A STUDY ON NUTRITIONAL STATUS, MEALTIME BEHAVIOR AND FOOD REFUSAL AMONG AUTISM SPECTRUM DISORDER (ASD) AND TYPICALLY DEVELOPING (TD) CHILDREN AGED 3 TO 11 YEARS OLD IN USM KUBANG KERIAN, KELANTAN

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SCHOOL OF HEALTH SCIENCES

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by

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Dissertation submitted in partial fulfillment of the requirement for the Bachelor Degree of Health Sciences (Honours) Nutrition

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CERTIFICATE

I certify that Ms ‘Isyatin Munirah binti Hashim has carried out her study entitled “A study on nutritional status, mealtime behavior and food refusal among autism spectrum disorder (ASD) and typically developing (TD) children aged 3 to 11 years old in USM Kubang Kerian, Kelantan” as a final year research project in nutrition during the period from September 2016 to May 2017 under my supervision. She has complied with the ethical standard and regulations in conducting her study and has completed writing her thesis. I am satisfied with her work and have no objection for the thesis to be examined by the appointed examiners by the School of Health Sciences, Universiti Sains Malaysia (USM).

Thank you.

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

‘ISYATIN MUNIRAH BINTI HASHIM

Date:

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LIST OF ABBREVIATIONS

ASD	Autism Spectrum Autism
BAMBIC	Brief Assessment Mealtime Behavior Inventory Children
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
FFQ	Food Frequency Questionnaires
FPI	Food Preferences Inventory
ICF	International Classification of Functioning Disability and Health
MOH	Ministry of Health
OT	Occupational Therapist
RM	Ringgit Malaysia
SD	Standard Deviation
SLP	Speech Language Pathologist
TD	Typically Developing
UNICEF	United Nations Children's Fund
US	United States
USMKK	Universiti Sains Malaysia Kubang Kerian
WHO	World Health Organization

LIST OF SYMBOL

X^2	Chi-square
%	Percentage
±	Standard deviation

KAJIAN MENGENAI STATUS PEMAKANAN, TINGKAH LAKU SEWAKTU MAKAN DAN PENOLAKAN TERHADAP MAKANAN DALAM KALANGAN KANAK-KANAK GANGGUAN SPEKTRUM AUTISME DAN KANAK-KANAK NORMAL YANG BERUMUR 3 HINGGA 11 TAHUN DI UNIVERSITI SAINS MALAYSIA, KUBANG KERIAN, KELANTAN

ABSTRAK

Kajian rentas ini dilaksanakan untuk mengkaji status pemakanan, tingkah laku sewaktu makan dan penolakan terhadap jenis kumpulan makanan dalam kalangan kanak-kanak gangguan spektrum autism dan kanak-kanak normal berumur 3 hingga 11 tahun di Universiti Sains Malaysia, Kubang Kerian, Kelantan (97 kanak-kanak). Dalam kajian ini, status pemakanan ditentukan dengan mengambil kira ukuran tinggi dan berat badan responden dan Indeks Jisim Badan dikategorikan berdasarkan CDC (2000). Selain itu, tingkah laku sewaktu makan ditentukan menggunakan Penilaian Ringkas Tingkah Laku kanak-kanak sewaktu makan. Penilaian Ringkas Tingkah Laku kanak-kanak sewaktu makan ini mengandungi 3 aspek iaitu aspek penolakan terhadap makanan, aspek tingkah laku yang boleh menimbulkan gangguan dan aspek kepelbagain yang terhad. Di samping itu, penolakan terhadap jenis kumpulan makanan ditentukan menggunakan Inventori Pilihan Makanan yang mengandungi 12 kumpulan makanan iaitu bijirin dan hasil bijiran, daging dan hasil daging, ikan dan makanan laut, telur, kacang dan kekacang, susu dan produk susu, sayur-sayuran, buah-buahan, konfeksi kek, minuman, sapuan roti dan perencah atau perisa. Hasil kajian menunjukkan kanak-kanak autisme lebih cenderung untuk memiliki berat badan yang kurang

