

## Higher Parental Age and Lower Educational Level are Associated with Underweight among Preschool Children in Terengganu, Malaysia

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### ABSTRACT

This cross-sectional study aimed to investigate the determinants of underweight among preschool children. A total of 218 preschool children were enrolled. Their sociodemographic data were collected using self-reported questionnaires whilst body weight and height were measured, recorded and the BMI for-age z-score was calculated using WHO AnthroPlus software. Of all preschool children participants, 47.7% were male and 53.3% were female. Most of them were Malays (99.5%), aged 4 to <5 years (40.8%) and came from low-income household (92.7%). Overall, the prevalence of underweight, normal, overweight and obese was 17.9%, 73.8%, 4.6% and 3.7% respectively. The underweight prevalence was higher than the national prevalence (13.7%). Of all parent participants, 12.4% were male and 87.6% were female. Most of them aged 30–39 years (55.5%) and did not hold a degree (89.4%). Multivariate logistic regression showed that parental age and their level of education were the determinants of childhood underweight. The risk of being underweight increased with the age of parents ( $p=0.033$ ) and lower level of education of parents ( $p=0.042$ ). In conclusion, this study found that underweight among preschool children was mainly associated with parental factors. Hence, designing a special nutritional intervention program involving older parents and lower education levels could overcome this problem.

**Keywords:** children, education level, older parental age, underweight

### INTRODUCTION

Malnutrition is defined as deficiencies or excesses in nutrient intake (WHO 2021). It consists of undernutrition, overweight and obesity. Undernutrition is preventable, but it remains a major public health issue as it has been associated with 45% or 3 million deaths of

children worldwide (Tan *et al.* 2021; WHO 2021). There are four broad forms of undernutrition—underweight, wasting, stunting and micronutrient deficiencies. Underweight refers to low weight-for-age (WHO 2021). A child's BMI z-score category of <-2SD is classified as underweight (WHO 2019). Childhood underweight has long-lasting implications. Apart from being responsible

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for the highest mortality rate in children, it also linked to poor mental development and school achievement as well as abnormal behaviour. Later in adulthood, it is related to increased risk of several psychiatric disorder and reduced capacity for manual work. Besides the health consequences, undernutrition also affects the economy. Through poor physical condition and learning deficits, there will be loss of productivity. Nonetheless, undernutrition also increases expenses. This will hinder the economic development and prolong poverty (Martins *et al.* 2011).

Among the significant risk factors of underweight are child age, gender, illness, maternal education and household income (Tosheno *et al.* 2017). Children at an early age are more likely to be underweight and the prevalence is higher in males (Khambalia *et al.* 2012). In some studies, children who experience illness had an increased chance of being underweight (Tosheno *et al.* 2017; Menalu *et al.* 2021). However, a child of a mother who had a diploma or higher education level is less likely to be underweight. A significantly lower prevalence of underweight children was also reported in families with higher monthly per capita income (Tosheno *et al.* 2017).

During the last two decades, childhood underweight problems in the less developed Asian countries have been increasing (Mak & Tan 2012). In Malaysia, the prevalence of underweight among children under 5 years old was 13.7% (NHMS 2016) and it persisted in the poor rural areas (Baharudin *et al.* 2019). As evidence-based-practice leads to quality intervention, this study aims to determine the prevalence and investigate the determinants of underweight in preschool children to offer additional evidence for future intervention planning.

## METHODS

### Design, location, and time

Malaysia is a Southeast Asian country. It includes Peninsular Malaysia or West Malaysia and East Malaysia which is located on the island of Borneo. There are 13 states and a federal territory which covers an area of 333,000 square kilometres (Bowden *et al.* 2013). The east coast region or the peninsular's cultural heartland consists of three states including Terengganu. Terengganu was selected for this study primarily because of lack of data from this area. The preschools were set up

by the Department of Community Development (KEMAS) of the Ministry of Rural Development. These public preschools provide early childhood education for children aged 4 to 6 years. Funded by the Ministry of Rural Development, the preschools followed the National Preschool Curriculum since 2003 (Abu Bakar 2016).

