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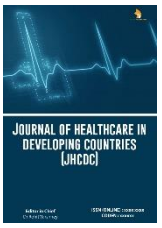

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RESEARCH ARTICLE

CHILDHOOD OVERWEIGHT AMONG UNDER FIVE IN PUTRAJAYA, MALAYSIA: THE CONTRIBUTING FACTORS

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ABSTRACT

Being overweight and obese during childhood increases the potential of becoming obese adults later in life. Therefore, this study aims to determine the factors associated with overweight (including obesity) among children under five years of age in Putrajaya, Malaysia. A total of 211 children with overweight cases were successfully recruited in this case-control study. The same number for control group which was normal children also being recruited by matching according to sex and age group with the case group. Data collection was performed by four approaches such as face-to-face interview, anthropometric measurements, finger prick for haemoglobin level and self-administered 3-day food diary. WHO Anthro software was used to determine the nutritional status of children. Descriptive statistic and logistic regression were performed to determine risk factors that contributed to overweight. Multiple logistic regressions showed overweight or obese father was 1.88 times more likely to have overweight children compared to normal BMI father. Mothers who had gestational diabetes mellitus (GDM) were 2.93 times more likely to have overweight children compared to those with no complication during pregnancy. Pregnant women who attended antenatal visits for less than 9 times were 3.33 times more likely to have overweight children compared to pregnant women who attended 9 to 14 times of antenatal visits. Children with fewer siblings were 2.10 times more likely to be overweight compared to children with four or more siblings. These findings indicated related risks factors contributing to childhood overweight from the early stages including maternal and paternal factors. Early life intervention especially during pregnancy stages which include antenatal care and antenatal intervention on dietary and physical activity during peri-conception period is seen to be important to prevent adverse pregnancy outcomes and further improve maternal and child's health. Hence it would be more effective to prevent childhood overweight or obesity in later age and its long-term consequences.

KEYWORDS

Overweight, obesity, Malaysia, children under five, case-control

1. INTRODUCTION

Malnutrition is a condition results from imbalance between nutrients required by the body and the nutrients it receives (Das, 2010). Childhood malnutrition is a major health concern in both developing and underdeveloped countries (Narayan et al., 2018). It is divided into two groups which are undernutrition and overnutrition. Undernutrition is defined as insufficiency or imbalance of nutrient intake by the body to meet its need and maintain a good health (Calder and Jackson, 2000). Undernutrition among children will further leads to stunting, wasting and underweight (De Onis et al., 2006). On the other hand, overnutrition is a state in which energy intake is oversupplied compared to energy required by the body contributing to increasing incidence of childhood overweight and obesity (Sahoo et al., 2015).

World Health Organization (WHO) has published growth standards for children from birth to 5 years of age. These international growth standards indicate how children should grow under optimal environmental conditions regardless of their ethnicity or socioeconomic status. There are height-for-age, weight-for-age, weight-for-length, weight-for-height and BMI-for-age. BMI-for-age is recommended as the screening tool for assessment of childhood overweight and obesity. Based on the BMI-for-age growth chart, children are categorized as overweight at above +2SD scores and obese at +3SD scores and above (WHO, 2006). The prevalence of overweight and obesity among children is increasing at an alarming rate. An estimated 38.2 million children under 5 years old were overweight or obese in 2019 according to WHO (WHO, 2020). This situation not only occurred in high-income countries but it also keep increasing in urban area of low- and middle-income countries (WHO, 2020). In Malaysia, the prevalence of overweight among children under five years old increased from 6.1% in 2011 to 6.4% in 2016 (Institute for Public Health, 2011; Institute for Public Health, 2016).

