Mal J Nutr 30(3): 459-471, 2024

Parenting influences associated with BMI-for-age z-score of Malaysian children aged 6-36 months: A cross-sectional study based on an online survey

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ABSTRACT

Introduction: Malnutrition in early life can contribute to lifelong health consequences. Both fathers and mothers can influence children's feeding, eating behaviours, and body weight status. This cross-sectional study aimed to determine the association between parental factors and body mass index-for-age z-score (BAZ) of Malaysian children aged 6-36 months. **Methods:** An online questionnaire using Google Form, which comprised of socio-demographic factors, parental lifestyle and feeding factors, children's birth history and eating behaviours, was completed by 282 pairs of fathers and mothers of full-term children during the COVID-19 pandemic. Health records were accessed with parental consent to ensure accurate measurements of children's weight and length, while both fathers and mothers self-reported their weight and height. **Results:** Prevalence of at-risk overweight, overweight, and obesity among children was 10.7%, 2.8%, and 1.1%, respectively, while wasting and severe wasting was 5.7% and 0.4%, respectively. Multiple linear regression analysis found that higher birth weight (β=0.271, p<0.001), less frequent use of food to calm by fathers (β=-0.127, p=0.035), and higher maternal BMI (β=0.136, p=0.021) significantly contributed to higher BAZ among children. **Conclusion:** These findings suggest that interventions should involve both fathers and mothers with a focus on nutrition education in promoting responsive feeding, such as minimising use of food, to calm children. Additionally, efforts to ensure good nutrition before and during pregnancy to achieve ideal birth weight are equally important.

Keywords: body mass index; children; fathers; feeding behaviours; mothers

INTRODUCTION

Globally, the prevalence of wasting (too thin for height) among children under five is 6.9% (47 million), whereas for overweight, it is 5.6% (38 million) UNICEF/WHO/World Bank Group, 2020). Malnutrition among children is the leading factor in morbidity and mortality globally, and the double burden of malnutrition is one of the barriers to economic growth in becoming a developed nation (IPH, 2019). The prevalences of wasting and overweight among Malaysian children under five are 9.7% and 5.6%, respectively, according to the National Health and Morbidity

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doi: https://doi.org/10.31246/mjn-2024-0043

Survey, NHMS 2019 (IIPH, 2020). Both global and national prevalences showed a higher prevalence of wasting than overweight in children. In a systematic review, the common factors of child malnutrition are maternal education, maternal nutritional status, child age, sanitation facility availability, household income, household size, birth order, and birth weight (Katoch, 2022). With limited literature on modifiable factors, there is a priority for further research.

The way both the father and mother relate to each other in childcare to attain joint decisions on child health outcomes is referred to as co-parenting (Abbass-Dick & Dennis, 2017). Feeding co-parenting is defined as parents relating to each other to determine their children's nutritional outcomes through feeding (Sherrard & Tan, 2022) and joint management of family dynamics (Feinberg, 2003). When both the father and mother are supportive in a feeding co-parenting relationship, there is more responsive feeding (Sherrard & Tan, 2022). Parents could exert influence through food parenting, such as persuasive feeding, and this may influence children's eating behaviours and weight status (Scaglioni *et al.*, 2018). Most research is primarily focused on mothers rather than on fathers or both fathers and mothers. Moreover, this early age group of 6-36 months has not been given much attention. The focus on children aged 6-36 months is much needed as it represents a continuum of development as children transition from milk to a diversified diet, which is influenced by parental feeding and the complex interplay between parent and children.

The present study aimed to determine the association between parental factors and body mass index (BMI)-for-age *z*-score (BAZ) of children aged 6-36 months in Malaysia. Identifying these factors could provide an opportunity for earlier intervention in improving child well-being and promoting the development of healthy growth, as well as for guiding clinical practice among public health professionals.

