

ORIGINAL ARTICLE

FACTORS ASSOCIATED WITH BODY WEIGHT STATUS AMONG CHILDREN WITH AUTISM SPECTRUM DISORDER AGED 2-11 IN KUCHING DIVISION, SARAWAK

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ABSTRACT

High prevalence of overweight and obese among children with autism spectrum disorder (ASD) gains attention due to its substantial adverse health impacts. This study aimed to determine the associations between sociodemographic characteristics, parental feeding practices, child eating behaviour, and dietary intake with body weight status of ASD children in Kuching Division, Sarawak. A cross-sectional study was conducted among 124 ASD children (83.9% boys and 16.1% girls) aged 2-11 years, together with their caregivers. The weight and height of ASD children were taken, and body mass index-for-age z-score (BAZ) was computed using AnthroPlus software. Child feeding practices, eating behaviour, and dietary intake were assessed through interviews, with the aid of a questionnaire. Multiple binary logistic regression was used in data analysis. The prevalence of underweight, risk-of-overweight, overweight, and obese ASD children was 3.2% (3.8% boys; 0% girls), 4.8% (2.9% boys; 15.0% girls), 16.9% (17.3% boys; 15.0% girls), and 20.2% (23.1% boys; 5.0% girls), respectively. The multiple binary logistic regression revealed that the caregivers with high perceived child weight (AOR 31.313, 95% CI=6.127-47.218), high concern towards child weight (AOR 1.774, 95% CI=1.112-2.829), and high sodium intakes (AOR 3.747, 95% CI= 1.515-9.269) were significantly associated with increased risk of overweight or obesity, explaining 37.2% of the variation in body weight status. It is important to prioritise the perspective of caregivers' feeding practices especially the caregivers with high perceived child weight and concerned child's weight as well as sodium level of the ASD children while planning for obesity intervention programmes.

Keywords: *Autism spectrum disorder, child, body weight status, feeding practices, eating behaviour, dietary intakes.*

INTRODUCTION

Autism spectrum disorder (ASD) denotes a neurodevelopmental condition characterised by impairments in communication, behaviour, and social functioning¹. The prevalence of ASD has been escalating for the past 50 years and approximately 1 in 160 children worldwide have ASD. Nevertheless, the prevalence of ASD in many low-and middle-income countries up to the present is unascertained². A recent meta-analysis incorporating nine countries (excluding Malaysia) denoted that the prevalence of ASD in Asia was 0.36% and is increasing in trend³. Locally, the related information is scarce. For example, based on a study conducted by the Ministry of Health in five locations in Malaysia, the prevalence of ASD was approximately 1.6 in 1,000 among children aged 18-36 months⁴.

The ASD population is exposed to numerous challenges in their lifetime, such as feeding problems⁵, idiosyncratic eating behaviour⁶, unhealthy weight status⁷, and motor deficit⁸. Undesired body weight status has adverse influences on one's capability to practise self-management⁹ and increases their susceptibility towards non-communicable diseases¹⁰, mental

health issues¹¹, and increased mortality¹². In the public sector, children with ASD are managed by a multidisciplinary team comprising paediatricians, occupational therapists, speech-language therapists, psychiatrists, family medicine specialists, and social officers¹³. Besides, varying services are provided by the National Autism Society of Malaysia (NASOM) to individuals with autism and their family members such as screening and diagnosis, assessment, social skills, behavioural and occupational therapy programmes, art therapy as well as early intervention programmes¹⁴. Despite all the efforts that are provided to support the children with ASD, issues regarding body weight status and its associated nutritional factors of this vulnerable group are often not given enough attention although previous literature has depicted that children with ASD are at risks of being overweight or obese¹⁵ or even being underweight¹⁶. Nutritional factors such as parental feeding practices may impose unfavourable impacts on the body weight status of the child¹⁷⁻¹⁸. Meanwhile, the child's eating behaviour has been found to affect the energy intake and hence weight via types of options and quantity of food¹⁹. Also, the relationship between insufficiency in dietary intake with

body weight status remains an interesting topic to be addressed²⁰.