Federal Territory of Putrajaya is one of the urban areas in Malaysia. The Department of Statistics Malaysia estimated that 100 000 residents lived in Putrajaya in 2019 (Department of Statistic Malaysia, 2010). Putrajaya was chosen because it is an urban area and its residents are mostly employed full-time that they are lack of time to prepare healthy food. Hence, they have less control over the food eaten by their children and both parents and children depend more on outside food. Therefore, this study conducted to determine the factors associated with overweight children less than five years of age in Putrajaya, Malaysia. It is important to keep trace the trend of overweight and obesity in children because childhood obesity is associated with many serious health conditions (De

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Onis et al., 2010). Being overweight and obese during childhood increases the potential of becoming obese adults later in life. Besides, they are also more likely to have high blood pressure and high cholesterol which are one of the risk factors for cardiovascular diseases.

2. METHODOLOGY

2.1 Study Design

This was a case-control study to determine the factors associated with overweight among children below five years old in Putrajaya. The case group was overweight children with BMI-for-age more than 2SDs whereas the control group was normal weight children with BMI-for-age between the range of 2SDs to -2SDs. The ratio of cases to controls in this study was 1 to 1.

2.2 Study Location

This study was conducted in Putrajaya from September 2018 to January 2019. There were two phases involved in this study which were Phase I and Phase II. Phase I was the screening process (measuring their anthropometry) of 248 children which was conducted in preschools. It conducted in preschools and all four government health clinics in Putrajaya from 12 September 2018 to 12 October 2018 whereas Phase 2 was the interview process with the caregivers. The interview was conducted from 16 October 2018 to 31 January 2019 in an appropriate location according to the caregivers such as their homes, offices or public areas.

2.3 Study Population

The inclusion criteria for this study were children aged 6 to 59 months of age, Malaysian citizen and have been living in Putrajaya for at least 6 months. Children with chronic disease, mentally or physically disabled and ill at the time of data collection were excluded for this study.

2.4 Sample size estimation

Sample size was calculated based on the objective of this study which is to determine factors associated with overweight among children under five years old in Putrajaya. PS software was used to calculate the sample size by using the formula of comparing two proportions according to identified risk factors based on NHMS 2016 and other previous studies with α (type 1 error) equal to 0.05, β (power) equal to 0.80 and 1 to 1 ratio for case and control group. Based on the calculation, the minimum sample size for overweight respondents was 308 children. The same numbers of respondents were recruited for control group because a ratio of 1 to 1 was applied in for this study.

2.4.1 Respondent Recruitment

Respondents for both case and control groups were selected according to phase I result. The overweight respondents needed were randomly selected using random between function in excel. Then, the selected cases were tabulated by sex and age group (6 – 11 months, 12 – 35 months and 36 – 59 months). Respondents for the control group respondents were also randomly selected using the same function in excel that was applied in normal dataset by matching with sex and age group. Ethical approval of the study was obtained from Medical Research Ethic Committee (MREC), Ministry of Health Malaysia (NMRR-18-847-41455). All respondents signed the consent forms prior to participation in the study.

2.4.2 Questionnaires and tools

Data was collected for this study using four instruments which were a set of questionnaires pre-installed in tablet, anthropometric measurement, finger prick for haemoglobin levels, and three days food diary. There were seven modules included in a set of questionnaires which involved sociodemographic and socioeconomic characteristics, health and medical history of the respondent and his or her mother, knowledge and practice of parents or caregivers towards child's feeding, dietary behavior of the children, infant and young child feeding (IYCF) history, food insecurity security (Radimer/Cornell hunger and food security instrument) and screen time/physical activity. The children and their parents or caregivers' weight and height were measured using Tanita Personal scale HD 319 and SECA Stadiometer 213.

The results obtained for weight and height were rounded to the nearest 0.1 kg and 0.1 cm respectively. The SECA 354 digital baby scale was used to measure baby or children who cannot stand properly and SECA 210 mobile baby measuring mat was used for measuring their length. The parents and caregivers completed the three days food diary provided. The food diary was prepared to cover two days of weekday and one day of weekend. The food intake was noted and recorded by teachers at school during the preschool hours. All food recorded in the diary were probed and confirmed again by trained researchers before the data was sent to data entry team at central station at Institute for Public Health (IPH). The data entry team then calculated the total energy and nutrient intakes using NutritionistPro software. Apart from the three-day food diary, all data collected whether via face-to-face interview or measured using the tools were recorded into the designed application in the tablet straightforwardly. The application used was created by Survey Creating System (SCS), Institute for Public Health for data collection in the field work. It was integrated in Samsung Tablet S2.