dan berat badan berlebihan serta obese. Hasil kajian bagi tingkah laku sewaktu makan pula, kanak-kanak autisme menunjukkan perbezaan yang ketara dalam aspek penolakan terhadap makanan dan aspek tingkah laku yang boleh menimbulkan gangguan. Namun, bagi aspek kepelbagaian yang terhad, tidak ada perbezaan antara kanak-kanak autisme dan kanak-kanak normal. Penolakan terhadap makanan lebih jelas perbezaannya antara kanak-kanak autisme dan kanak-kanak normal adalah dalam jenis kumpulan makanan bijirin dan hasil bijiran ($p<0.001$), daging dan hasil daging ($p=0.039$), konfeksi kek ($p=0.012$) dan sapuan roti ($p=0.387$). Namun, tiada perbezaan dalam penolakan terhadap makanan antara kanak-kanak autisme dan kanak-kanak normal terhadap jenis kumpulan makanan sayur-sayuran ($p=0.239$), buah-buahan ($p=0.089$), ikan dan makanan laut ($p=0.090$), minuman ($p=0.456$), susu dan produk susu ($p=0.387$) dan perencah atau perisa ($p=0.925$). Kesimpulannya, kanak-kanak autisme lebih cenderung untuk memiliki masalah berat badan samada kurang berat badan atau berat badan berlebihan atau obese. Hal ini mungkin berkaitan dengan pengambilan makanan kurang sihat secara berlebihan dan kurang pengambilan sayur-sayuran serta buah-buahan menyebabkan mereka cenderung untuk mendapat berat badan berlebihan atau obese. Ada jugak sebahagian daripada mereka memiliki berat badan yang kurang kesan daripada pengambilan makanan yang kurang nutrisi serta mempunyai masalah tingkah laku sewaktu makan yang kerap berbanding kanak-kanak normal.

A STUDY ON NUTRITIONAL STATUS, MEALTIME BEHAVIOR AND FOOD REFUSAL AMONG AUTISM SPECTRUM DISORDER (ASD) AND TYPICALLY DEVELOPING (TD) CHILDREN AGED 3 TO 11 YEARS OLD IN USM KUBANG KERIAN, KELANTAN

ABSTRACT

A cross-sectional study was conducted to investigate the nutritional status, mealtime behaviors and food refusal among Autism Spectrum Disorder and Typically Developing children aged 3 to11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan (97 children). In this study, nutritional status was calculated and categorized based on CDC (2000). On the other hand, mealtime behaviors was determined using Brief Assessment of Mealtime Behavior in Children (BAMBIC). BAMBIC questionnaires consisted 3 factors which were Food Refusal, Disruptive Behaviors and Limited Variety. While food refusal among respondents was determined by using Food Preferences Inventory (FPI) based on 12 group which namely cereals and cereal products, meat and meat products, fish and seafood, eggs, legumes and legume products, milk and dairy products, vegetables, fruit, confectionery, beverages, spreads, seasonings and flavoring. Result showed that ASD children possessed higher in both underweight, overweight and obese as compared to TD children. In mealtime behaviors outcome, the food refusal and disruptive behavior factor were significantly different among ASD children compared to TD children. However, for limited variety factor, not significant mean differences was noted between ASD and TD children. The common food refusal that significantly different among ASD and TD children were cereal and cereal

product ($p < 0.001$), meat and product ($p=0.039$), bread spread ($p=0.017$) and confectionery cake ($p=0.012$). However, ASD and TD children do not show significant mean differences in refusing vegetables ($p=0.239$), fruits ($p=0.089$), fish and seafood ($p=0.090$), beverages ($p=0.456$)), milk and milk product ($p=0.387$) and flavoring and seasonings ($p=0.925$). In conclusion, children with ASD more likely to suffer underweight, overweight and obese issues as compared to TD children. This might be related to higher unhealthy food intake and less vegetables and fruits intake so leads some of them to overweight and obese. However, there were also a few of them might consuming less energy dense food and had higher mealtime behaviors problem so leads them to have lower BMI compared to TD children.

CHAPTER 1

INTRODUCTION

1.1 Background

Children experience new foods, tastes, and textures during their primary years of life. However, they often encountered with many types of feeding problem during their early childhood. Childhood feeding problems are common with 25% of the pediatric population experiencing a feeding or eating problems at some time during childhood (Manikam and Perman, 2000). According to Samour (2005) stated that feeding problems can be defined as "child is unable or refuses to eat certain foods because of the neuromotor dysfunction, eating behavior or psychosocial factors".

Children with special needs have been found to be at higher risk for feeding problems than children with typical development. More specifically, children with autism spectrum disorder (ASD) were reported to have more feeding problems than same-aged peers with typical development (Lukens and Linscheid, 2008). The child also has difficulties or fails to eat or drink sufficient quantity or variety of foods to meet their nutritional needs and growth (Piazza and Carroll-Hernandez, 2004). Feeding problems such as food refusal, selective eating and inappropriate texture of food in the child population have also been shown to become more obvious and intense as children get older and especially as they move into primary school age (between the ages of 5 and 12 years) (Fox and Joughin, 2002).

According to Douglas (2002), food refusal has been considered as a general term that embraces a wide range of a child's feeding problems. The definition of food refusal can be determined as the refusal to eat all or most foods offered which resulting in the child not getting adequate food to meet their caloric or nutritional requirements (Field *et al.*, 2003). Food refusal also defined as an individual consuming fewer than the number of calories necessary for weight gain and linear growth or the rejection of food. However, children who do not allow to eat because they were not safe oral feeders were not defined as having food refusal.