This cross-sectional study was conducted from April to September 2019. There were 28 preschools involved in this study. Each was managed by a teacher and an assistant. They were contacted to set the date and time available for every meeting. During the first meeting, they were explained further about this study and given sets of questionnaires to be taken home by the children and filled in by their parents. In this study, parents refer to either father or mother of preschool children. During the second meeting, all children and parent participants gathered and completed any incomplete section in the questionnaires. Their anthropometry measurements were taken by trained enumerators. This study was approved by The Human Research Ethics Committee. The permission to carry out this study at the preschools was obtained from the Ministry of Rural Development Malaysia (KEMAS.BPAK 620-02/01/01 Jld 6 (28)).

### Sampling

Terengganu is divided into 8 districts. By using the lottery method of simple random sampling, three districts – Besut, Kemaman and Kuala Nerus were chosen as study locations. A list of public preschools was obtained and 10 preschools which situated in each district were chosen randomly. Out of 30, only 28 preschools were included. The remaining 2 were excluded due to permanent closure and participation reluctance. Preschool children participants' recruitment was based on having a parental participation. We included preschool children aged 3 to younger than 7 years old. Preschool children or parents with physical and mental disabilities and pregnant mothers were excluded. The sample size (n) was calculated using the single proportion formula for prevalence (Naing *et al.* 2006; Arifin 2013).

$$n = \frac{Z^2 P (1 - P)}{d^2}$$

For  $\alpha=0.05$ ,  $z=1.96$  for a two-tailed test. The expected prevalence (p) was 13.7% and the precision (d) was 0.05. By including dropout

of 20%, a minimum of 218 participants were included.

Of all 350 questionnaires distributed, 220 were returned. But 2 of them were incomplete, resulting in a response of only 218 preschool children. They were 104 males and 114 females aged 39 to 77 months old whilst their parents or legal guardians were 28 males and 190 females aged 21 to 63 years old.

#### **Data collection**

Sociodemographic data were collected using a set of self-reported questionnaires which was developed based on several validated questionnaire from previous studies (Katzmarzyk *et al.* 2013; Norimah *et al.* 2014). The questionnaire consisted of 10 sections. It was available in both Malay and English languages.

All participants' height and weight were taken and recorded by trained enumerators in duplicate to ensure accuracy. Their height was measured to the nearest 0.1 cm using a Seca 213 portable stadiometer without shoes (Seca, Germany) whilst weight was measured to the nearest 0.1 kg using a calibrated Tanita body composition analyzer (TANITA, Japan). The children BMI for-age z-score was calculated using the WHO AnthroPlus software, Version 1.0.4 anthropometric calculator. Data such as the date of measurement, participant's gender, date of birth, participant's weight and height were entered to calculate BMI. Categories of BMI z-scores for children were defined as follows: underweight,  $\leq 2SD$ ; normal,  $-2SD$  to  $+1SD$ ; overweight,  $>1SD$  to  $+2SD$ ; and obese,  $\geq 2SD$  (WHO 2019). The parents' BMI was obtained from the body composition analyser. Parents' BMI results were categorized as follows: underweight,  $<18.5$ ; normal,  $18.5-24.9$ ; overweight,  $25-29.9$ ; obese class I,  $30-34.9$ ; obese class II,  $35-39.9$ ; and obese class III,  $\geq 40$ .