MATERIALS AND METHODS

Study setting and design

This cross-sectional study was conducted between March 23 and August 27, 2021, during Malaysia's transition to the Conditional Movement Control Order and National COVID-19 Immunisation Programme. The present study used voluntary response sampling. Minimum sample size calculation in the present study was determined by using the multiple linear regression formula (Milton, 1986). A sample size of 644 respondents was required after adjusting for the estimated sample size effect. A pre-test was performed on 30 respondents to determine the clarity and understanding of the questionnaire, the completion time for the questionnaire, and to identify possible problems (Perneger *et al.*, 2015). A total of 648 eligible respondents participated in the present study. The completion rate was 43.5% (282 out of 648 families). Upon receiving permission to conduct the present study, the researcher contacted the government nutritionists in Malaysia through the Nutritionist *KKM* Telegram group to disseminate information related to nutrition among nutritionists nationwide. A brochure comprising of the advertisement for subject recruitment, information sheet, and informed consent form were made available in hardcopy and internet link via a quick response (QR) code to reach out to potential study participants. The present study was conducted using an online questionnaire (Google Form) covering 13 states and three territories in Malaysia.

If one of the parents with a child aged 6-36 months (singleton) was

present at the clinic, the parent was asked to complete the informed consent. After consenting to participate in the study, both the father and mother were asked to complete the self-administered online questionnaire, respectively. Upon completion of the questionnaire, respondents were given a token of appreciation. If the parents had multiple children within the age range of 6-36 months, the youngest child was used as the reference when answering the questionnaire. Parents were Malaysian citizens who owned a smartphone or computer with internet accessibility to complete the questionnaire. Children with disabilities, born pre-term, and with a single parent were excluded. The inclusion and exclusion criteria were stated in the information sheet.

Permission to conduct this study was obtained from the Ethics Committee for Research Involving Human Subjects, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia (JKEUPM-2020-409). Ethical approval for this study was obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (NMRR-20-2176-55322 IIR).

Study instruments

The questionnaire comprised four (4) sections. In the first section, socio-demographic factors, such as age, ethnicity, childcare, education, occupation, monthly household income, and household members, were included. In the second section, body weight status information, such as children's weight, length, BAZ, parental weight, height, BMI, as well as maternal pre-pregnancy weight, BMI, and gestational weight gain, were obtained.

Mothers retrieved their child's weight and height information from the child's health record. According to the standard operating procedure at government clinics, weight is measured to the nearest 0.1kg, while length/ height is measured to the nearest 0.1cm. Mothers either filled in the information or uploaded a picture of the latest anthropometry readings from the health record when answering the questionnaire. The date of measurement was within the same month as the date they answered the questionnaire. Child's body weight status was determined using World Health Organization (WHO) 2006 Growth Standards (WHO, 2006). Mothers also filled in or uploaded a picture of their pre-pregnancy weight and gestational weight gain information from their antenatal health record. Direct measurements of weight and height were not feasible during the COVID-19 pandemic, therefore both fathers and mothers self-reported their height and weight. Mothers were further categorised as having excessive and non-excessive gestational weight gain (GWG) based on the recommended range of GWG (IOM, 2009).

Feeding co-parenting factors were measured using the Feeding Coparenting Scale (FCS) (Tan, Lumeng & Miller, 2019b). The FCS consisted of 13 items with three subscales to assess shared positive views and values (5 items), active engagement (4 items), and solo parenting (4 items). Both fathers and mothers responded to the items based on a five-point Likert scale, from (1) 'strongly disagree' to (5) 'strongly agree'. The items for solo parenting were reversely scored with (5) 'strongly disagree to (1) 'strongly agree'. Mean scores were calculated for each subscale. A higher value indicated greater endorsement of the subscale.

Parental feeding practices and structure factors were measured using the Feeding Practices and Structure Questionnaire (FPSQ) for infants and toddlers (Jansen *et al.,* 2021). This questionnaire can be used for infants who are currently milk-fed (18 items) or predominantly solid-fed (34 items). There were six subscales to assess non-

responsiveness in child feeding. Each item was rated on a five-point Likert scale, from (1) 'never' to (5) 'always'. The six subscales were feeding on demand, using food to calm, persuasive feeding, parent-led feeding, family meal environment, and using (non-)food rewards.