Many parents of children with autism spectrum disorders (ASD) reported that their children have feeding problems (Ledford *et al.*, 2006). One of the common feeding problems among ASD children was food refusal (Field *et al.*, 2003). Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder which can be characterized by impairments in communication, social functioning and repetitive pattern of behavior beginning in childhood (Scott and Plauché, 2007). The Centers for Disease Control and Prevention (CDC) found that US boys were almost five times more likely to receive an ASD diagnosis than girls, indicating that approximately one in 42 boys is currently diagnosed with ASD (Barnhill *et al.*, 2017).

At present, there is no epidemiological data available on the prevalence of autism in Malaysia. However, a smaller scale study by the Ministry of Health on children between the ages 18 to 26 months showed a rate of 1.6 in 1000 children (Lim, 2015). In the USA, the overall prevalence rate on ASD is 14.7 per 1000 (1 in 68 children aged 8 years old) and it still increasing over the year (Scott and Plauché, 2007). Common characteristics of autism such as the abnormal eating behaviors, the desire for sameness and feeding difficulties may put this population at increased nutritional risk (Schmitt *et al.*, 2008).

Feeding involves every sensory system (touch, sight, taste, smell and sound). Many children with ASD have difficulties with sensory processing and this can make eating certain foods a challenge for them. ASD children have concerns with the texture which leads to the refusal of many groups of food. Due to the food refusal problems, ASD children intake generally contains fewer foods and covers a more restricted range of food categories compared to children without autism (Schreck *et al.*, 2004).

Children with autism can develop behavioral problems during mealtimes. For example, children may learn that they can leave the table and play after refusing a food they do not like. Parents of children with autism spectrum disorder (ASD) often report concerns about the mealtime behaviors of their children (Schreck *et al.*, 2004). Problem eating behaviors such as picky eating or selective food refusal with lead to insistence on specific, nonfunctional mealtime routines, for example, one food is not allowed to touch another food or only specific utensils can be used, tantrums or other noncompliance behaviors during meals are normally involved ASD children (Lukens and Linscheid, 2008).

A study had indicate that ASD children have a prevalence of overweight that is similar to children in the general population and they are at increased risk for obesity and extreme obesity (Curtin *et al.*, 2005). Nutritional status assessment is important as these children are at risk of underweight, overweight or obesity. Nutritional status is an important indicator of the overall health status and wellbeing of children with disability. It portrays the physical growth of children and whether they are at risk of being underweight, overweight or obese (Safiza Mohamad Nor *et al.*, 2015).

Based on the recommendation by the World Health Organization, body mass index (BMI) and waist circumference are used frequently to measure obesity across different populations (UNICEF, 2013). Whether children with ASD have poor nutritional status compare to Typically Developing (TD) children and exhibit a greater prevalence of food refusals and mealtime behavior is poorly understood in Kelantan. Therefore, the purpose of this cross-sectional study is to identify nutritional status, mealtime behaviors and food refusal among ASD and TD children in Universiti Sains Malaysia, Kubang Kerian, Kelantan.

1.2 Problem Statements

According to Cermak *et al.* (2010a) reported children with autism spectrum disorder (ASD) experience more feeding problems than typically developing (TD) children and food selectivity is particularly problematic. In the previous study, they provided an operational definition of food selectivity include food refusal (number of foods refused of those offered) and food repertoire (variety of foods eaten). In a study by Bandini *et al.* (2010), they found a higher prevalence of food refusal and limited food repertoire among children with ASD. Food refusal among children with ASD may arise for multiple physiologic or mealtime behavioral reasons that may be difficult to sort out.

Regarding mealtime behavior, preschool-aged children with ASD have also been reported to have different eating behaviors compared to typically developing children (Provost *et al.*, 2010). Among ASD children, the prevalence of problem eating behaviors has been estimated to range between 46% and 89% (Ledford and Gast, 2006a). Curtin *et al.* (2005) reported that overweight and obesity are as important a concern in children with

autism as in the general population and their unusual dietary patterns and decreased access to opportunities for physical activity may be contributory factors. Since there is no other research in Kelantan about the issues related to nutritional status, food refusal and mealtime behavior among ASD and TD children, the aim of the study was to identify these 3 components among ASD and TD children in Universiti Sains Malaysia.

1.3 Significance of Study

The findings from this research could give benefits to parent and caregiver as they will able to identify the appropriate food that they need to prepare for their ASD children. They also can learn how to handle and tackle their ASD children behavior during their meal time. This study will also provide information that can be used for the prevention and treatment of these feeding problems. Next, physicians and health practitioner such as dietitians, Speech Language Pathologist (SLP), Occupational Therapist (OT) will also get benefit from the findings of this study for a better understanding and intervention planning.

Besides that, the findings from this study also can be used as guidelines for the teachers in providing food that more suitable for ASD preschoolers at school to reduce the risk of food refusal. The benefits will not be limited to awareness and knowledge that could be attained but also practical for daily life use. Nowadays, the research regarding ASD children population still limited in Malaysia, so this research can be beneficial for further study in this country.