#### **Data analysis**

All data were analysed using IBM SPSS Statistics for Windows software, Version 22.0 (IBM Corporation, Armonk, New York, USA) licensed to Universiti Sains Malaysia. Descriptive statistics were used to describe most of the participants' characteristics in means and their standard deviation or prevalence percentage. The normal distribution was tested by using the Kolmogorov-Smirnov. An independent t-test was

used to test the difference of mean of the variables. For logistic regression analysis, underweight children were coded as 1; and normal, overweight or obese children were coded as 0. One-way Univariate Analysis of Variance (ANOVA) was used to assess the relationship between age of parents and level of education. In binary logistic regression analysis, each determinant factor having a  $p < 0.25$  was considered for multivariable analysis. Adjusted odds ratios (aOR) with a 95% Confidence Interval (CI) were calculated for predictor variables with  $p \leq 0.05$  was considered as statistically significant.

## **RESULTS AND DISCUSSION**

Table 1 shows sociodemographic characteristics of 218 preschool children with a mean age of  $5 \pm 1$  years old, ranging from 3 to younger than 7 years old. More than half of the children were female (52.3%) and had  $3 \pm 1$  number of siblings. Most children had normal birth weight (89.9%) and were delivered full term or post term (87.6%). The mean duration of breastfeeding and formula feeding were  $16 \pm 11$  and  $20 \pm 19$  months respectively. The duration of breastfeeding in this study was comparable with previous study ( $15.0 \pm 7.6$  months) (Noraida *et al.* 2017). Our findings show that children are introduced to eat solid foods at the age of  $6 \pm 2$  months, which is acceptable. There is growing evidence of the importance of complementary feeding that may affect both short- and long-term effects on optimal growth, body composition, neurodevelopment, and healthy food preferences (Campoy *et al.* 2018).

Table 2 represents the sociodemographic data of parents with mean age of  $35 \pm 7$  years old. Most of them had secondary school education both among fathers (63.0%) and mothers (57.6%). Most fathers were working (92.6%) whilst majority of mothers were not working (66.0%). The mean number of dependent and household members was  $4 \pm 1$  and  $5 \pm 1$  respectively. Most parents reported a monthly income of less than RM4,851 (USD1,158), (92.7%). It was reported that majority of fathers had a normal BMI (51.9%). In contrast, mothers were more prevalence (53.9%) of being overweight or obese.

Overall, the prevalence of underweight, normal, overweight and obese among the children were 17.9%, 73.8%, 4.6% and 3.7% respectively

Table 1. Sociodemographic distribution of preschool children in Terengganu

Variable	n=218 (%)	Mean±SD
Gender of preschool children		
Male	104 (47.7)	
Female	114 (52.3)	
Age, years		5±1 (3–6 years)
<4	19 (8.7)	
4–<5	89 (40.8)	
5–<6	77 (35.3)	
6–<7	33 (15.1)	
Number of siblings		3±1
<2	84 (38.5)	
≥2	134 (61.5)	
Birth weight		
Normal	196 (89.9)	
LBW/VLBW/ELBW	22 (10.1)	
Birth category		
Post term/full term	191 (87.6)	
Moderate to late term/ very preterm/ extremely preterm	27 (12.4)	
Duration of breastfeeding, months		16±11
Duration of formula feeding, months		20±19
Age starts solid food, months		6±2

LBW: Low Birth Weight; VLBW: Very Low Birth Weight; ELBW: Extremely Low Birth Weight

(Table 3). Our finding on underweight prevalence was much higher compared to the national prevalence which was 14% (NHMS 2019). The discrepancies may be due to the national data including the general population while our study focuses only on preschool children on the east coast of Peninsular Malaysia. Lee *et al.* (2021) also reported a lower prevalence of underweight among preschool children as compared to this study. The lower prevalence was due to previous study involve preschool children living in the urban capital city of Malaysia. However, children

from rural area located at Tuba Island reported a slightly higher prevalence of underweight which was 22.4% (Salleh *et al.* 2021). The skewed improvement in certain places while other places remained stagnant might be attributable to the range of strategies and implementations done by the government. Though the prevalence of underweight has decreased over the past decades, close monitoring is needed to ensure Malaysian children are able to grow healthily. This study was in line with previous study by Lee *et al.* (2021) which showed no difference in BMI classification of male and female preschool children.

