

ORIGINAL ARTICLE

Eating behaviors and Dietary Pattern in Children with Autism Spectrum Disorder (ASD) in Puncak Alam, Selangor, Malaysia

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Abstract:

An Autism Spectrum Disorder (ASD) is a neurological and progressive disorder that starts early in childhood and persists throughout a person's life. It is assessed and diagnosed by medical professionals and the symptoms associated with ASD can be detected in childhood as early as 2 years of a child's age. Children with ASD were known to have certain eating habits that affecting their dietary intake. Thus, this study aims to determine the eating behaviors and dietary pattern in children with ASD in Puncak Alam, Selangor. This cross-sectional study used a non-probability sampling with validated eating behavior questionnaire and food frequency questionnaire (FFQ) as the research instrument. From this study, it was found that, children with ASD positively relate with several eating behaviors. The most associated eating behaviors are refusing food of certain textures and refusing food from certain food group (100%). This followed with behavior of sometimes they eat only a small amount but in repeated times (73.9%), some of them often eat too much (56.5%) and some of them frequently refuses food of certain colors (47.8%). The children with ASD mostly associated with the Western pattern, followed by the Malay pattern, while the healthy pattern mostly not preferred by the children.

Keywords: Eating behaviors, Autism, Dietary pattern

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1. INTRODUCTION

An Autism Spectrum Disorder (ASD) is a multifaceted progressive condition that involves continuous challenges in social interaction, speech and nonverbal communication, and restricted or repetitive behaviors [4]. The children with this type of disorder usually present with significant delays in language, social skills and the ability to communicate. Some of them may possess strange behaviors, interests and have a noticeable intellectual disability. Moreover, children with ASD usually presents along with comorbidities and one of them is food selectivity. Food selectivity is a comorbid condition majorly occur in children with ASD [1]. This behavior known as picky eating which can lead a child with ASD to have certain dietary patterns which considered as a problem because it can be related with inadequate nutrition as a result of the restricted diet [15]. Dietary patterns among children with ASD can be one of the crucial factors to be taken into account in order to ensure they gain enough energy and nutritional intake for optimal life functioning. This kind of behavior leads to disruptive food avoidance behavior that may poses nutritional risks and may be linked to negative food related health outcomes [14].

It is proved that nutrition is one of the keys in helping the children to function healthily and ultimately thrive [12]. Through an appropriate and healthy dietary intake, it can helps in improving digestion due to the bowel irregularities, balancing blood sugar to control hyperactivity symptoms, raising omega-3 fats to due to the problem related to the

metabolism of essential fats, rising vitamins and minerals to overcome deficiencies and avoiding food allergies, among children with ASD [13]. In order to ensure the children with ASD getting appropriate energy and nutrients, it is important to know the dietary patterns associated with ASD children.

However, handling children with ASD can be difficult on many levels and healthy eating is no exception. Current researches emphasize on the occurrence of food selectivity among children with ASD that affecting their dietary patterns [8]. The food selectivity results from the children's food refusal behavior [7] and resistant to change [14]. These create challenge especially for the parents or the caretakers to ensure the children take appropriate energy and nutrients from the diet itself. Although the reason for food refusal remaining unclear, it is likely that the children with ASD refuse food based on their texture or appearance [16]. With regards to these behaviors, children with ASD usually reported to have certain dietary patterns. Moreover, this condition exaggerated with the parents that reporting a lack of understanding about the way to add additional food to their child's diet. Sometimes, recommendations by professional not go as planned such as sneaking non-preferred food into preferred food that resulted the child to refuse the food previously accepted [14].

In order to ensure the children with ASD getting appropriate energy and nutrients, it is important to know the dietary patterns associated with children with ASD. Thus, this study aimed for identifying the eating behaviors and dietary

patterns associated in children with ASD. Hopefully the findings could give a picture on dietary intake of children with ASD that are inadequate or in excess, thus can help in planning optimal nutritional plan through dietary intervention with special focus on children with ASD.

2. METHODOLOGY

This is a cross-sectional study where the subjects were recruited at few places around Puncak Alam. Parents or caretaker of children with ASD were selected based on the non-probability sampling method. This cross sectional study is conducted based on the inclusion criteria which intended for the children of ASD who stayed in Puncak Alam, with the age that range from 1 to 12 years old and also the children with ASD that present along with comorbidities. While, children with ASD that having chronic illnesses such as heart disease, or conditions that affecting dietary intake and those who take medications that alter appetite were excluded from this study.