1.4 Research Objectives

1.4.1 General Objectives

To compare the nutritional status, mealtime behavior and food refusal among Autism Spectrum Disorder and Typically Developing (TD) children aged 3 to11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

1.4.2 Specific Objectives

1. To compare nutritional status among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

2. To compare mealtime behavior among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

3. To compare food refusal among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

4. To determine the dietary pattern among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

1.5 Research Questions

1. Is there any significant difference in nutritional status among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan?

2. Is there any significant difference in mealtime behavior among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan?

3. Is there any significant difference in food refusal among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan?

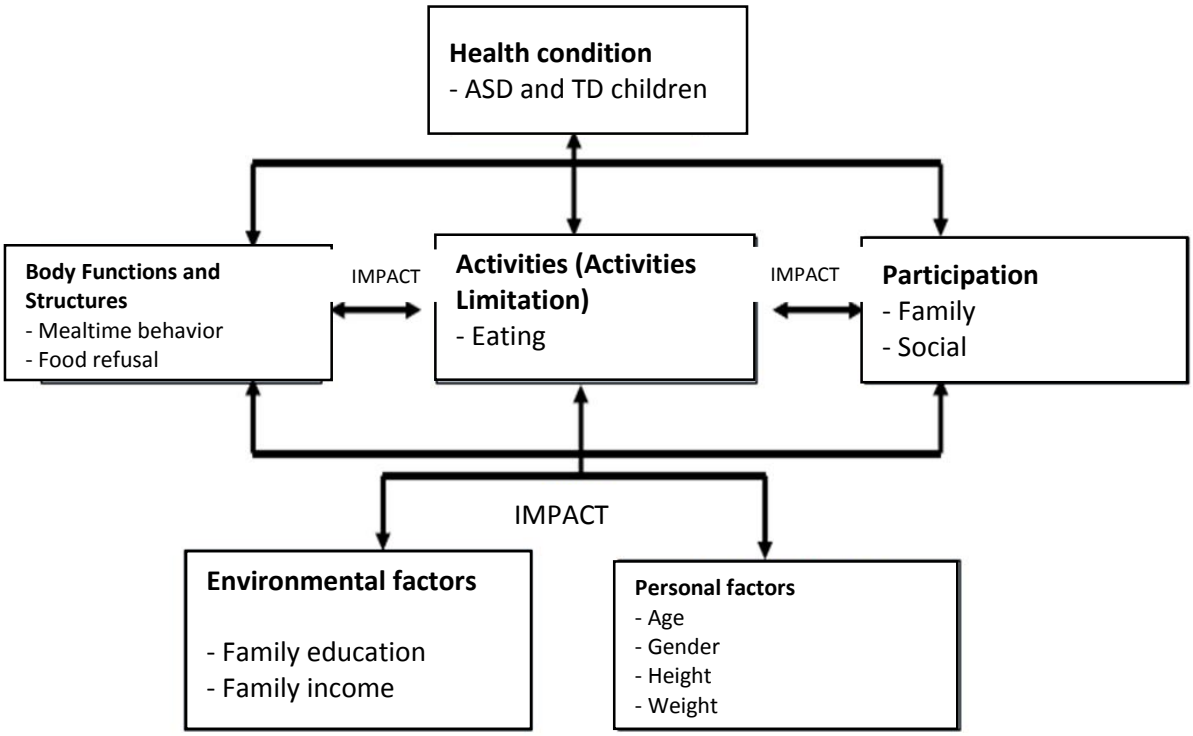
1.6 Hypothesis

1) Null Hypothesis: There is no significant difference in nutritional status mealtime behavior and food refusal among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

Alternative Hypothesis: There is a significant difference in nutritional status, mealtime behavior and food refusal among ASD and TD children aged 3 to 11 years old in Universiti Sains Malaysia Kubang Kerian, Kelantan.

1.7 Conceptual Framework

Figure 1.1: Conceptual framework



The conceptual framework guiding this study is based on the figure above obtained from study by Nor (2012), it used the International Classification of Functioning, Disability and Health (ICF) framework by the World Health Organization (WHO) (World Health Organization , 2001). The figure above used to structure the component of study which were nutritional status, food refusal and mealtime behavior among ASD and TD children.

There are many possible factors influencing this rise in severity and intensity of the nutritional status, mealtime behavior and food refusal among those children. The factors including the child's level of increase physical activities, environmental factors (home, schools, family, and siblings) and exposure to other lifestyle compared with the experiences of infants or toddlers (Fox & Joughin, 2002; Nicholls & Bryant-Waugh (2009).

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The feeding process plays an important role during the first year of life when much of the parent-infant communication is centered on this process (Lene Lindberg *et al.*, 1991). Early childhood is a period when children experience new foods, tastes, and textures. Childhood eating problems are common and reported by about 20% of parents which they often cause concern for parents and lead to high treatment seeking in pediatric settings (Micali *et al.*, 2016). Evidence indicates that feeding problems in early childhood are highly persistent and may lead to range of adverse outcomes including long term medical complications. Feeding problems including food refusal, limited dietary intake, and behavior problems at mealtime are common clinical concerns reported by parents of children with autism.