The objective under the framework of the National Plan of Action for Nutrition of Malaysia III (2016-2025)²¹ is to enhance children's nutritional status by promoting maternal nutrition, as well as preventing and controlling obesity. Tackling unhealthy body weight status among children with special needs, including children with ASD is within the scope of the policy. Thus, this study was conducted with an aim to determine the association between sociodemographic characteristics, parental feeding practice, child eating behaviour, and dietary intake with body weight status among ASD children in the Kuching Division, Sarawak. With a better understanding of their interaction, appropriate strategies and intervention programmes specially designed for ASD children can be proposed and planned to improve their body weight status.

METHODS

Participants and sampling

The cross-sectional study involved all the eligible caregiver-child dyads who attended the nine out of 15 special childcare centres. The participants were selected through a purposive sampling method. Six of the centres were excluded as none of the children met the inclusion criteria of selection: aged 2-11 years. The special childcare centres were under the Department of Social Welfare, Sarawak, non-governmental organisations, and private sectors situated in the Kuching Division, Sarawak. The inclusion criteria were children aged 2-11 years, both males and females, and who were diagnosed with ASD according to Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV or DSM-5. The primary caregivers of the ASD children comprised the parents or grandparents at home who knew about the daily food intake of the children. The formula of $n = [DEFF * Np(1-p)] / [(d^2 / Z^2_{1-\alpha/2} * (N-1) + p*(1-p))]^2$ was used to calculate the sample size, whereby *DEFF* is design effect, *N* is the population size, *Z* is the statistic for a level of confidence, *p* is anticipated population proportion for overweight and obese of 0.332²³, *d* is precision, $Z_{1-\alpha/2}$ is 1.96. The minimum sample required was 118.

Procedures

Permission to conduct research was acquired from the nine special childcare centres. The name list of all the eligible caregiver-child dyads (total eligible caregiver-child dyads: 178) was obtained from each centre. The enumerators were obtained from the workforces who were working at the special childcare centres to assist the researcher, especially for the caregivers who were tight in their schedules. The enumerators were trained for the assigned tasks incorporating the interview method concerning all four parts of

the questionnaire as well as the techniques for conducting the 24-hour dietary recall. The research objectives and significance, the confidentiality of the information acquired, and the data collection procedure were explained to all the eligible caregivers by the researcher or the research assistants, based on the caregiver information sheet. Informed consent from the caregivers who agreed to participate was obtained before data collection. Data was collected through interviews with caregivers with the aid of a questionnaire. The data collection was conducted at the centres or at a planned location on an appointment basis, whichever was convenient for the caregivers. Next, the weight and height of the ASD children were measured.

Instruments

Sociodemographic characteristics

Household characteristics (for examples, age, education levels, occupation, and income) and children's characteristics (for examples, date of birth, age, sex, ethnicity, gestational age, and number of siblings) were collected from the participants.

Parental feeding practices

The Child Feeding Questionnaire (CFQ)²⁴, which consists of seven subscales with 31 items, was used to determine the parental beliefs, attitudes, and practices related to child feeding and feeding behaviour. Four subscales were used to assess the parental beliefs regarding the children's obesity predisposition, namely (1) perceived responsibility for child feeding (three items), (2) perceived parental weight (four items), (3) perceived child weight (three items), and one subscale assessed the attitude concerning child's weight, namely (4) concerns about the child weight (three items). Other than that, three subscales were used to assess the parental control practices and attitudes concerning child feeding: (1) monitoring (three items), (2) restriction (eight items), and (3) pressure to eat (four items). The 5-point Likert scale was used. For each subscale, a mean score varying from 1 to 5 was computed. Validation of the CFQ was conducted among Malaysian children²⁵. Cronbach's alpha in this study was 0.72.