Nutrition and Feeding Assessment

The revised version of Feeding Assessment Survey (FAS) was used to evaluate the children with ASD's eating behaviors. It consists of ten items that asked about the child's behavior of food intake. The information gained from FAS is conducted through interviewing session (face to face) between the researcher and the parents or caretakers of the child. The Food Frequency Questionnaire (FFQ) was used to determine the dietary preferences among children with ASD. The FFQ was adapted from [9], and have been validated by Loy, Marhazlina, and Hamid Jan (2013). There are a total of 128 food items list in the FFQ that are divided into 15 different group. The item list on the FFQ comprises of the food that can be found in Malaysia to ensure the accuracy of food intake frequency by taking into account the demographic factor. Related to the dietary patterns, for the healthy pattern comprises of all vegetables, fruits, legumes, fish (steamed, grilled, canned), whole grains and dairy. For the Western pattern, comprises of the takeaway food, confectionary, soft drinks, crisps, refined grains, red meats, processed meats, fried potato (chips), potato (not fried), dairy products, sauces and dressings and fried fish and poultry. For the Malay pattern, comprises of the cooked rice, marine fish, green leafy vegetables, sweetened condensed milk, powdered milk, bread, biscuits, *local kuih*, chicken egg and anchovies. All of items listed for each dietary pattern will be noted their intake through the FFQ itself. Then, the frequency for each item intake will be taken to calculate for the mean frequency intake.

3. RESULTS

Table 1 shows that children with ASD in Puncak Alam occurred commonly in boy as compared to girl. Only one This finding is supported through a systemic review done by Halladay et al. (2015), stated that a finding about ASD that usually diagnosed in male gender was one of the most common discovery in the ASD researches. Internationally, commonly stated ratio between ASD boy and ASD girl was 4:1. In total, prevalence studies prove that ASD is usually over-represented in males as compared to females. This

might be related with evidences about "genetic load" that differs in female from male. This explained through the multiple-threshold multifactorial liability model, stated that the threshold for female to reach affection status (to be affected by ASD) was higher than male. This related to the female-specific protective factors from ASD such as estrogens and paternal X chromosome. While male were more suspected on having ASD due to the male-specific risk factors such as fetal testosterone and the Y chromosome. Most children with ASD in Puncak Alam range from 4 – 6 years old. This finding supported by a critical review done by Daniels and Mandell (2014), stated that mean age at diagnosis for all ASD ranged from 3 – 10 years old. Children with ASD in Puncak Alam mostly came from the family with household income of more than RM5000 per month. This finding was supported by a study found that rise in ASD was related with being nonpoor [9]. This resulted from a conclusion stated that the poverty status differentially affected parent-reported lifetime prevalence and comorbidities of ASD disorder, hence suggesting for future research on parent and system-level features that may further describe poverty's variable effect. Furthermore, under-reporting of the ASD cases among children, were higher in the rate of occurrence associated in family with low than average household income.

The eating behaviors among children with ASD in Puncak Alam were observe specifically during the mealtime or the food intake. Table 2 shows the eating behaviors in children with ASD. Overall, the result of this local research found that it was in line with several findings in a study done by [8]. Findings that in line are the part where children with ASD are found to have higher rates of food refusal based on texture and food group.

Table 1: Socio-demographic Data of the children with ASD (n=23).

Variable	n (%)
Gender	
Boy	22(95.7)
Girl	1(4.3)
Age (Mean \pm SD)	6.57 \pm 2.63
1-3	2(8.7)
4-6	12(52.2)
7-9	6(26.1)
10-12	3(13.0)
Race	
Malay	23(100)
Indian	0 (0)
Chinese	0 (0)
Educational level	
No-formal school	13(56.5)
Formal school	10(43.5)
Household income	
<RM1500	2(8.7)
RM1500 – RM3500	5(21.7)
RM3501 – RM5000	4(17.4)
\geq RM5000	12(52.2)

For the Puncak Alam area, all of the children with ASD positively associated with both behaviors. In describing the food texture, it was known that children with ASD often associated with either hyper- or hyposensitivity towards certain sensations and those sensations including the food sensation [2]. For the child with ASD whose mouth is very sensitive (sensory hypersensitivity) may only be able to accept food with the texture of bland or soft. A child with ASD whose mouth-sensation are less sensitive (sensory hyposensitivity) may prefer very strong-tasting or crunchy food's texture that gave them some stimulation. In this research, most of the children with ASD in Puncak Alam having high rates in eating food that are crunchy and crispy. In addition, most of them don't like mushy-texture food such as porridge and food that have been mushed into thick paste or pureed form. Moreover, this finding supported in a study done by Tomheck et al. (2014), conclude that the hyposensitivity associated in ASD cause the child to eat food that help to make up for experiences they are missing and for this it can be found in the food with crunchy or crisps-like texture.