In addition, parents of children with ASD often report that their children are highly selective eaters, with very limited lists of food acceptance that may be restricted to as few as five foods group (Cermak *et al.*, 2010b). Although picky eating is not uncommon among young children who are typically developing, pickiness and food refusal in children with autism spectrum disorders (ASD) may be even more limiting and may extend beyond the early childhood period (Legge, 2002) . A study in Postorino *et al.* (2015), they defined food refusal based on the absolute number of foods the parent indicated that the child would not eat, as well as the percentage of foods offered.

2.2 Autism Spectrum Disorder children

Autism is a disability that strongly affects the way a child communicates and interacts (National Autistic Society, 1995). Diagnosis was commonly made in the second or third year of life, since these information is known about the nature and children appear physically normal and early development may be unremarkable. Autism children often present with weird eating habits, feeding difficulties and restrictive diets (Cornish, 1998). Parents with autism spectrum disorder (ASD) children frequently report that their children have selective eating behaviors and refuse many foods which could result in the inadequate nutrient intake. (Ledford and Gast, 2006b).

Autism spectrum disorder (ASD) is a condition that affects sensory integration disorders and feeding problems. Autistic children have difficulty in the sensory integration whether hyper-sensory (avoid stimulus) or hypo sensory (demand stimulus) which lead to feeding problem such as food selectivity (Beighley *et al.*, 2013). It is normal that eating problems, for children with autism, begin from the age of six months and continue until the age of four and a half years. When children begin to talk and speak or show the ability to express themselves, problems begin to extensively appear and get more complicated. Then, other problems are bound to occur, especially in choosing the quality of food (Williams et al., 2010).

Eating problems start to appear in numerous shapes and behaviors. Some subjects with autism eat quickly therefore, they become subjects to some physical problems, such as vomiting and choking. While some examine reject eating with their families and peers, others become very selective eaters. Still, others become very hard to convince to accept any kind of food so they start to reject eating most kinds of food (Williams, 2011).

Parents of children with autism spectrum disorder (ASD) frequently report that their children have selective eating behaviors and refuse many foods, which could result in inadequate nutrient intake (Lockner *et al.*, 2008) .Usually, they eat numerous types of food, or maybe less in some studies, which indicated that about 50% of children from age 18-24 months have the characteristic trait of limitedness in the variety of food, and 13% of them reject eating altogether (Lukens, Linscheid, 2008).

2.3 Food Refusal among ASD and TD children

A study by Sun *et al.* (2013) investigated the comparison of the nutritional status of children with autism and typically developing children at aged 4 to 6 years in China. The result showed that the levels of vitamins A and B6, zinc and calcium intakes were less than 80 % of the dietary reference intakes in both groups. Furthermore, the proportions of vitamin C and calcium intake deficiencies in the autism group were showed the higher than those in a typically group. Moreover, serum Zn level was less than the normal reference range in both the groups. Thus, nutritional inadequacies were observed among autism and typically developing children in China, however, this problem more noticeable among children with autism.

In a study by Zimmer *et al.* (2012), the children with autism had poorer food variety scores compared to age-matched typical developing group. This study showed that typical children had a wider range of food choices than children with autism. Some children with autism appeared to be as flexible in their food choices as typical children, while others were much more limited and seemed to restrict their intake. However, in this study, the group with

autism had the greater average intake of magnesium than the control group. Foods high in magnesium include green vegetables, cashews, almonds and whole, unrefined grains (Gerrior et al. 2004). However, poor calcium intake has been consistently reported among children with autism. Yet, this data is especially concerning in light of the fact that many parents of children with autism limit or completely eliminate dairy from their child's diet as part of the popularity of the gluten free casein free diet.

In a study by Dubois *et al.* (2007), they investigated the measures for eating behaviors were derived from self-administered maternal questionnaires of children at aged 2.5, 3.5 and 4.5 years old. The result of mealtime behavior showed that the percentage of children reported being a picky eater was quite stable in preschool years which range from 14 to 17%, 11 to 13% of irregular eaters and the proportion of children reported as overeaters ranged among 19 and 23%. Regarding the nutrient intake, picky eaters consumed less energy, fat, and protein compared to children who reported never being picky eaters. Meanwhile, overeaters consumed more energy and more of each macronutrient than children who were never reported as being overeaters during their preschool years. In addition, the children which were reported as being overeaters at all ages that showed increases with consumption involving the more servings of grain products per day the children showed they positively related to increasing of BMI. BMI was higher for overeaters than for children who never reported overeating behaviors even though they consume the same number of servings (Dubois *et al.*, 2007).

