google.com/books?hl=zh-TW&lr=&id=uHt4EAAAQBAJ&oi=fnd&pg=PP1&dq=applied+missing+data+analysis&ots=W0uQR4qwRc&sig=H73rVKtZE3qHwcXa7MTo_7bGoPs.

Faith, M. S., Scanlon, K. S., Birch, L. L., Francis, L. A., & Sherry, B. (2004). Parent-child feeding strategies and their relationships to child eating and weight status. *Obesity Research, 12*(11), 1711–1722. https://doi.org/10.1038/oby.2004.212

Farrow, C., & Blissett, J. (2012). Stability and continuity of parentally reported child eating behaviours and feeding practices from 2 to 5 years of age. *Appetite, 58*(1), 151–156.

Farrow, C. V., Haycraft, E., & Blissett, J. M. (2015). Teaching our children when to eat: How parental feeding practices inform the development of emotional eating—a longitudinal experimental design. *The American Journal of Clinical Nutrition, 101*(5), 908–913.

Favieri, F., Marini, A., & Casagrande, M. (2021). Emotional regulation and overeating behaviors in children and adolescents: A systematic review. *Behavioral Sciences, 11*(1), 11. https://doi.org/10.3390/bs11010011

Fernandes, D. V., Canavarro, M. C., & Moreira, H. (2021). The mediating role of parenting stress in the relationship between anxious and depressive symptomatology, mothers' perception of infant temperament, and mindful parenting during the postpartum period. *Mindfulness, 12*(2), 275–290. https://doi.org/10.1007/s12671-020-01327-4

Finbråten, H. S., Wilde-Larsson, B., Nordström, G., Pettersen, K. S., Trollvik, A., & Guttersrud, Ø. (2018). Establishing the HLS-Q12 short version of the European Health Literacy Survey Questionnaire: Latent trait analyses applying Rasch modelling and confirmatory factor analysis. *BMC Health Services Research, 18*(1), 1–17.

Fisher, J. O., & Birch, L. L. (1999). Restricting access to foods and children's eating. *Appetite, 32*(3), 405–419.

González, L. M., Lammert, A., Phelan, S., & Ventura, A. K. (2022). Associations between parenting stress, parent feeding practices, and perceptions of child eating behaviors during the COVID-19 pandemic. *Appetite, 177*, Article 106148.

Gundersen, C., & Ziliak, J. P. (2015). Food insecurity and health outcomes. *Health Affairs, 34*(11), 1830–1839. https://doi.org/10.1377/hlthaff.2015.0645.

Haines, J., Kleinman, K. P., Rifas-Shiman, S. L., Field, A. E., & Austin, S. B. (2010). Examination of shared risk and protective factors for overweight and disordered eating among adolescents. *Archives of Pediatrics and Adolescent Medicine, 164*(4), 336–343.

Hsia, H. (2000). Transnational marriage and internationalization of capital-the case of the "foreign bride" phenomenon in Taiwan. *Taiwan: A Radical Quarterly in Social Studies, 39*(1), 45–92.

Hsia, H.-C. (2009). Foreign brides, multiple citizenship and the immigrant movement in Taiwan. *Asian and Pacific Migration Journal, 18*(1), 17–46.

Hun, N., Urzúa, A., & López-Espinoza, A. (2021). Anxiety and eating behaviors: Mediating effect of ethnic identity and acculturation stress. *Appetite, 157*, Article 105006. https://doi.org/10.1016/j.appet.2020.105006

Huryk, K. M., Drury, C. R., & Loeb, K. L. (2021). Diseases of affluence? A systematic review of the literature on socioeconomic diversity in eating disorders. *Eating Behaviors, 43*, Article 101548.

Jansen, P. W., Derks, I. P. M., Mou, Y., van Rijen, Gaillard, R., … Hillegers, M. H. J. (2020). Associations of parents' use of food as reward with children's eating behaviour and BMI in a population-based cohort. *Pediatric Obesity, 15*(11), Article e12662. https://doi.org/10.1111/ijpo.12662.

Johnson, S. L., & Birch, L. L. (1994). Parents' and children's adiposity and eating style. *Pediatrics, 94*(5), 653–661.

Kalantzis, M. A., Lim, S., Dauber, A. K., Studer-Perez, E. I., Silverman, Z. J., & O'Brien, W. H. (2022). Acculturative stress and eating disorder psychopathology: A meta-analysis. *Eating Behaviors*, Article 101694.

Kalantzis, M. A., Lim, S. C. X., Dauber, A. K., Studer-Perez, E. I., Silverman, Z. J., & O'Brien, W. H. (2023). Acculturative stress and eating disorder psychopathology: A meta-analysis. *Eating Behaviors, 48*, Article 101694. https://www.sciencedirect.com/science/article/pii/S1471015322001003.

Kavian, F., Coveney, J., Matwiejczyk, L., & Mehta, K. (2021). Food acculturation experiences of new Iranian skilled migrant mothers in South Australia. *Nutrition and Dietetics, 78*(4), 434–441. https://doi.org/10.1111/1747-0080.12659

Keenan, G. S., Christiansen, P., Owen, L. J., & Hardman, C. A. (2022). The association between COVID-19 related food insecurity and weight promoting eating behaviours: The mediating role of distress and eating to cope. *Appetite, 169*, Article 105835.