2.4.3 Field Preparation and Logistic Support

A total of 6 teams carried out data collection for this study. Each team consisted of a team leader, a research assistant, and a nurse. Screening phase was held at preschools and government health clinics in Putrajaya. The preschools involved were listed by Department of Social Welfare and they were informed prior to the study. The parents and caregivers were given formal invitation letters through the managements to inform them that their children were selected for screening. Weight and height of the children were measured according to standard methods during the screening phase. Other basic information of the children'sprofile such as their name, date of birth, gender, parent's name, living address, and contact number of the parents were also obtained. The data collection teams also visited all four government health clinics in Putrajaya located in Precint 9, 11, 14 and 18.

The information on children's latest check-up (weight and height, name, birth of date, gender, name of parents, living address, and contact number of parents) were obtained from the patient management system or record books at the clinics. Data obtained from screening phase were compiled and duplicates were removed and children living outside of Putrajaya were excluded. The eligible cases and controls were identified using WHO Anthro Software. Based on age groups and sex, matched cases and controls matched were randomly chosen. After all cases and controls were identified, face-to-face interviews were conducted. Phone calls and home visits served as the medium to approach and recruit parents and caregivers of the selected respondents. Interview sessions were carried out at their homes. However, for those parents or caregivers who were unavailable or unable or reluctant to be interviewed at home, they could have the interview session at two government clinics which were established as the interview centres.

2.4.4 Data Management and Data Analysis

An identification number (ID) was given to every selected respondent during phase II data collection. The ID was a unique number consisted of precinct, number of households, number of children in household, code for case (A) or control (B), and binary code (0001) to represent overweight. Data collected and stored in the tablet were sent directly to IPH server located in Bangsar, Kuala Lumpur through internet. The data were monitored by a data manager in IPH to confirm all data has been received accordingly. The data were pulled out from the server in Microsoft excel format. The three-day food diaries were delivered to IPH weekly and the data entry team in IPH transformed the food intake reported into gram according to standard menu or recipe. Then, the data were converted into calorie and nutrition intake value based on Malaysian Food Composition Database (MyFCD) and another established database using NutritionistPro software 7.5. For all variables, descriptive statistics of the study population have been computed. The associated factors were identified by performing logistic regression. Each variable was estimated for its odds ratio (OR) and 95% confidence interval (CI). All possible factors were controlled by performing multiple logistic regressions. The factor was considered as a risk factor when the adjusted odds ratio (aOR) significantly ($p<0.05$) higher than 1.00. On the other hand, factor with aOR significantly ($p<0.05$) less than 1.00 was counted as a protective factor. The SPSS software version 23 was used to analyse all data statistically.

3. RESULTS

According to Table 1, there is a high percentage of overweight children among overweight mothers (68.7%) and overweight fathers (76.8%). Comparing between overweight and normal weight children, the percentage was similar as there is a higher percentage of overweight mothers (59.3%) and overweight fathers (66.8%) compared to normal weight mothers (37.9%) or normal weight fathers (26.5%). The percentages of overweight and normal weight children were found to be higher among parents with tertiary education compared to their primary/secondary education counterparts. Compared to normal weight

children, more overweight children were observed to have mothers and fathers with primary/secondary education, monthly household income threshold, there is a higher percentage of overweight children (63.5%) than normal weight children (52.6%) among the B40 group.