Child eating behaviour

The Child Eating Behaviour Questionnaire (CEBQ) assesses eating behaviour and appetites in children. It contains 35 items with eight subscales on the eating style associated with the risk of obesity²⁶. The eight subscales are classified under two major dimensions known as food approach and food avoidance. The food approach dimension comprises four subscales namely (1) food responsiveness (seven items), (2) enjoyment of food (three items), (3) emotional overeating (three items), and (4) desire to drink (three items). Under the food avoidance dimension, it encompasses (1) satiety

responsiveness (five items), (2) slowness in eating (four items), (3) emotional undereating (four items), and (4) food fussiness (six items). A 5-point Likert scale (inclusive of 'never', 'rarely', 'sometimes', 'often', and 'always') was used. There are five reversed items namely 3, 4, 10, 16, and 32. Validation of the CEBQ was conducted among Malaysian children²⁷. Cronbach's alpha of 0.65 was obtained in this study.

Dietary intake

The information concerning food and drinks consumed by the ASD children in the past 24 hours was assembled by using a one-day 24-hour dietary recall by interviewing the primary caregivers. Time of food consumption, types of food and drinks, portion size, methods of food preparation, or brand names of the processed food were recorded too. The estimated portion of each food item was quantified with the assistance of pictures that illustrated varied household measures such as cups, plates, and bowls. Food and drink items were then queried from the Nutrient Composition of Malaysia Food²⁸ and the online Malaysian Food Composition Database (MyFCD)²⁹ to obtain the estimated values for energy, macronutrients, and micronutrients for each food and drink item. For items that were not in the Malaysian Food Composition Database, the dietary information was taken from the Food Composition Guide, Singapore³⁰. For products with specific brands such as milk, snacks, and organic biscuits, their nutrition information was obtained from the products' nutrition labelling available in the supermarket or from the official web pages of the companies. The nutrient reference values were based on the recommended nutrient intakes for Malaysia³¹. A software programme, Nutritionist Pro™ 2.4.1 (First Data Bank Inc., South San Francisco, the United States) was used to analyse the dietary intake of the children.

Anthropometric measurements

The body weight and standing height of each child were measured twice using a portable electronic digital weighing scale to the nearest of 0.1 kg (Omron, Kyoto, Japan) and SECA portable stadiometer 213 (SECA, Hamburg, Germany) to the nearest 0.1 cm, respectively. The WHO AnthroPlus software version 1.0.4 (WHO, Geneva, Switzerland) was used to enumerate the BMI-for-age z score (BAZ) of the ASD children. For children aged below 5 years old, the WHO Child Growth Standards³² was employed. Meanwhile, the WHO Growth References³³ was used for children aged 5 and above.

Statistical analysis

IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA) was used for data analysis. All variables were checked for missing values, duplications, and outliers. In the descriptive

analysis, data were presented in table forms which incorporated frequency and percentage for categorical data. Mean, median, minimum, and maximum values were used for descriptive continuous data. The body weight status (dependent variable) was categorised into dichotomous variables, namely non-overweight/obese (thinness/normal) and overweight/obese (risk of overweight/overweight/obese). A simple binary logistic regression was used to obtain the crude odd ratio and variables with p-value < 0.20³⁴ were included in the multivariable binary logistic regression as the cut-off level of 0.05 might not pinpoint the essential variables³⁵. The standard enter method of multiple binary logistic regression was used. The significance level was set at P < 0.05.

RESULTS

Descriptive analysis

A total of 124 caregiver-child dyads participated in this study (response rate of 70.0%). A preponderance of boys (83.9%) among the ASD children was observed (Table 1). The mean age of the ASD children was 6.63±2.41 years. Nearly two-fifths of them were Malays (33.1%), followed by Chinese (25.0%) and Bidayuh (25.8%). About one-fourth (24.2%) of the children were born before 37 weeks of gestation. The majority of the primary caregivers of ASD children were mothers (96.8%). The mean for paternal age and maternal age was 40.12±7.21 and 36.86±5.31 years, respectively. Most of the fathers (50.4%) and mothers (58.1%) with ASD children had accomplished at least a post-secondary level of education. The percentages of employment among fathers and mothers in this study were 96.7% and 62.9%, respectively. Besides, the predominant occupations among the paternal group were technicians and associate professionals' workers (39.5%)³⁶, while housewives constituted nearly two-fifths (35.5%) of the maternal group. More than half (51.6%) of the children with ASD had a substantial family with total household earnings of RM5,000 and above. Likewise, more than half (66.1%) of the ASD children had less than two siblings, and 53.2% of them were the eldest.