Klosowska, J., Verbeken, S., Braet, C., De Henauw, S., & Michels, N. (2022). Emotion regulation moderates the associations of food parenting and adolescent emotional eating. *Journal of Nutrition Education and Behavior, 54*(9), 808–817.

Larson, N., & Story, M. (2009). A review of environmental influences on food choices. *Annals of Behavioral Medicine, 38*(suppl_1), s56–s73. https://doi.org/10.1007/s12160-009-9120-9

Leung, C. W., Parnarouskis, L., Slotnick, M. J., & Gearhardt, A. N. (2023). Food insecurity and food addiction in a large, national sample of lower-income adults. *Current Developments in Nutrition, 7*(12), Article 102036.

Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods, 48*(3), 936–949. https://doi.org/10.3758/s13428-015-0619-7

Lin, J.-P. (2012). *Tradition and progress: Taiwan's evolving migration reality*. https://www.migrationpolicy.org/article/tradition-and-progress-taiwans-evolving-migration-reality.

Lin, L.-H., & Hung, C.-H. (2007). Vietnamese women immigrants' life adaptation, social support, and depression. *Journal of Nursing Research, 15*(4), 243–254.

McCurdy, K., Gans, K. M., Risica, P. M., Fox, K., & Tovar, A. (2022). Food insecurity, food parenting practices, and child eating behaviors among low-income Hispanic families of young children. *Appetite, 169*, Article 105857.

Meyer, C., Taranis, L., Goodwin, H., & Haycraft, E. (2011). Compulsive exercise and eating disorders. *European Eating Disorders Review, 19*(3), 174–189. https://doi.org/10.1002/erv.1122

Michels, N., Sioen, I., Braet, C., Eiben, G., Hebestreit, A., Huybrechts, I., Vanaelst, B., Vyncke, K., & De Henauw, S. (2012). Stress, emotional eating behaviour and dietary patterns in children. *Appetite, 59*(3), 762–769.

Ministry of the Interior. (n.d.). Ministry of the Interior. Retrieved August 4, 2024, from http://www.moi.gov.tw/english/default.aspx.

Muthén, B., & Asparouhov, T. (2015). Causal effects in mediation modeling: An introduction with applications to latent variables. *Structural Equation Modeling: A Multidisciplinary Journal, 22*(1), 12–23. https://doi.org/10.1080/10705511.2014.935843

Muthén, B., & Muthén, L. (2019). *Mplus: A general latent variable modeling program*. Muthén & Muthén. https://www.statmodel.com/download/Mplus-A/20General/20Latent/20Variable/20Modeling/20Program.pdf.

Ng, E., & Omariba, D. W. R. (2014). Immigration, generational status and health literacy in Canada. *Health Education Journal, 73*(6), 668–682. https://doi.org/10.1177/0017896913511809

Nutbeam, D. (1998). Health promotion glossary. *Health Promotion International, 13*(4), 349–364. https://doi.org/10.1093/heapro/13.4.349.

Nutbeam, D. (2008). The evolving concept of health literacy. *Social Science & Medicine, 67*(12), 2072–2078. https://doi.org/10.1016/j.socscimed.2008.09.050.

Office of Trade Negotiations, Executive Yuan. (2011). *Government website open information announcement. 2.16.886.101.20003*. https://www.ey.gov.tw/otnen/.

Pandey, M., Maina, R. G., Amoyaw, J., Li, Y., Kamrul, R., Michaels, C. R., & Maroof, R. (2021). Impacts of English language proficiency on healthcare access, use, and outcomes among immigrants: A qualitative study. *BMC Health Services Research, 21*(1), 741. https://doi.org/10.1186/s12913-021-06750-4

Park, S. Y., Lee, H., & Kang, M. (2018). Factors affecting health literacy among immigrants-systematic review. *The European Journal of Public Health, 28*(suppl_4), cky214–283.

Park, C., Nam, S., Redeker, N. S., Shebl, F. M., Dixon, J., Jung, T. H., & Whittemore, R. (2022). The effects of acculturation and environment on lifestyle behaviors in Korean immigrants: The mediating role of acculturative stress and body image discrepancy. *Ethnicity and Health, 27*(1), 157–173. https://doi.org/10.1080/13557858.2019.1658182

Pervanidou, P., Chatzidaki, E., Nicolaides, N. C., Voutetakis, A., Polychronaki, N., Chioti, V., Kitani, R.-A., Kyrkopoulou, E., Zarkogianni, K., & Kalafatis, E. (2023). The impact of the ENDORSE digital weight management program on the metabolic profile of children and adolescents with overweight and obesity and on food parenting practices. *Nutrients, 15*(7), 1777.

Powell, F. C., Farrow, C. V., & Meyer, C. (2011). Food avoidance in children. The influence of maternal feeding practices and behaviours. *Appetite, 57*(3), 683–692.