Mothers who were overweight/obese during pre-pregnancy period reported a higher percentage of having overweight children (45.5%) than normal weight children (36.5%). Excess weight gain during pregnancy also contributes to a higher percentage of overweight children (31.3%) than normal weight children (23.2%). Mothers who had gestational diabetes mellitus during pregnancy reported a higher percentage of overweight children (11.8%) than normal weight children (7.1%). A lesser number of antenatal visits during pregnancy contributes to a higher percentage of overweight children (8.1%) than normal weight children (4.3%). Pre-term babies resulted in a higher percentage of overweight children (8.5%) than normal weight children (6.6%). Low birth weight babies also resulted in a higher percentage of overweight children (8.1%) than normal weight children (7.6%).

There is a higher percentage of overweight children (19.9%) than normal weight children (10.0%) among children who were a single child in the family. Children who have a lesser number of siblings (1 to 3 siblings) contributed to a higher percentage of overweight children (83.9%) than normal weight children (73.0%). Children who had non-exclusive breastfeeding constituted a higher percentage of overweight children (43.1%) than normal weight children (32.2%). As much as 18.5% of overweight children stopped breastfeeding at the age of less than 6 months compared to normal weight children (10.0%). There is a higher percentage of overweight children (94.8%) than normal weight children (84.8%) among those who were fed with formula milk.

Table 1: Percentage of overweight and normal weight children according to different variables

Variables		Overweight, n (%) (Case Group)	Normal weight, n (%) (Control Group)
Mother's BMI	Normal	60 (28.5)	80 (37.9)
	Underweight	6 (2.8)	6 (2.8)
	Overweight/obese	145 (68.7)	125 (59.3)
Father's BMI	Normal	40 (18.9)	56 (26.5)
	Underweight	9 (4.3)	14 (6.6)
	Overweight/obese	162 (76.8)	141 (66.8)
Mother's Education Level	Primary & Secondary	48 (22.7)	32 (15.2)
	Tertiary	163 (77.3)	179 (84.8)
Father's Education Level	Primary & Secondary	64 (30.3)	46 (21.8)
	Tertiary	147 (69.7)	165 (78.2)
Monthly household income threshold	<RM7,380 (B40)	134 (63.5)	111 (52.6)
	RM7,380 – RM14,789 (M40)	71 (33.6)	90 (42.7)
	≥RM14,790 (T20)	6 (2.8)	10 (4.7)
Pre-pregnancy BMI	Normal	102 (48.3)	118 (55.9)
	Underweight	13 (6.2)	16 (7.6)
	Overweight/obese	96 (45.5)	77 (36.5)
Weight gain during pregnancy	Sufficient	95 (45.0)	114 (54.0)
	Insufficient	50 (23.7)	48 (22.7)
	Excess	66 (31.3)	49 (23.2)
Complication during pregnancy	None	153 (72.5)	166 (78.7)
	GDM	25 (11.8)	15 (7.1)
	Anaemia	25 (11.8)	28 (13.3)
	Other (IUGR, HPT, etc)	8 (3.8)	2 (0.9)
Number of antenatal visits	<9	17 (8.1)	9 (4.3)
	9-14	148 (70.1)	159 (75.4)
	≥15	46 (21.8)	43 (20.4)
Delivery status	Mature	193 (91.5)	197 (93.4)
	Pre-term	18 (8.5)	14 (6.6)
Birth weight status	Normal birth weight	190 (90.0)	191 (60.5)
	Low birth weight	17 (8.1)	16 (7.6)
	Macrosomia	4 (1.9)	4 (1.9)
Single child	Yes	42 (19.9)	21 (10.0)
	No	169 (80.1)	190 (90.0)
Number of siblings	1 – 3	177 (83.9)	154 (73.0)
	4 and above	34 (16.1)	57 (27.0)
Exclusive breastfeeding	Yes	120 (56.9)	143 (67.8)
	No	91 (43.1)	68 (32.2)
Predominant breastfeeding	Yes	136 (64.5)	163 (77.3)
	No	75 (35.5)	48 (22.7)
Age stop breastfeeding	<6 month	39 (18.5)	21 (10.0)
	6-24 month	122 (57.8)	127 (60.2)
	>24 month	50 (23.7)	63 (29.9)
Formula milk feeding	Yes	200 (94.8)	179 (84.8)
	No	11 (5.2)	32 (15.2)