A summary of the dietary intake in ASD children is shown in Table 2. Nearly two-thirds (66.1%) and almost all of the children (97.6%) had achieved the recommended intake for calories and protein correspondingly. The intakes of carbohydrates and fat were based on the percentage of contribution towards total daily energy intake (TEI) in which the percentage of energy from carbohydrates was 50-65%, whereas fat accounts for 25-30%. Slightly more than half of the children (51.6%) had sufficient carbohydrate intake. About two-fifths of the children (39.5%) had exceeded the recommended fat intake, which was more than 30% of the TEI.

Concerning micronutrient intakes, the majority of the children did not attain the recommended intake for most of the vitamins and minerals. More than half of the ASD children achieved the recommended intake for only seven types of vitamins and minerals which constituted vitamin B2 (73.4%), vitamin B3 (52.4%), vitamin B6 (61.3%), vitamin C (62.1%), iron (83.1%), selenium (75.0%) and phosphorus (60.5%). Table 3 exhibits the body weight status of ASD children. The majority of the ASD children had a normal BMI-for-age (54.8%). The prevalence of risk of overweight, overweight, and obesity was 4.8%, 16.9%, and 20.2%, respectively. Hence, the total prevalence of overweight and obesity among them was 41.9%. Conversely, thinness was found to be the lowest (3.2%) among all body weight categories of the ASD children.

Inferential analysis

The five-predictors model was statistically significant $\chi^2(5, N=124) = 40.180, p < 0.001$. Based on the value of Nagelkerke R^2 , about 37.2%

of the variances in the dependent variable was explained by this model. There were no interactions and no multicollinearity (Variance Inflation Factor <10) between the independent variables. The Hosmer and Lemeshow test (p -value = 0.224) denoted that the dataset fitted well with the model. The area under the receiver operating characteristic curve of the model was 0.81, while the classification table showed 79.0%. Both connoted that it was capable to differentiate between two outcomes. The caregivers with a higher mean score in perceived child weight (AOR 31.313, 95% CI = 6.127-47.218), and concern about child weight (AOR 1.774, 95% CI = 1.112-2.829) had 31.4 times and 1.8 times higher odds to have ASD children who were overweight/obese, accordingly. Also, sodium intake was associated with an increased likelihood of overweight/obesity among children with ASD (AOR 3.747, 95% CI = 1.515-9.269, $p < 0.01$) (Table 4).

Table 1a: Sociodemographic characteristics of the caregivers and children (n=124)

Household characteristics	n (%)	Statistics
Caretaker(n=124)		
Father	3(2.4)	
Mother	120(96.8)	
Grandmother	1(0.8)	
Caretaker’s marital status (n=124)		
Married	117(94.4)	
Remarried	2(1.6)	
Never married	1(0.8)	
Divorced or separated	2(1.6)	
Widowed	2(1.6)	
Father’s age(n=121)		
≤30	4(3.3)	Mean±SD: 40.12±7.21 Min, Max: 26,70
31-40	69(57.0)	
41-50	36(29.8)	
>50	12(9.9)	
Mother’s age(n=122)		
≤30	15(12.3)	Mean±SD: 36.86±5.31 Min, Max: 27,49
31-40	77(63.1)	
41-50	30 (24.6)	
Father’s education level(n=121)		
No formal schooling	3(2.4)	
Primary education	4(3.2)	
Secondary education	53(42.7)	
Pre-University education	26(21.0)	
Tertiary education	35(28.2)	
Mother’s education level(n=122)		
No formal schooling	1(1.6)	
Primary education	3(2.4)	
Secondary education	47(37.9)	
Pre-University education	35(28.2)	
Tertiary education	36(29.0)	

Table 1b: Sociodemographic characteristics of the caregivers and children (n=124)