Feeding on demand was defined as children deciding the feeding time and having less routine (Jansen *et al.,* 2021). A lower score indicated feeding on demand, while a higher score meant structured meal timing. Using food to calm was (e.g., 'I feed my baby to make sure she/he does not unsettle/cry) to resolve emotion. Persuasive feeding was related to parents encouraging or pressuring their children to eat more, even when they show satiety cues. Parent-led feeding was when the parent decides how long or how much the child is fed (Jansen *et al.,* 2021). Family meal environment was related to the eating context whereby the family members are present and the child eats the same food as other family members (Jansen *et al.,* 2021). The mean scores for each subscale were averaged to obtain a single continuous score.

FCS and FPSQ in the present study demonstrated internal consistency reliability with Cronbach's alpha values of 0.85-0.90 and 0.51-0.93, respectively. A Cronbach's alpha range of between 0.45-0.98 is considered acceptable for a subscale with less than five items (Taber, 2018). The FCS has good internal consistency, with Cronbach's alphas ranging from 0.60-0.83 in the United States (Tan *et al.,* 2019b). The FPSQ also showed good internal reliability, with Cronbach's alpha values ranging from 0.71-0.92 in Australia (Jansen *et al.,* 2021). The FCS and FPSQ were validated in prior studies in the United States and Australia. Both FCS and FPSQ in the present study were validated using the content validity form. A minimum item-level content validity index (I-CVI) of 0.78 for six experts and an average scale-level content validity index (SCVI/ Ave) of 0.90 or higher is recommended. All the items met the minimum I-CVI and SCVI/ Ave for both the FCS (0.97) and the FPSQ (1.00).

Data analysis

Data were analysed using the IBM SPSS Statistics for Windows version 26.0 (IBM Corp., Armonk, NY, USA). Statistical significance level was set at $p<0.05$. Normality test was performed for continuous data. Descriptive results for normally distributed continuous variables were reported as mean and standard deviation (SD), while variables not normally distributed were reported as median and interquartile range (IQR).

Categorical variables were reported as frequency (*n*) and percentage (%). Associations of normally distributed continuous variables with BAZ were determined by Pearson's product-moment correlation (*r*) analysis, while associations of not normally distributed variables were determined by Spearman's rho correlation (*rs*) analysis. The multiple linear regression model tested all variables with a $p<0.25$ from the simple linear regression analysis (Hosmer, Lemeshow & Sturdivant, 2013). A total of 12 factors were tested in the multiple linear regression model, namely maternal ethnicity, paternal ethnicity, paternal occupation, birth weight, birth length, father using food to calm, maternal persuasive feeding, paternal persuasive feeding, paternal BMI, maternal BMI, maternal pre-pregnancy BMI, and paternal smoking status.

RESULTS

A total of 282 families who fulfilled all criteria have completed the survey.

Table 1 outlines the respondents' socio-demographic characteristics, revealing that more than half of the respondents were of Malay ethnicity. Majority of the children were aged 6-17 months old and nearly half of the families resided in Selangor. About two-thirds of the children had working parents, with 189 (67.0%) working mothers who indicated that they had maternity leave after childbirth. More than 70% of the parents had tertiary education and almost half were middle-income families.

Table 2 displays the body weight status of children and their parents. One in ten children was at risk of overweight. The prevalence of wasting (6.1%) among children was higher when compared to the prevalence of overweight (3.9%). More than half of the fathers (57.4%) were overweight and obese, while only one-third of the mothers (33.3%) were overweight and obese. In reference to the Institute of Medicine recommendations (IOM, 2009), there were more mothers who had inadequate gestational weight gain (51.1%) as compared to excessive gestational weight gain (22.3%).

Table 3 displays the association of parental feeding factors with BAZ of children. Both paternal and maternal feeding co-parenting factors were not significantly associated with BAZ of children in the present study. Both fathers and mothers in the present study shared positive views and values, and actively engaged in feeding-related tasks, as indicated by their high mean scores on these variables. The two factors – father using food to calm, and maternal persuasive feeding – were inversely associated with the BAZ of children.

Table 4 shows the association of parental body weight status factors with BAZ of children. Maternal and paternal weights were positively associated with BAZ of children ($p<0.05$). Table 5 shows the multiple linear regression model computed using the stepwise variable selection method. Higher child's birth weight, less frequent use of food to calm by fathers, higher maternal BMI, and non-Malay mothers significantly contributed to higher BAZ among children aged 6-36 months. All significant factors explained 12.4% of the variances in BAZ among children in the present study.