In a study by Johnson *et al.* (2008), they reported that the parents of children with autism rated more feeding problems, especially related to individual refusal of foods based on texture, color, and type than did parents of typically developing. ASD children showed there was no significant different in their intake of total calories and most nutrient. However, children with autism consumed fewer vegetables so it is not surprising at all when they were reported with lower Vitamin K consumption (Johnson *et al.*, 2008). However, over 50% of children in both groups had inadequate fiber consumption. Therefore, both groups of young children had low fiber intake. In addition, inadequate iron was more frequent in the children with autism (26%) compared to controls (0%) based on the FFQ data. Findings of this study showed that the food intake among both of group does not have a big gap of difference.

A preliminary cross-sectional study was conducted to investigated the dietary intake and parents reported, the perception of food behaviors among 20 ASD children and typically developing children at aged 3 to 5 years old (Lockner *et al.*, 2008). The reported food behaviors and use of vitamin or mineral supplements showed that the nutrient intake was similar for both groups of children with the majority of children consuming more than the recommended amounts of most nutrients. However, minimum nutrients that likely to be consumed in recommended amounts were vitamin A, vitamin E, fiber, and calcium. ASD children showed more possibility to consume vitamin or mineral supplements than typically developing children. Compared with parents of typically developing children, parents of children with ASD were more likely to report that their children were picky eaters and resisted trying new foods, and they were less likely to describe their children as healthy eaters or that they eat a variety of foods (Lockner *et al.*, 2008).

2.4 Mealtime Behavior Problem in ASD children

A study by Al-Khuffash (2013) consisted of 156 children, of whom 59 children have autism, 57 children belong to the category of the mentally retarded, and 40 were subjects with normal. The result has shown that the subjects of the study have a problem of eating sweets and sugars. This demonstrates that children, overall, are alike in showing preferences to sugars and sweets. This study also showed that children with autism have a problem in wasting a long time at mealtimes exceeding 45 minutes. This result may also illustrate that children with autism have a problem in chewing, or in moving the tongue, or swallowing, thus reaching to the fact that they require a longer time. In addition, it was clearly evident that children with mental retardation have a problem in eating uncooked and/or solid vegetables. This might be attributed to the fact that autism children have been unable to differentiate between fruits and vegetables, because of the lowness of intelligence level.

A study by Nadon *et al.* (2011) has investigated the problems of eating for autism children only at the time of eating. Results have shown that the children with ASD had a mean of 13.3 eating problems, namely, the timing of eating and rejecting specific kinds of foods. However, the brothers have shown some problems with an average mean of 5.0 compared with their autistic siblings who live in the same social environment. More parents noticed a decrease in intake among their children with ASD compared to their siblings. Children with ASD showed significantly more associated behaviors at mealtimes than their siblings. More children with ASD ate fewer than 20 different food items and did not stay seated during meals compared to their siblings. Children with ASD were more selective with respect to food texture, temperature, and type of recipe, and it was more difficult to introduce unfamiliar food items to them. More children with ASD could not tolerate foods that they

did not like on their plate, compared to their siblings and some of them even refused foods they had eaten before.

Bandini *et al.* (2010) have applied food problems on a sample of 53 autistic children compared to 58 normally grown children whose ages ranged from 3-11. They found that children with ASDs displayed more food refusal and exhibited a more limited food repertoire compared with typically developing children, although food refusal was seen in both groups of children. Results have shown that 41.7% of autistic children have acquired the behavior of rejecting food compared to 18.9% for normally grown children. Further, results have shown that 4 autistic children compared to one normal child have hesitated to eat a special kind of food.

Martins *et al.* (2008) have investigated the problems of eating habits in a case study of autism and normal children. They studied the nature of autism, and they measured how frequently it takes place. The sample of the study consisted of 41 autism children and 41 children with normal development within ages ranged from 2-12 years old. Results have shown that autistic children lacked the skill of independently eating their meals by showing some aspects of rejection and fear from food. Children with ASD were found to have slightly poorer self-feeding skills and were more likely to avoid foods and to exhibit food neophobic behaviors. Additionally, results have shown that there was a correlation between eating problems and food confusion, whereas normal children showed very few eating problems.

2.5 Nutritional Status ASD and TD children

An observational case–control study by Marí-Bauset *et al.* (2015) investigated the nutritional factors in ASD and TD children. Children with autism spectrum disorder (ASD) have problems of food selectivity which also including food refusal and limited variety which implying risks of nutritional deficiencies. The aim was to compare intakes of macro and micronutrients and body mass index in ASD and typically developing (TD) children. In this study, 3-day food diaries and anthropometric measurements were completed for ASD (n = 40) and TD (n = 113) children at aged 6–10 years which living in the same area. Body mass indices were below the 5th percentile in 20 % of ASD versus 8.85 % of TD children. They found that BMI values were lower in ASD than TD children. The findings of the research revealed that the intakes were lower for fluoride ($p = 0.017$) and higher for vitamin E ($p = 0.001$). Most children in both groups (ASD and TD children) failed to meet recommendations for carbohydrates and fiber, with intakes lower than the RDIs, and for lipids and cholesterol, intakes these types of nutrients being excessive, particularly among TD children.