Father's Occupation(n=123)		
Armed Forces	6(4.8)	
Managers	1(0.8)	
Professionals	30(24.2)	
Technicians & Associate Professionals	49(39.5)	
Clerical Support Workers	3(2.4)	
Service and Sales Workers	4(3.2)	
Agricultural, Forestry Livestock & Fishery	1(0.8)	
Craft and Related Trades Workers	6(4.8)	
Plant, Machine Operators & Assemblers	12(9.7)	
Elementary Occupations	7(5.6)	
Not working	1(0.8)	
Pensioner	1(0.8)	
Passed away	2(1.6)	
Mother's Occupation(n=124)		
Professionals	35(28.2)	
Technicians & Associate Professionals	21(16.9)	
Clerical Support Workers	10(8.1)	
Service and Sales Workers	7(5.6)	
Agricultural, Forestry, Livestock & Fishery	1(0.8)	
Craft & Related Trades Workers	1(0.8)	
Elementary Occupations	3(2.4)	
Housewife	44(35.5)	
Passed away	2(1.6)	
Father's income (n=121)		
< RM1000	9(7.3)	
RM1000 - RM2999	47(37.9)	
RM3000 - RM4999	31(25.0)	
≥ RM5000	34(27.4)	
Mother's income (n=122)		
< RM1000	47(37.9)	
RM1000 - RM2999	31(25.0)	
RM3000 - RM4999	24(19.4)	
≥ RM5000	20(16.1)	
Total Household income (n=124)		
< RM1000	1(0.8)	
RM1000 - RM2999	32(25.8)	
RM3000 - RM4999	27(21.8)	
≥ RM5000	64(51.6)	
Child's characteristics		
Sex		
Male	104(83.9)	
Female	20(16.1)	
Age (years)		
<3	4(3.2)	Mean ±SD:6.63±2.41
3-5	44(35.5)	Min, Max: 2,11
6-8	44(35.5)	
9-11	32(25.8)	

Table 1c: Sociodemographic characteristics of the caregivers and children (n=124)

Ethnicity	
Malay	41(33.1)
Chinese	31(25.0)
Iban	17(13.7)
Bidayuh	32(25.8)
Others ^a	3(2.4)
Gestational age(weeks)	
<37	30(24.2)
≥37	94(75.8)
Birth weight (gram)	
<2500	14(11.3)
≥2500	110(88.7)
Number of sibling(s)	
0-1	82(66.1)
2-3	42(33.9)
Rank of the child among the sibling(s)	
1 st	66(53.2)
2 nd	37(29.8)
3 rd	12(9.7)
4 th	9(7.3)
Psychotropic medication	
Yes ^b	6(4.8)
No	118(95.2)

^a Others (Dusun, Bisaya, Melanau)

^b Stimulant, atypical antipsychotic, cognitive enhancer, and mood stabilizer medications.

DISCUSSION

In this study, the prevalence of overweight and obesity among children with ASD was 21.7% and 20.2%, respectively. These findings showed a higher overweight prevalence than other studies³⁷⁻³⁹ that found that the overweight prevalence in ASD children (aged 2-13 years) ranged from 10.0% to 15.1%. Likewise, this study revealed much higher rates of obesity compared to other studies^{37,40-42} with an obesity rate of 9.0% to 18.3%. The reason for the variation in findings was unknown, but it could be attributed to the disparate geographical regions covered, culturally diverse population, sample size, varying methods of anthropometric data assembled, and different BMI cut-offs for categorisation of weight status⁴³⁻⁴⁴.

Besides, a positive association between perceived child weight and overweight/obese was in line with the findings from previous literature^{25,45}. Parents of the children with special needs were more engaged with physical care, incorporating body weight status and other well-being-related issues⁴⁶. Hence, the parents might have a higher inclination of possessing perceptions in altering the weight of their children by intervening in the children's eating behaviour together with their physical activity practices, unlike the parents who did not precisely discern overweight in their children⁴⁷. Moreover, an incongruity of parental perceptions

of child overweight was also seen among the parents in which mothers were found to be more vigilant than fathers in distinguishing weight issues in their children⁴⁸. This was as evidenced in the present study whereby mothers accounted for 96.7% of the caregivers.