DISCUSSION

In this study, a total of 224 children (almost eight out of ten) had normal body weight status, while one in ten children (14.5%) was at possible risk of overweight, overweight, and obesity. The prevalence of at-risk overweight, overweight, and obesity among children was 10.7%, 2.8%, and 1.1%, respectively, while wasting and severe wasting was 5.7% and 0.4%, respectively. These findings are similar to the global trend, where the prevalence of overweight continues to increase, with obesity tripling from 1975 to 2016 (LBD Double Burden of Malnutrition Collaborators, 2020). The national data in Malaysia, based on the National Health and Morbidity Health Survey in 2019, showed that the prevalence of wasting (9.7%) was higher than the prevalence of overweight (5.6%) in children (IPH, 2020). However, in the present study, the prevalence of wasting (6.1%) was lower, while the prevalence of possible risk of being overweight (10.6%) was higher than overweight (2.8%) and obesity (1.1%).

The present study found that higher birth weight, less frequent use of food to calm by fathers, higher maternal BMI, and non-Malay mothers significantly contributed to higher BAZ among children aged 6-36 months. The association between higher birth weight and increased BAZ in early childhood is well documented, according to a

Table 1. Socio-demographic characteristics of respondents (*N*=282)

Characteristics	*n*	*%*	*Mean±SD/Median (IQR)*
Age (months)	282	100	16.0±8.6
6-11	111	39.4	
12-17	66	23.4	
18-23	49	17.4	
24-36	56	19.8	
Ethnicity			
Malay	176	62.4	
Chinese	81	28.7	
Indian	16	5.7	
Other Bumiputera	7	2.5	
Others (Punjabi, Sino Dusun)	2	0.7	
Gestational age (weeks)			38.5±1.1
Childcare			
Own care	120	42.6	
Formal care (center/nursery)	48	17.0	
Informal care (non-relative)	69	24.4	
Relative care (grandparents etc.)	45	16.0	
Paternal age (years)			34.3±5.3
Maternal age (years)			32.4±4.3
Paternal ethnicity			
Malay	176	62.4	
Chinese	81	28.7	
Indian	16	5.7	
Other Bumiputera	7	2.5	
Others (Punjabi, Sino Dusun)	2	0.7	
Maternal ethnicity			
Malay	176	62.4	
Chinese	87	30.8	
Indian	14	5.0	
Other Bumiputera	4	1.4	
Others (Punjabi, Sino Dusun)	1	0.4	
Paternal education			
Tertiary	215	76.3	
Secondary	63	22.3	
Primary	4	1.4	
Maternal education			
Tertiary	251	89.0	
Secondary	31	11.0	
Paternal occupation			
Private sector	167	59.2	
Public sector	56	19.9	
Self-employed	52	18.4	
Unemployed	7	2.5	
Maternal occupation			
Unemployed/ housewife	91	32.3	
Public sector	91	32.3	
Private sector	84	29.8	
Self-employed	16	5.6	
Maternity leave (months) *n*=189[†]			3.0 (0.0)[‡]
> 3 months or has not returned to work	26	9.2	
≤ 3 months	163	57.8	
Monthly household income (MYR)			6000.00 (6272.25)[‡]
Low, B40 (< RM 4,850)	107	37.9	
Middle, M40 (RM 4,850 – RM 10,959)	131	46.5	
High, T20 (> RM 10960)	44	15.6	
Household members			4.0 (2.0)[‡]

MYR: Malaysian Ringgit, USD 1 = MYR 4.20 as per 9 July 2022
[†]number of working mothers who reported that they had maternity leave
[‡]median (IQR)

Table 2. Distribution of the body weight status of children and parents (*N*=282)