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*, 1–36. https://www.jstatsoft.org/article/view/v048i02.

Runge, R. A., Glaesmer, H., Schmitz, J., & Nesterko, Y. (2022). Mental health in children of immigrants in Germany: The role of socio-demographic and immigration-related characteristics. *Journal of Child and Family Studies, 31*(1), 155–168. https://doi.org/10.1007/s10826-021-02141-9

Sántha, Á. (2021). The sociodemographic determinants of health literacy in the ethnic Hungarian mothers of young children in eastern europe. *International Journal of Environmental Research and Public Health, 18*(11). https://doi.org/10.3390/ijerph18115517. Article 11.

Sørensen, K., Pelikan, J. M., Röthlin, F., Ganahl, K., Slonska, Z., Doyle, G., Fullam, J., Kondilis, B., Agrafiotis, D., & Uiters, E. (2015). Health literacy in Europe: Comparative results of the European health literacy survey (HLS-EU). *The European Journal of Public Health, 25*(6), 1053–1058.

Salas-Wright, C. P., Vaughn, M. G., Miller, D. P., Hahm, H. C., Scaramutti, C., Cohen, M., Delva, J., & Schwartz, S. J. (2019). Overeating and binge eating among immigrants in the United States: New terrain for the healthy immigrant hypothesis. *Social Psychiatry and Psychiatric Epidemiology, 54*, 1007–1017.

Schneider-Worthington, C. R., Smith, K. E., Roemmich, J. N., & Salvy, S.-J. (2022). External food cue responsiveness and emotional eating in adolescents: A multimethod study. *Appetite, 168*, Article 105789.

Shahid, R., Shoker, M., Chu, L. M., Frehlick, R., Ward, H., & Pahwa, P. (2022). Impact of low health literacy on patients' health outcomes: A multicenter cohort study. *BMC Health Services Research, 22*(1), 1148. https://doi.org/10.1186/s12913-022-08527-9.

Simmons, S., & Limbers, C. A. (2019). Acculturative stress and emotional eating in Latino adolescents. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 24*(5), 905–914. https://doi.org/10.1007/s40519-018-0602-2

Song, I. (2024). Relationship between health literacy and health-related quality of life in Korean adults with chronic diseases. *PLoS One, 19*(4), Article e0301894.

Soper, D. S. (2021). *A-priori sample size calculator for structural equation models [Software]. 2021*. https://Www.Danielsoper.Com/Statcalc, 2023-05-25.

Sørensen, K., Pelikan, J. M., Röthlin, F., Ganahl, K., Slonska, Z., Doyle, G., … Uiters, E. (2015). Health literacy in Europe: Comparative results of the European health literacy survey (HLS-EU). *European Journal of Public Health, 25*(6), 1053–1058.

Stevens, G. W., Walsh, S. D., Huijts, T., Maes, M., Madsen, K. R., Cavallo, F., & Molcho, M. (2015). An internationally comparative study of immigration and adolescent emotional and behavioral problems: Effects of generation and gender. *Journal of Adolescent Health, 57*(6), 587–594.

Stice, E., Presnell, K., & Spangler, D. (2002). Risk factors for binge eating onset in adolescent girls: A 2-year prospective investigation. *Health Psychology, 21*(2), 131.

Stone, R. A., Blissett, J., Haycraft, E., & Farrow, C. (2022). Predicting preschool children's emotional eating: The role of parents' emotional eating, feeding practices and child temperament. *Maternal and Child Nutrition, 18*(3), Article e13341. https://doi.org/10.1111/mcn.13341

Stone, R. A., Haycraft, E., Blissett, J., & Farrow, C. (2022). Preschool-aged children's food approach tendencies interact with food parenting practices and maternal emotional eating to predict children's emotional eating in a cross-sectional analysis. *Journal of the Academy of Nutrition and Dietetics, 122*(8), 1465–1473.

Toh, J. Y., Quah, P. L., Wong, C. H., Lun Yuan, W., Aris, I. M., McCrickerd, K., Godfrey, K. M., Chong, Y.-S., Shek, L. P., & Tan, K. H. (2021). Evaluation of a child food reward task and its association with maternal feeding practices. *PLoS One, 16*(7), Article e0254773.

Vandraas, K. F., Reinertsen, K. V., Kiserud, C. E., Bøhn, S. K., & Lie, H. C. (2022). Health literacy among long-term survivors of breast cancer; exploring associated factors in a nationwide sample. *Supportive Care in Cancer, 30*(9), 7587–7596. https://doi.org/10.1007/s00520-022-07183-3

Wu, W., Wu, J. C.-L., & Chiang, T. (2015). Variation in the association between socioeconomic status and breastfeeding practices by immigration status in taiwan: A population based birth cohort study. *BMC Pregnancy and Childbirth, 15*(1), 1–11.

Yang, H.-J., Wu, J.-Y., Huang, S.-S., Lien, M.-H., & Lee, T. S.-H. (2014). Perceived discrimination, family functioning, and depressive symptoms among immigrant women in Taiwan. *Archives of Women's Mental Health, 17*(5), 359–366.