Apart from that, it was observed that concern about child weight was linked with overweight/obesity among the children with ASD in the current study. This fitted well with pre-existing findings⁴⁹⁻⁵¹. The higher degree of concern among parents regarding the risk of being overweight in their children, the greater the likelihood that they would exert monitoring and restriction on unhealthy food intake. Concurrently, feeding practices of restriction were correlated with adverse outcomes such as increased body weight, a predilection for restricted food and snack intakes, and curtailed eating self-control among children⁵²⁻⁵³. Nevertheless, the relationship between concern about child weight and body weight status could be reciprocal. The parents who cared about the overweight problem in their children tended to have children with higher BMI²⁴. Contrariwise, overweight/obese children might contribute to increasing concern from their parents concerning eating⁵⁰. It was revealed that the parents tended to express higher concern towards their obese ASD children in comparison to the parents with an obese typical child. A plausible explanation for this might be due to higher utilisation of

health care facilities and knowledge of their child’s health among parents with ASD children⁴⁹.

Moreover, the research finding indicated that sodium intake under dietary intake was associated with an increased likelihood of overweight/obesity among children with ASD. This finding resonated with the results from prior studies⁵⁴⁻⁵⁵. In this study, nearly one-fifth of the ASD children (17.7%) had an intake of sodium that exceeded the tolerable upper intake level whereby 12 (54.5%) of them were in the category of overweight/obese and 10 (45.5%) were in non-overweight/obese group (findings not shown). In Malaysia, studies on sodium consumption among

children were limited. Prior local research conducted in Peninsular Malaysia involving 794 students aged 13 years discovered that the overall mean intake of sodium was 2289.5 mg/d (sodium UL: 2000 mg/d)⁵⁶. Previous research indicated that overweight/obesity was associated with sodium intake by stimulating adiposity gene synthesis regardless of sugary beverage and energy intake⁵⁷⁻⁵⁹. Similarly, it was reported that an increase in sodium intake may activate thirst and sugar-sweetened drinks, which resulted in high energy intake⁶⁰.

Table 2: Macronutrient and micronutrient intakes among ASD children (n=124)

Macronutrient	=RNI n (%)	<RNI n (%)	>RNI n (%)
Calories/Energy	82 (66.1)	42 (33.9)	
Macronutrient contribution towards TEI*			
	10-20 %	<10 %	>20%
Protein	104(83.9)	8(6.5)	12(9.7)
	50-65%	<50%	>50%
Carbohydrate	64(51.6)	55(44.4)	5(4.0)
	25-30%	<25 %	>30%
Fat	58(46.8)	17(13.7)	49(39.5)
Micronutrient	≥ RNI n (%)	<RNI n (%)	
Vitamin B1	37(29.8)	87(70.2)	
Vitamin B2	91(73.4)	33(26.6)	
Vitamin B3	65(52.4)	59(47.6)	
Vitamin B5	9(7.3)	115(92.7)	
Vitamin B6	76(61.3)	48(38.7)	
Vitamin B9	2(1.6)	122(93.4)	
Vitamin B12	52(41.9)	72(58.1)	
Vitamin C	77(62.1)	47(37.9)	
Vitamin A	59(47.6)	65(52.4)	
Vitamin D	8(6.5)	116(93.5)	
Vitamin E	29(23.4)	95(76.6)	
Vitamin K	21(16.9)	103(83.1)	
Calcium	12(9.7)	112(90.3)	
Iron	103(83.1)	21(16.9)	
Iodine	8(6.5)	116(93.5)	
Zinc	33(26.6)	91(73.4)	
Selenium	93(75.0)	31(25.0)	
Phosphorus	75(60.5)	49(39.5)	
Sodium	45(36.3)	79(63.7)	
Potassium	2(1.6)	122(98.4)	
Magnesium	14(11.3)	110(88.7)	
Copper	6(4.8)	118(95.2)	