In multivariate logistic regression, variables with  $p < 0.25$  in binary logistic regression such as age of preschool children, birth weight, age of parents, education level and BMI of parents were included into the model (Table 4). In the final model, only the age of parents and education level were found to be significant determinants of underweight. However, there was no significant relationship between age of parents and education level (one-way ANOVA,  $F=2.054$ ,  $p=0.131$ ). As the age of parents increases, there is a 1.065 times higher risk of preschool children to be underweight ( $p=0.033$ ;  $OR=1.065$ ;  $95\% CI:1.005-1.129$ ). Previous study has highlighted the role of caregiver or parent as one of the most relevant explanatory variables of children’s health issues (Khattak *et al.* 2017). As parents age, the children have more risk of being underweight. This scenario may be due to increased commitment and burden among caregivers, resulting in less time spent to feed children. Previous research has found that levels of housework, combined with having more children and increased parenting responsibilities from work, often contribute to women's physical discomfort (Owoo & Lambon-Quayefio 2021). Lack of food quality, poor child feeding, and care practices are often thought to be the primary causes of child malnutrition (Chowdhury *et al.* 2016). It was found that the parenting practices will determine the extent, quality, quantity and manner of children on food (Vollmer & Baietto 2017). Parental responsibility is one of the main reasons for insufficient duration of breastfeeding or complementary feeding. Parents need to take the time to learn parenting practices related to responsiveness to the child's needs (Vollmer 2019).

In addition, parents with a lower level of education were reported to have a 4.383 times

*Determinant of underweight among preschool children in Malaysia*

Table 2. Sociodemographic distribution of parents in Terengganu (n=218)

Variable	Father		Mothers		Parents	
	n (%)	Mean±SD	n (%)	Mean±SD	n (%)	Mean±SD
Age, years		36±8		35±6		35±7
Education level						
Primary	1 (3.7)		10 (5.2)		11 (5.0)	
Secondary	17 (63.0)		110 (57.6)		127 (58.3)	
Tertiary	9 (33.3)		71 (37.2)		80 (36.7)	
Employment status						
Working	25 (92.6)		65 (34.0)		90 (41.3)	
Not working	2 (7.4)		126 (66)		128 (58.7)	
Number of dependents					4±1	
Number of household member					5±1	
Household monthly income						
B40 (<RM4,851)	25 (92.6)	25 (92.6)		177 (92.7)		202 (92.7)
M40 (RM4,851–RM10,970)	2 (7.4)	2 (7.4)		14 (7.3)		16 (7.3)
Body mass index classification						
Underweight	1 (3.7)	1 (3.7)		13 (6.8)		14 (6.4)
Normal	14 (51.9)	14 (51.9)		75 (39.3)		89 (40.8)
Overweight/Obese	12 (44.4)	12 (44.4)		103 (53.9)		115 (52.8)

B40: Refers to the lowest 40% household income group with average monthly income below RM4,851 (USD:1,158); M40: Refers to the middle-income household group with average monthly income ranging from RM4,851 to RM10,970 (USD:1,158–2,619) according to Department of Statistics Malaysia (2020)

Table 3. Association between body mass index for age (BMI-for-age) and gender among preschool children

BMI-for-age	Male	Female	Total	Fisher's exact test	p
Underweight	20 (19.2)	19 (16.7)	39 (17.9)	2.942	0.401
Normal	74 (71.2)	87 (76.3)	161 (73.9)		
Overweight	4 (3.8)	6 (5.3)	10 (4.6)		
Obese	6 (5.8)	2 (1.8)	8 (3.7)		

No significant different at p>0.05 using fisher's exact test

higher risk for their children to be underweight (p=0.042; OR=4.383; 95% CI:1.054–18.232). This finding suggests the education level of parents is strong determinant of underweight. This is in line with previous study which found that being born into families/parents with low education level were associated with poor nutrition (wasting and underweight) compared to children born from university or college-educated families (Menalu *et al.* 2021). Parental education level is one of the important factors

for child development. Poor education levels increase vulnerability to food insecurity and can affect children's feeding (Abdul Talib *et al.* 2020). A better nutritional status leads to a lesser chance of having developmental delay (Huiracocha-Tutiven *et al.* 2019). Guidance for parents on balancing nutrition helps in engaging their children to achieve a healthy weight.