A study by Shmaya *et al.* (2015) investigated about three to six year old children with ASD were compared to their typically developing siblings and to a typically developing age and gender matched control group, in order to evaluate their intake and body mass index. Nutrient intake was compared to the Dietary Reference Intake using three-day diet diaries completed by the parents. The results of the current study show Z scores of weight and BMI for children with ASD were significantly higher than those of the typical development group. A trend toward higher deficiency in the ASD group was observed as compared to the sibling group. A higher body mass index was found in the ASD group compared to their counterparts, despite their nutritional deficiencies.

A case-control study conducted in Valencia, Spain by Bauset *et al.* (2013), they compared the body mass index (kg/m2) of 40 children with autism spectrum disorders (cases) and 113 typically developing children (controls) from the same area of residence. The present study found that the body mass index percentile of children with autism spectrum disorders was significantly lower than that of matched controls from the general population after adjusting for both sex and age. The sex- and age-adjusted odds ratios for being underweight in cases was 2.41 compared to controls. In particular, 20% of the cases had a body mass index below the fifth percentile compared to 8.85% of the controls. This study suggested that the anthropometric development of children with autism spectrum disorders should be monitored as part of routine care.

There was a study to assess the association between age and the prevalence of obesity among children with and without autism spectrum disorder (ASD) in the 2011–2012 National Survey of Children's Health. Must *et al.* (2017) reported although the overall prevalence of obesity among children with ASD was significantly ($p < 0.001$) higher than among children without ASD (23.1% vs. 14.1%, 95% confidence interval for difference 3.6 to 14.4), child age significantly ($p = 0.035$) modified this difference. This pattern arose due to a consistently high prevalence of obesity among children with ASD and a decline in prevalence with advancing age among children without ASD.

2.6 Factors Influencing Nutrition and Health among Asd And Td Children

There were a few studies have examined the weight status of children with ASD. The result from National Survey of Children's Health has revealed the prevalence of obesity among children with ASD was at least as high as among other children (Evans *et al.*, 2012). This situation may relate to socioeconomic status and the education and knowledge level. Parent play an important role to provide healthily and balance with all nutrient on food intake in their children. Based on the result in the National Health Interview Survey by the Centers for Disease Control and Prevention revealed that the highest obesity rates were associated with the lowest incomes and low educational levels (Drewnowski and Specter, 2004).

2.6.1 Socioeconomic Status

A cross-sectional study by Shoeps *et al.* (2011) involving 1544 children from daycare centers of Santo Andre, Brazil. In this study, they measured body weight, height and body mass index that can be classified according to the 2000 National Center for Health Statistics (CDC/NCHS). The result from the study reported that girls were taller and heavier than boys while there were similar BMI between both genders. The frequency of children below -2 z scores was lower than expected which were 1.5% for weight, 1.75% for height and 0% for body mass index. This result showed none of the children were malnourished. The extreme result showed with evident of the prevalence of overweight and obesity of 16.8% and 10.8% respectively. From the result, it was reported that the children in Santo Andre showed that their growth in stature was similar and higher compared to the US even though they come from low-income families. This situation maybe can be considered due to the reason that

low-income families cannot access proper nutrition which would account for the rest of their daily caloric intake. Furthermore, it was possible that these pre-school children perform the less physical activity at home due to the use of television (Shoeps *et al.*, 2011).

2.6.2 Education and Knowledge Level

A cross-sectional study by Sarrafzadegan *et al.* (2012) targeted the parents of normal, underweight, overweight and obese children who were selected using multistage random sampling method. The result showed that 90% of parents were aware that obesity is a disease, and 92% knew that eating too much fast food would lead to obesity in children. Only 5% assumed that obese children are healthier than non-obese children. Families with fathers, whose education level was higher than high school diploma rated their children's weight status as overweight or obese significantly less than families with fathers, whose education level was high school diploma or lower.

Only 12% of parents tried to help their children lose weight at least once and only 6% arranged sports activities for the family members. In 57% and 41% of families, the child who decided how much time was enough to watch TV, and how much chocolates and sweets to eat. 46% of children watched TV for more than 2 hours/day, and 49% of children watched TV while eating meals. The mean total score of boys' parents was significantly lower than that of girls' parents ($P < 0.05$). Families with low income, with no medical insurance, or not owning a house thought that the cost of registration in sports activities for children was too high ($P < 0.03$).

CHAPTER 3

METHODOLOGY

3.1 RESEARCH DESIGN

This was a comparative cross-sectional study and conducted from January to April 2017. This study involved a group of selected respondents in USM, Kubang Kerian, Kelantan.