Characteristics	*Mean±SD*	*n (%)*
Children		
Weight (kg)	9.4±2.0	
Length or height (cm)	75.8±8.3	
BMI-for-age z-score, BAZ	-0.27±1.22	
Severely wasted		1 (0.4)
Wasted		16 (5.7)
Normal		224 (79.4)
At risk of overweight		30 (10.6)
Overweight		8 (2.8)
Obesity		3 (1.1)
Child's birth history factors		
Birth weight (g)	3007.6±402.1	
Low birth weight (<2500g)	25 (8.9)	
Normal birth weight	255 (90.4)	
Large for gestational age (>4000g)	2 (0.7)	
Birth length (cm)	49.5±2.5	
Parents		
Paternal weight (kg)	77.1±14.7	
Paternal height (cm)	170.7±6.8	
Paternal BMI (kg/m^2)	26.5±4.8	
Underweight (<18.5)		5 (1.8)
Normal (18.5-24.9)		115 (40.8)
Overweight (≥25.0)		101 (35.8)
Obesity (≥ 30.0)		61 (21.6)
Maternal weight (kg)	58.5±12.4	
Maternal height (cm)	157.3±5.5	
Maternal BMI (kg/m2)	23.7±4.8	
Underweight (<18.5)		30 (10.6)
Normal (18.5-24.9)		158 (56.0)
Overweight (≥25.0)		62 (22.0)
Obesity (≥ 30.0)		32 (11.4)
Maternal pre-pregnancy weight (kg)	56.8±11.6	
Maternal pre-pregnancy BMI (kg/m^2)	22.9±4.4	
Underweight (<18.5)		37 (13.1)
Normal (18.5-24.9)		170 (60.3)
Overweight (≥25.0)		55 (19.5)
Obesity (≥ 30.0)		20 (7.1)
Maternal weight before delivery (kg)	67.6±12.7	
Gestational weight gain, GWG (kg)	10.9±4.9	
Excessive GWG		63 (22.3)
Non-excessive GWG		219 (77.7)
Adequate GWG		75 (26.6)
Inadequate GWG		144 (51.1)

BMI: Body mass index; GWG: Gestational weight gain

Table 3. Association of parental feeding factors with BAZ of children (*N*=282)

Parental feeding factors	*Mean±SD/ Median (IQR)*	*r*	*p*
Feeding co-parenting factors			
Paternal shared positive views and values	4.00 (1.25)[a]	-0.012[a]	0.842
Paternal active engagement	4.12±0.76	-0.052	0.383
Paternal solo parenting	3.18±0.96	-0.003	0.961
Maternal shared positive views and values	4.60 (1.00)[a]	0.039[a]	0.516
Maternal active engagement	4.21±0.74	-0.019	0.746
Maternal solo parenting	2.19±0.93	-0.055	0.353
Feeding practices and structure factors			
Paternal feeding on demand vs feeding routine	3.61±0.70	-0.023	0.702
Father using food to calm	2.66±1.09	-0.131	0.028
Paternal persuasive feeding	3.27±0.99	-0.107	0.073
Paternal parent-led feeding	2.94±0.83	-0.054	0.363
Paternal family meal environment	3.80±0.97	-0.129	0.106
Father using (non-)food rewards	2.81±1.07	-0.125	0.108
Maternal feeding on demand vs feeding routine	3.51±0.51	-0.064	0.285
Mother using food to calm	2.69±0.98	-0.028	0.634
Maternal persuasive feeding	3.42±0.93	-0.119	0.045
Maternal parent-led feeding	3.20±0.92	0.012	0.843
Maternal family meal environment	3.87±0.91	-0.067	0.406
Mother using (non-)food rewards	2.80±1.02	-0.002	0.980

[a]median (IQR). Spearman's rho correlation (r^s)

systematic review (Ziauddeen *et al.,* 2018). Birth weight is associated with adult overweight (Adair *et al.,* 2013). Higher birth weight reflects better prenatal nutrition and health, which can predispose children to greater weight gain postnatally, emphasising the importance of the first 1000 days in life. Hence, proper nutrition and care during the first 1000 days can lower the risk of developing chronic diseases, such as diabetes, hypertension, and heart diseases, later in life.