Table 2: Eating Behaviors in children with ASD (n=23)

Eating behavior	Total, n (%)
Throws food	
Never	20(87.0)
Sometimes	3(13.0)
Spits food	
Never	19(82.6)
Sometimes	4(17.4)
Cries, screams	
Never	20(87.0)
Sometimes	3(13.0)
Leaves the table before finished	
Never	1(4.3)
Sometimes	12(52.2)
Often	8(34.8)
Frequent	2(8.7)
Takes food from others	
Never	18(78.3)
Sometimes	5(21.7)
Refuses food of certain texture	
Frequent	23(100.0)
Refuses food of certain colour	
Sometimes	8(34.8)
Often	4(17.4)
Frequent	11(47.8)
Refuses food of certain food group (vegetables, fruits, grains, protein)	
Frequent	23(100.0)
Eats only a small amount	
Never	1(4.3)
Sometimes	17(73.9)
Often	3(13.0)
Frequent	2(8.7)
Eats too much	
Never	1(4.3)
Sometimes	6(26.1)
Often	13(56.5)
Frequent	3(13.0)

All of the children with ASD in Puncak Alam refuses food of certain food group. From this finding, all of them associated with poor intake of vegetables and followed with fruits. However, although the intakes were really poor, but there were still notable pattern of few preferred fruits and vegetables among them. For the children with ASD in Puncak Alam, those that still accept vegetables preferred carrots and potato. For the fruits, commonly chose were apples, mandarin orange, banana, watermelon, grapefruit and guava. This can be related to the behavior of food selectivity among children with ASD [14]. However, the term food selectivity here still relates to the texture of the food presented. For the vegetables choice among children with ASD, it can be explained as for the carrots possess a uniform consistency and are commonly served raw and crunchy. Moreover, the carrots have a taste with mix composition of sweet and fruity. For the potato the texture can be crisps if deep fried, plus having the sweetish taste. These factors make carrots and potatoes among preferred choice of vegetables. Furthermore, children with ASD known to have hypersensitivity towards bitter taste, for instance, some vegetables have bitter taste and that makes the children with ASD fully avoid the intake of vegetables.

For the fruits, the intake higher as compared to the intake of vegetables. This due to the texture and sweet taste of the fruits. Apples are a mixed consistency when served with the peel. Bananas are often mushy and sweet. Grapes and mandarin orange are juicy and sweet. The guava having apple-like texture along with the sweetness, while the watermelon due to the light crunchy-like texture along with sweet taste. In terms of texture preferences, there were children that preferred smooth and mushy texture like bananas and this can be due to the child having sensory hypersensitivity. For the child that preferred more crunchy-like texture such as in apples and guava, this can be due to the sensory hyposensitivity. For the sweet taste of fruits, it was common for children with ASD to possess a hedonic responses to sweet taste, and this relates to taste sensitivity [2].

While for the food colours, it is found that almost half of the children with ASD in Puncak Alam eat food of certain colours only. Several of them reported not eating food that having vegetables-like colours such as shades of green. However this was more associated with the negative experience the child had with the green colour due to the child not liking the vegetables (sensory sensitivity towards bitter taste claimed when eating vegetables, hence not liking it), as compared to sensory sensitivity. Previous research have found that children with ASD see colours more intensely as compared to their neurotypical peers. This has resulted them in more preferring food with striking and attractive colours that usually be found in junk food such as candies [3].