Table 2: Logistic regression analysis for childhood overweight according to different variables

Variables		Logistic Regression Analysis			
		Crude OR	p-value	Adjusted OR	p-value
Mother's BMI	Normal	1		1	
	Underweight	1.33 (0.410-4.339)	0.633	1.65 (0.290-9.433)	0.571
	Overweight/obese	**1.55 (1.025-2.334)***	0.038	1.54 (0.801-2.978)	0.195
Father's BMI	Normal	1		1	
	Underweight	0.90 (0.355-2.282)	0.824	1.05 (0.320-3.426)	0.940
	Overweight/obese	**1.61 (1.011-2.559)***	0.045	**1.88 (1.049-3.359)***	0.034
Mother's Education Level	Primary & Secondary	**1.65 (1.004-2.703)***	0.048	1.05 (0.518-2.112)	0.900
	Tertiary	1		1	
Father's Education Level	Primary & Secondary	1.56 (1.007-2.423)*	0.047	1.26 (0.647-2.445)	0.499
	Tertiary	1		1	
Monthly household income threshold	<RM7,380 (B40)	2.01 (0.709-5.709)	0.189	2.28 (0.400-12.972)	0.345
	RM7,380 – RM14,789 (M40)	1.32 (0.456-3.791)	0.612	1.93 (0.360-10.361)	0.443
	≥RM14,790 (T20)	1		1	
Pre-pregnancy BMI	Normal	1		1	
	Underweight	0.94 (0.432-2.047)	0.826	1.08 (0.313-3.688)	0.908
	Overweight/obese	1.44 (0.967-2.152)	0.073	1.05 (0.563-1.940)	0.888
Weight gain during pregnancy	Sufficient	1		1	
	Insufficient	1.25 (0.773-2.021)	0.363	1.22 (0.662-2.256)	0.522
	Excess	**1.62 (1.021-2.558)***	0.040	1.26 (0.702-2.254)	0.441
Complication during pregnancy	None	1		1	
	GDM	1.82 (0.919-3.558)	0.086	**2.93 (1.239-6.936)***	0.014
	Anaemia	0.97 (0.541-1.734)	0.915	0.98 (0.470-2.053)	0.963
	Other (IUGR, HPT, etc)	4.34 (0.907-20.756)	0.066	5.99 (0.896-38.841)	0.065
Number of antenatal visits	<9	2.03 (0.877-4.693)	0.098	**3.33 (1.088-10.174)***	0.035
	9-14	1		1	
	≥15	1.15 (0.717-1.843)	0.564	0.95 (0.521-1.747)	0.879
Delivery status	Mature	1		1	
	Pre-term	1.31 (0.635-2.713)	0.463	0.59 (0.209-1.679)	0.325
Birth weight status	Normal birth weight	1		1	
	Low birth weight	1.07 (0.524-2.176)	0.856	0.45 (0.139-1.467)	0.186
	Macrosomia	1.01 (0.248-4.078)	0.994	1.41 (0.207-9.654)	0.725
Single child	Yes	**2.25 (1.280-3.950)***	0.005	1.49 (0.706-3.128)	0.297
	No	1		1	
Number of siblings	1 – 3	**1.93 (1.197-3.103)***	0.062	**2.10 (1.097-4.004)***	0.025
	4 and above	1		1	
Exclusive breastfeeding	Yes	1		1	
	No	**1.60 (1.072-2.372)***	0.021	0.95 (0.392-2.317)	0.915
Predominant breastfeeding	Yes	1		1	
	No	**1.87 (1.221-2.873)***	0.004	1.46 (0.547-3.919)	0.448
Age stop breastfeeding	<6 month	**2.34 (1.225-4.471)***	0.010	1.12 (0.455-2.764)	0.804
	6-24 month	1.21 (0.774-1.892)	0.402	1.10 (0.620-1.964)	0.739
	>24 month	1		1	
Formula milk feeding	Yes	**3.25 (1.591-6.638)***	0.001	2.49 (0.910-6.802)	0.076
	No	1		1	