The present study found that father's use of food to calm was negatively associated with BAZ in children. This suggests that when parents use food to soothe their children, it might regulate their negative emotions and overall food intake, which is more commonly found among children with lower BAZ. This aligns with previous findings, such as the GUSTO study, where mothers similarly used food to calm fussy children (Quah *et al.*, 2016). The Generation R population-based birth cohort study in the Netherlands also showed that parents calming their child with food was prospectively associated with children's BAZ (Jansen *et al.,* 2019). Understanding these dynamics is crucial for developing effective interventions to promote healthy eating behaviours and weight in children, as using food to calm children is associated with food responsiveness in a cohort study in the United States (Temmen *et al.*, 2021).

Higher maternal BMI in the present study also emerged as a significant predictor of higher BAZ in children. This finding is supported by a systematic review, which reported that mothers who were obese had 264% higher odds of having an obese child (Heslehurst *et*

Table 4. Association of parental body weight status factors with BAZ of children (*n*=282)

Parental body weight status	*Mean±SD*	*r*	*p*
Paternal weight (kg)	77.1±14.7	0.120	0.044
Paternal height (cm)	170.7±6.8	0.096	0.108
Paternal BMI (kg/m^2)	26.5±4.8	0.069	0.251
Maternal weight (kg)	58.5±12.4	0.155	0.009
Maternal height (cm)	157.3±5.5	0.088	0.141
Maternal BMI (kg/m^2)	23.7±4.8	0.115	0.053
Maternal pre-pregnancy BMI (kg/m^2)	22.9±4.4	0.107	0.073
Maternal GWG (kg)	10.9±4.9	0.041	0.495

BAZ: BMI-for-age *z*-score; BMI: Body mass index; GWG: Gestational weight gain

al., 2019). The present study found that higher maternal BMI, but not paternal BMI, contributed to higher BAZ in children, likely due to prenatal and early postnatal influences on the growth of children (Leonard *et al.,* 2017). Excessive gestational weight gain is often associated with a higher risk of children being born large for gestational age (LGA) (Ferraro *et al.,* 2012), which can lead to increased BAZ in later childhood (Salahuddin *et al.,* 2017). One in three mothers (33.4%) in the present study were overweight and obese. Mothers with higher BMI may share genetic predispositions with their children, as maternal BMI has been positively correlated with child BAZ (Hsu *et al.,* 2022). In another study that determined the factors associated with BAZ of children, parental BMI, birth weight, and milk product serving size were associated with BAZ, whereas household size was negatively associated with BAZ among Malaysian children aged 12 years in a cross-sectional study in Terengganu (Ahmad *et al.,* 2021). The significant predictors explained 13.1% of the variances in children's BAZ (Ahmad *et al.,* 2021). This may result in unhealthy weight across generations due to inherited genetic traits and behavioural pathways via modelling of dietary and lifestyle behaviours.

A systematic review of 47 cross-sectional and cohort studies in Malaysia found Malaysian males to be more prone to overweight than females (Tan *et al.,* 2019c). Similarly, in the USM pregnancy cohort study, more fathers (42.2%) were overweight compared to mothers (25.0%) (Zalbahar *et al.,* 2016). This aligns with the present study, which also showed more overweight and obese fathers than mothers. This disparity can be attributed to sociocultural, lifestyle, and healthcare-related factors; men

Table 5. Factors contributing towards BAZ using multiple linear regression (*N*=282)

Factors	*Adjusted B*	*SE*	*Beta*	*t*	*95% CI*	*P*
Intercept	-3.282	0.618				
Child's birth weight	0.814	0.170	0.271	4.78	0.479, 1.148	<0.001
Father using food to calm	-0.141	0.066	-0.127	-2.12	-0.272, -0.010	0.035
Maternal BMI	0.035	0.015	0.136	-2.33	0.005, 0.064	0.021
Maternal ethnicity	0.304	0.151	0.121	2.01	0.006, 0.601	0.045

SE: Standard error, CI: Confidence interval, B: Unstandardised coefficient, Beta: Standardised coefficient

F(4, 277) = 9.758, p<0.001; Durbin-Watson = 1.881; variable selection method: stepwise R^2=12.4%; Homoscedasticity, normality and linearity of the model was checked, and model assumptions were met.

may consume higher calories and have fewer household activities after work, while women might be more proactive in seeking health intervention and concerned about body weight perception.