3.2 POPULATION AND SETTING

This research involved children aged 3 to 11 years old who attending Permata Pintar Kindergarten and Nursery Complex for Typically Developing children and for ASD children who attending Speech Clinics HUSM, Prince USM and Occupational Therapy Unit.

3.3 SAMPLE POPULATION

3.3.1 Required Sample Size

The total number of children with ASD in Speech Clinics HUSM, Prince USM and Occupational Therapy Unit which around 47 of children were gained from the registration counter while the number of TD children about 68 was gained from the officer in Permata Pintar Kindergarten and Nursery Complex. The total number of both groups of children after adding up was about 115. The sample was calculated with 5 % for margin error, 90% for

confidence level and 50% for response distribution by using the Raosoft Sample Size Calculator. From the calculation, the minimum sample size for this research about 81 children (Raosoft, 2004). By taking into account that 20% of drop out, the total sample size was 97 respondents. For two different group, it was divided into 47 children in ASD group and 48 children for TD children group.

3.3.2 Sampling Design

When recruited the respondents, due to limited access to get ASD respondents, purposive sampling was used during data collection in Speech Clinic and Occupational Therapy Unit HUSM, Prince USM. A purposive sample is a non-probability sample that is selected based on characteristics of a population and the objective of the study (Palys, 2008). In Permata Pintar Kindergarten and Nursery Complex, simple random sampling was used based on the classes given by Officer. The list name of students among 4 classes was given and the name of respondents was choose randomly.

3.3.3 Reference population

The reference population was children with Autism Spectrum Disorder (ASD) and Typically Developing (TD) children aged 3 to 11 years old in USM, Kelantan. The age range of children which at 3 to 11 years old was obtained from the study by (Hubbard *et al.,* 2014).

3.3.4 Source Population

This research was conducted at Universiti Sains Malaysia Health Campus, Kubang Kerian, Kelantan. 4 different location was included in this study for subject recruitment which from Speech Clinics HUSM, Prince USM and Occupational Therapy 4 (ASD children) and Permata Pintar Kindergarten and Nursery Complex (TD children). Children were categorized into TD when they had no developmental delay reported by parents and teachers. ASD children were diagnosed by psychiatrists or speech pathologist or occupational therapist in HUSM. It was possible that a research regarding the comparison of nutritional status, food refusal and mealtime behaviors among children with ASD and TD children aged 3 to 11 years old in USM, Kelantan was not done yet.

3.4 INCLUSION AND EXCLUSION CRITERIA

Table 3.1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Group 1 - Autism Spectrum Disorder (ASD) 1. Children with ASD (aged 3 to 11 years old) who were attending Speech Clinic at Hospital Universiti Sains Malaysia (HUSM), Prince USM and Occupational Therapy Unit. 2. Parents or caretaker of the children (above) who were able to understand, speak and write in Malay (disregards of any dialects) or English. 3. Parents and caretaker of the children (above) who consented in participating the study.	Group 1 (ASD) 1. Children with ASD who were not within the stated age range, and who were not attending Speech Clinic at Hospital Universiti Sains Malaysia (HUSM), Prince USM and Occupational Therapy Unit. 2. Parents or caretaker of the children (above) who were not able to understand, speak and write in Malay (disregards of any dialects) or English. 3. Parents and caretaker of the children (above) who are not consented in participating the study.
Group 2 - Typical Development (TD) 1. Typically developing children (aged 3 to 11 years old) who were attending *Permata Pintar* Kindergarten and Nursery Complex. 2. Parents or caretaker of the children (above) who were able to understand, speak and write in Malay (disregards of any dialects) or English. 3. Parents and caretaker of the children (above) who consented in participating the study.	Group 2 (TD) 1. Typically developing children (aged 3 to 11 years old) who were not attending *Permata Pintar* Kindergarten and Nursery Complex. 2. Parents or caretaker of the children (above) who were not able to understand, speak and write in Malay (disregards of any dialects) or English. 3. Parents and caretaker of the children (above) who were not consented in participating the study.

3.5 VARIABLE MEASUREMENT

Table 3.2: Independent and dependent variables

Independent variables	Dependent variables
1) Mealtime behaviors 2) Food refusal 3) Gender 4) Family income 5) Education level.	1) Nutritional status

3.6 INSTRUMENT AND MEASUREMENT

The data collection was comprised with body weight and height measurement of respondents, self-administered questionnaires for Socio-Demographic Profile**,** Brief Autism Mealtime Behavior Inventory Children (BAMBIC) and Food Preferences Inventory (FPI).

3.6.1 Socio-Demographic Profile

Table 3.3: Socio-demographic status questionnaire

Child Information	Parents Information (Mother/Father)
1. Registration number 2. Age 3. Date of birth 4. Gender 5. Weight 6. Height 7. Body Mass Index	1. Age 2. Race 3. Education level 4. Occupation 5. Family members 6. Monthly total family income 7. Monthly total family income for food