* p<0.05 for logistic regression analysis

Table 2 shows the logistic regression analysis for possible risk factors associated with childhood overweight. Paternal BMI was a significant risk factor for overweight among under-five children (aOR 1.88, 1.049-3.359; p<0.05). Maternal BMI was only significantly associated with childhood overweight in crude analysis (OR 1.55, 1.025-2.334) but not in the final adjusted model (aOR 1.54, 0.801-2.978).

Gestational diabetes mellitus was another significant risk factor for childhood overweight (aOR 2.93, 1.239-6.936; p<0.05). Having a lesser number of antenatal visits at clinic was also found to be significantly associated with childhood overweight (aOR 3.33; 1.088-10.174). Excess weight gain during pregnancy seems to be a significant risk factor in crude analysis (OR 1.62, 1.021-2.558), but it was not statistically significant

when being further analysed in the final adjusted model.

In addition, children with less than four siblings were significantly more likely to be overweight children (aOR 2.10, 1.097-4.004; p<0.05). Being a single child (OR 2.25, 1.280-3.950), those who were not exclusively breastfed (OR 1.60, 1.072-2.372), not predominantly breastfed (OR 1.87, 1.221-2.873), stopped breastfeeding at the age of less than 6 months (OR 2.34, 1.225-4.471), and those being fed with formula milk (OR 3.25, 1.591-6.638) were significantly associated with childhood overweight only in crude analysis but not in the final adjusted model.

4. Discussion

Our study found that parental BMI status was strongly associated with children's BMI status. Previous study among children in Vienna, Austria also reported that overweight parents were more likely to have overweight children (Nemecek et al., 2017). Overweight parents were more susceptible to perceive their kids as "normal" even though their BMI status stated otherwise (Berggren et al., 2018). A group researchers reported that having a family history of obesity increased the risk of childhood overweight/obesity (Nor et al., 2020). Hence, it is important for any future intervention program to target not only children, but also their family members especially parents to ensure a more positive outcome.

Both maternal and paternal education level have inverse association with overweight status of children. Mothers and fathers with lower educational background were most likely to have overweight children. Similar finding was found in Indonesia where a study in local district showed that mothers who completed junior high or above were less likely to have overweight children compared to those who did not complete primary education (Maehara et al., 2019). Some researchers explained that parents with lower education background may have shown less concern about their children's body weight and did not do anything about it compared to higher educated parents (Matthiessen et al., 2014). This claim was supported in which the awareness of the parents plays some parts in their children's body weight status (Muthuri et al., 2016). They also found that in wealthier countries, the parental education had the same inverse relationship with children's overweight status.

Our study revealed that children from low-income family have a higher risk of being overweight compared to children from high-income family, but the results were not statistically significant. Although other researchers found that socioeconomic status had a positive relationship with children's BMI status (Ahmad et al., 2018). A group researchers found a trend in which the distributions of overweight and obesity have been moved from high income household to low-income household (Mariapun et al., 2018). A group researchers justified that low-income families have to give priorities to other things in raising their children, which may lead to consumption of more calorie-dense foods instead of more nutritious foods (Poh et al., 2019). They are also more prone to indulge in less healthy lifestyle compared to families with high income.