Lastly, the present study found that non-Malay mothers were more likely to have children with higher BAZ. A previous cross-sectional study showed that Chinese and Malay children living in welfare homes in Malaysia tended to have higher BAZ (Rahim *et al.,* 2019). These findings may reflect cultural, socio-economic or lifestyle differences influencing dietary and physical activity behaviours. Further studies in different ethnic cultures are warranted to provide insights into the similarities and differences inherent across cultures regarding eating behaviours related to body weight status in children.

Interventions should thus be culturally tailored, educating parents about healthy emotional regulation strategies and promoting positive feeding practices. The broader implications of these findings underscore the need for public health policies that support family-based interventions to prevent childhood obesity. Future research should aim to explore the causality and long-term impacts of these practices through longitudinal and interventional studies, providing a clearer understanding of how to address this issue at the familial and societal levels effectively (Wolstenholme, Hennessy & Heary 2020). These additional points will make the discussion more robust and provide a well-rounded perspective on the findings, implications, and future directions.

The low variances explained by the factors in the present study could be due to other factors not included in the present study, such as nutritional intake, environmental factors, individual variability of the child's temperaments, and non-parental caregivers. The other contributing factors may include child's age, sex, food responsiveness, satiety responsiveness, and parental BMI, which explained 5.7% of the variances in BAZ in a cross-sectional study among Australian children aged 2-5 years (Boswell, Byrne & Davies, 2017). Child's sex, parental BMI, household income, restriction and pressure to eat were significant factors that explained 15.6% of the variances in BAZ among Thai children aged 9-12 years (Yamborisut *et al.,* 2018). Food responsiveness and sleep duration explained the higher BAZ among American children at 6 years old in a cohort study (McCurdy *et al.,* 2019).

The co-parenting feeding factors were not associated with BAZ in the present study. The results from the present study provided baseline information on feeding co-parenting, closing existing knowledge gaps in this area of interest. Despite traditional gender roles, mothers are often seen as the primary caregiver; however, there is a growing trend towards more egalitarian parenting as socio-economic changes and increased awareness of gender equality influence family structure. In the present study, mothers showed similar positive views aligned with fathers, while fathers were actively engaged with mothers in guiding children's feeding. It was shown that when a mother sees her partner equally involved in child feeding, her primary caregiver's role in feeding may be reduced (Tan *et al.,* 2019a). Mothers in the present study scored lower in solo parenting as they perceived their partner helping with the feeding task. It is unknown whether the lack of association was due to other confounders or due to null findings in the present study.

There were limitations in the present study. Firstly, causality cannot be inferred from the results due to the cross-sectional study design. Secondly, the sample was not representative of all Malaysian parents and children, as

selection bias might have occurred due to the voluntary response sampling method used for data collection via an online survey during the COVID-19 pandemic, which measured the proportions in the study sample only. Thirdly, the present study relied on self-reported parental weight and height, which might not be as accurate as direct measurements. Despite these limitations, the present study provided insights into the contributing factors to body weight status in children aged 6-36 months, which is important considering the lack of research regarding the role of parents in this age group in Malaysia.

CONCLUSION

Higher birth weight, less frequent use of food to calm by fathers, higher maternal BMI, and non-Malay mothers significantly contributed to higher BAZ of children. These findings suggest that interventions should involve both fathers and mothers. For example, intervention could focus on nutrition education in promoting responsive feeding, such as minimising the use of food to calm children. Intervention efforts could also ensure good nutrition before and during pregnancy to achieve the ideal birth weight. Further research to determine the causal effects of these significant factors is recommended.

Acknowledgements

We thank all parents for their cooperation and those who have helped directly and indirectly during data collection. The authors would like to thank the Director-General of Health, Malaysia for his permission to publish this article.

Authors' contributions

Chin YS, conceptualised and designed the study, reviewed the manuscript, supervised data collection, data analysis and interpretation; Wong HJ, conceptualised and designed the study, conducted the study, data collection, data analysis, data interpretation, and prepared the draft of the manuscript; Lim PY, reviewed the manuscript and supervised data analysis and interpretation; Tan CC, reviewed the manuscript, supervised data analysis and interpretation.

Conflicts of interest

The authors declare no conflicts of interest.

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