*TEI=Total daily energy intake, RNI= recommended nutrient intakes

Implications

First, it is recommended that routine screening and assessment of BMI, nutrient intakes (especially sodium intake), and basic biochemical analysis with a combination of individual nutritional consultations among ASD children⁶¹⁻⁶² in governmental and private healthcare clinics should be contemplated in combating the unhealthy body weight status. Second, interventional studies about parental feeding practices (high parental perceived child weight and concern child’s weight) and dietary intakes (ASD children with high sodium intake) to tackle the issue of abnormal body weight status can be pondered and planned for the benefits of children with ASD with their family members in

the future. Third, this study serves as a baseline for future researchers in conducting in-depth studies to examine the dissimilarities in parental feeding practices, child eating behaviour, and dietary intakes according to age groups, sex differences, ASD severity, medical conditions, and dietary restrictions to further understand and explicate whether the existing of abnormal body weight status is only exists on a certain group of ASD children or affecting the whole ASD population. Lastly, policy appertaining to the ASD population in the context of health, nutrition, and education shall be scrutinized and established to enable specific resources and means of service delivery for the ASD population in the country.

Table 3: Body weight status of the ASD children (n=124)

Body Weight Status	n (%) / Mean ± SD		
	Boys (n = 104)	Girls (n = 20)	Total (n = 124)
Weight (kg)	26.0±10.9	24.6± 11.5	25.8± 11.0
Height (cm)	119.1±14.8	118.7± 18.9	119.0± 15.4
BMI (kg/m ²)	17.9±4.5	16.8± 2.2	17.7± 4.2
BMI-for-age z score	0.85±1.92	0.48± 0.99	0.79± 1.81
Thinness	4(3.8)	0(0)	4(3.2)
Normal	55(52.9)	13(65.0)	68(54.8)
Risk of overweight	3(2.9)	3(15.0)	6(4.8)
Overweight	18(17.3)	3(15.0)	21(17.0)
Obese	24(23.1)	1(5.0)	25(20.2)

Table 4: Factors associated with body weight status among ASD children (n=124)

Variables	B	SE	Wald (df)	p-value	AOR	95% CI OR	
						Lower	Upper
Perceived child weight	4.248	0.945	13.135(1)	<0.001	31.313	6.127	47.218
Concern about child weight	0.573	0.238	5.790(1)	0.016	1.774	1.112	2.829
Sodium	1.321	0.462	8.170(1)	0.004	3.747	1.515	9.269
Food fussiness	-0.566	0.335	2.862(1)	0.091	0.568	0.294	1.094
Magnesium	-1.216	0.670	3.297(1)	0.069	0.296	0.080	1.101

AOR = Adjusted odds ratio; Nagelkerke R square=0.372

Study Limitations

By dint of cross-sectional study design, deduction of causality and directionality between independent and dependent variables could not be determined. Besides, the sample size obtained in this study was small, which may influence the statistical power. Next, usage of a one-day 24-hour dietary recall assessment method may not depict an individual’s routine diet due to the day-to-day food consumption variability, recall bias, deliberate misreporting of particular food consumed related to individual peculiarities such as gender and obesity⁶³, social desirability, and over/under-estimation of the dietary intake⁶⁴. Also, some variables that could potentially the body weight status such as

measurement of parental BMI, physical activities, sleep disturbance, and screen time were not included in this study. For these reasons, due care must be exercised while interpreting the findings of the present study.

CONCLUSION

A higher prevalence of overweight and obesity was observed in comparison to underweight children with ASD. Therefore, the policymakers in Malaysia should draft policies on childhood obesity for ASD children to assist them in achieving a better quality of life. In addition, it is crucial to focus on the perspective of

caregivers' feeding practices, particularly the caregivers with high perceived child weight and concern about child weight as well as sodium level of the ASD children while planning for obesity intervention programmes. The study's findings can serve as a springboard for future research concerning the body weight status of ASD children with other factors associated with it such as socio-environmental risk factors.

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Competing interest

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Ethical issues

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