Despite the important findings to fill the knowledge gap about the phenomena in Terengganu, there are several limitations of this

Table 4. Determinants of underweight among preschool children and their parents

Determinant variables	Crude p	Adjusted p	AOR	95% CI	
				Lower limit	Upper limit
Gender of preschool children					
Male	0.622	-	-	-	-
Female					
Age, years					
<4	0.138	0.504	1.752	0.338	9.085
4-<5		0.190	2.262	0.669	7.659
5-<6		0.870	1.114	0.305	4.062
6-<7		Ref	Ref	Ref	Ref
Number of siblings	0.971	-	-	-	-
Birth weight					
Normal	0.241	Ref	Ref	Ref	Ref
LBW/VLBW/ELBW		0.085	2.567	0.879	7.492
Birth category					
Post term/Full term	0.254	-	-	-	-
Moderate to late term/very preterm/extremely preterm					
Duration of breastfeeding	0.716	-	-	-	-
Duration of formula feeding	0.535	-	-	-	-
Age starts solid food	0.351	-	-	-	-
Age of parents	0.089	0.033*	1.065	1.005	1.129
Education level of parents					
Primary	0.175	0.042*	4.384	1.054	18.232
Secondary		0.851	0.925	0.411	2.421
Tertiary		Ref	Ref	Ref	Ref
Employment status of parents					
Working	0.300	-	-	-	-
Not working					
Number of dependents	0.400	-	-	-	-
Number of household member	0.304	-	-	-	-
Household monthly income					
B40 (<RM4,851)	0.444	-	-	-	-
M40 (RM4,851–10,970)					
Body mass index classification of parents					
Underweight	0.244	0.844	1.162	0.261	5.183
Normal		0.904	1.053	0.458	2.421
Overweight/Obese		Ref	Ref	Ref	Ref

CI: Confidence Interval; AOR: Adjusted Odds Ratio; Ref: Reference Group; LBW: Low Birth Weight; VLBW: Very Low Birth Weight; ELBW: Extremely Low birth Weight; B40: Refers to the lowest 40% household income group with average monthly income below RM4,851 (USD:1,158); M40: Refers to the middle-income household group with average monthly ranging from RM4,851 to RM10,970 (USD:1,158–2,619) according to Department of Statistics Malaysia (2020); \*Significant at  $p < 0.05$  using multiple logistic regression; Variables with  $p < 0.25$  in the binary logistic analysis were included to the final model for adjustment (AOR)

study. As the sample population is specific, this study should be followed up by a large-scale study that includes all public and private preschools in all districts and states in Malaysia to improve its generalisability. In addition, this study used a cross-sectional design which limits causations. Nonetheless, our findings could provide an overview to alert the authorities for future targeted intervention. A more comprehensive study can be explored to gain a deeper understanding of underweight among preschool children.

### CONCLUSION

The higher prevalence of underweight among preschool children in Terengganu (17.9%) is higher than the national prevalence, raising national health concerns. Parental age and education level were identified as the risk factors. As underweight linked to negative outcomes, it is important to raise awareness and implement preventive measures targeting these factors in the population. There is a need to implement a special nutritional intervention program involving parents of older age and lower education levels to overcome this problem. There is also a need to track feeding practices to provide basic ideas for effective prevention. The potential and holistic strategy on childcare and child feeding may improve children's health and reduce the risk of underweight later in life.

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### DECLARATION OF INTERESTS

The authors have no conflict of interest.

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