More than half the children in this study were report to leave the table before finish eating. This can be related to that facts that the children with ASD can find it really hard to focus on things that don't interest them really well. However, for their favorite food, most of them reported to seat still and eating until finished. Some of the children with ASD sometimes eat in a small amount. However, they usually took the food repetitively in a small amounts. More than half of the children with ASD often eat too much. The amount of food intake can be related to the food selectivity that resulted from the oral over-responsiveness and oral under-responsiveness. The oral over-responsiveness (defensiveness) cause the children to experience difficulty with food textures. Oral under-responsiveness, cause the child feeling he/she did not perceive enough sensations which may result in the child over-loading his/her mouth with food. This may lead in over-eating behavior. Oral seeking behavior may result in the child putting everything in his/her mouth for the purposes of oral stimulation. This lead to bigger food intake experienced in children with ASD [2]. In the nutshell, eating behaviors of the children with ASD often due to the Sensory Processing Disorder (SPD). Eating is a multi-sensory experience. Each food intake that enter the mouth caused the children with ASD to experience possible variety of flavors, textures and temperatures, which in turn cause them to over or under reacting towards food that finally shaping their unique food preferences.

Dietary pattern among children with ASD resulted from their dietary intake taken from FFQ. Table 3 shows most preferred dietary pattern among children with ASD in Puncak Alam was eating Western pattern, followed by Malay eating pattern and the lastly was the healthy eating pattern. The preferred Western pattern that associated with ASD was in line with a study done Kanoski and Davidson (2011), found that autism-like behaviours and memory deficits result from a Western diet in mice. From the preference of the Western pattern, it can be used to describe the association with the excess energy intake among children with ASD. The excess energy intake related to the frequent intake of energy-dense food such as the confectionaries, takeaway food, soft drinks, fried food and refined grains. This type of food also associated with the empty calories. The empty calories lead to excess energy intake but very low in nutrients 10. The children with ASD were known for having strong preferences towards food with the texture of crunchy or crisps, taste of sweetness and a bit salty and will eat the preferred food more or known as atypical behavior in eating. The atypical behavior leads the children being preferring the same preferred food.

4.0 CONCLUSION

In conclusion, it was found out that all the children in this study associated with eating behaviors of refusing to eat certain texture of food from certain food groups. Hence, children having specific food preferences were prone to have either inadequacy or excessive dietary intake. For the dietary eating patterns, most preferred eating pattern was the western eating pattern followed by Malay eating pattern.

Table 3: Dietary pattern of children with ASD

HEALTHY EATING PATTERN			
	Minimum frequency daily intake	Maximum frequency daily intake	Mean \pm SD
All vegetables	0.0	2.29	0.33 \pm 0.64
Fruits	0.0	3.03	0.76 \pm 0.96
Legumes	0.0	1.43	0.16 \pm 0.31
Fish (steamed, grilled, canned)	0.0	1.0	0.16 \pm 0.21
Whole grains	0.0	0.14	0.03 \pm 0.05
Dairy	0.0	2.0	0.64 \pm 0.68
Mineral water	3.0	7.0	5.17 \pm 1.07
WESTERN PATTERN			
Takeaway food	0.50	1.14	0.90 \pm 0.15
Confectionary	0.00	5.29	2.75 \pm 1.69
Soft drinks	0.00	0.57	0.05 \pm 0.13
Crisps	0.00	1.00	0.14 \pm 0.24
Refined grains	1.31	7.46	4.79 \pm 2.02
Red meats	0.00	0.29	0.06 \pm 0.08
Processed meats	0.00	5.00	1.27 \pm 1.48
Fried potato (chips)	0.00	1.14	0.19 \pm 0.23
Potato (not fried)	0.00	1.00	0.14 \pm 0.28
Dairy products	0.00	2.00	0.64 \pm 0.68
Sauces and dressings	0.03	1.14	0.30 \pm 0.40
Fried fish and poultry	0.26	2.00	0.85 \pm 0.46
MALAY PATTERN			
Cooked rice	0.5	5.00	2.20 \pm 1.23
Marine fish	0.0	0.86	0.37 \pm 0.23
Green leafy vegetables	0.0	0.71	0.07 \pm 0.17
Sweetened condensed milk	0.0	14.00	0.82 \pm 2.94
Powdered milk	0.0	3.00	0.51 \pm 0.97
Bread	0.0	6.00	1.82 \pm 1.54
Biscuits	0.0	6.00	2.42 \pm 1.81
Local kuih	0.0	0.86	0.28 \pm 0.31
Chicken egg	0.0	3.00	0.56 \pm 0.68
Anchovies	0.0	0.57	0.11 \pm 0.12

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