Our result showed that excess weight gain during pregnancy leads to higher risk of overweight children compared to sufficient weight gain. Mothers who suffered gestational diabetes mellitus also increased their risk of having overweight children as intrauterine exposure to maternal obesity may induce dysregulation of appetite, metabolism and activity levels of offspring, even further increase the risk of childhood overweight or obesity (Josey et al., 2019). Habits and dietary preference that mothers developed during pregnancy might continue even after they deliver their babies and hence, affecting children dietary preference and habits as well (Tam et al., 2018). This explained that the common behavioral and surrounding among mothers and their children can be continued over the children's growth (Leonard et al., 2017). Thus, it is crucial for the mothers to monitor their weight gain during pregnancy as well as a proper intervention in order to avoid childhood obesity (Hillier et al., 2016).

Antenatal visits are important during pregnancy for the health of both, the mother and fetus inside the womb. Currently, antenatal care has become an important stage to avoid, identify, as well as treating associated risk factors during pregnancy (Toma et al., 2018). Our findings found an inverse relationship between number antenatal of visits and the risk of children being overweight, in which a reduced number of antenatal visits (less than 9 visits) increased the risk of having overweight children up to 3 times. Although previous study only found significant relationship between antenatal visits and malnourished children the importance is still very much the same in which early detection and intervention can help pregnant mothers deliver and raising a healthy children (Toma et al., 2018; Kuhnt and Volmer, 2017; Raynes-Greenow, 2017).

In our study, children with low numbers of siblings were significantly more likely to be overweight. This finding is comparable with few studies in which reported that being first born child and having fewer children at home are higher risk of developing childhood overweight and obesity (Park and Cormier, 2018; Suomalainen, 2017). For the first-born child or fewer children at home, they usually receive more attention from their parents and tend to be overfed (Janjua et al., 2012). On the other hand, larger number of siblings resulted in a lower odd ratio for overweight may due to additional siblings may decrease the availability of food for each child as well as increase child-to-child interaction and further increase their physical activity (Ochiai et al., 2012).

Breastfeeding is known to have protective effects on childhood obesity. Previous studies have shown that breastfed children are more likely to have normal BMI compared to children who were breastfed less than 6 months (Pattison et al., 2019; Palaska et al., 2020). Additionally, increased in breastfeeding duration reduced the probability of being obese at 2 years old (Modrek, 2015). In our study, non-predominant breastfeeding increased the risk of childhood overweight while children who were breastfed for less than 6 months were more likely to be overweight compared to those who were breastfed more than 6 months. However, such findings are not statistically significant after controlling for all other potential factors.

There are several strength and weakness of the study. In this study, the methodology of case-control rather than cross-sectional study is applied. Case-control study is useful in determining the possible exposure factors after a known disease incidence by comparing both matched cases and control groups. Besides, complete set of data or variables on sociodemographic and socioeconomic characteristics, health and medical history of the respondent and parents, knowledge and practice of parents or caregivers towards child's feeding, dietary behaviour of the children, infant and young child feeding history, food security and screen time/physical activity are included. This is helpful in determining the possible exposure factors toward childhood overweight and obesity in wider aspect. However, there will be response bias during the subject answering the questionnaire.

Apart from that, number of overweight children successfully recruited in this study is lower than sample size required. Therefore, it probably affects the power of the study and multiple logistic regression analysis unable to detect many significant associations. In conclusion, the findings are able to help to understand the related risks factors in childhood adiposity among Malaysian children. Early life intervention especially during pregnancy stages which include antenatal care and antenatal intervention on dietary and physical activity during peri-conception period is seen to be important to prevent adverse pregnancy outcomes and further improve maternal and child's health. Hence it would be more effective to prevent childhood obesity in later age and its long-term consequences.

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Availability of Data and Materials

The dataset of this manuscript belongs to the Ministry of Health Malaysia. At present, the data are not publicly available but can be obtained from the authors upon reasonable request and with the permission from the Director General of Health, Malaysia.

Ethics Approval and Consent to Participate

Ethical approvals were obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia bearing registration number NMRR-18-847-41455.

Consent For Publication

Not applicable

Discloser Statement

The authors declare no conflicts of interest.

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