

**ASSESSMENT OF NUTRITIONAL STATUS,
NUTRITION RELATED KNOWLEDGE LEVEL AND
ITS ASSOCIATED FACTORS AMONG LEARNING
DISABILITIES CHILDREN IN SPECIAL EDUCATION
INTEGRATION PROGRAMME (SEIP) IN KOTA
BHARU, KELANTAN**

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**ASSESSMENT OF NUTRITIONAL STATUS,
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AND ITS ASSOCIATED FACTORS AMONG
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SPECIAL EDUCATION INTEGRATION
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KELANTAN**

by

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LIST OF SYMBOLS AND ABBREVIATIONS

ADA	American Dietetic Association
ADHD	Attention deficit hypersensitivity disorder
AIFO	Italian Association Amici di Raoul Follereau
A	Cronbach's alpha
ANCOVA	Analysis of covariance
ASD	Autism spectrum disorders
BMI	Body mass index
BMR	Basal metabolic rate
CBR	Community-based rehabilitation
CDC	Centres for Disease Control
CI	Confidence interval
CP	Cerebral palsy
EI	Energy intake
F	Female
FAO	Food and Agriculture Organization
GERD	Gastro-esophageal reflux disease
ID	Intellectual disability
IPH	Institute for Public Health
JKM	Jabatan Kebajikan Masyarakat
LD	Learning disabilities
M	Male
MOH	Ministry of Health
MUAC	Mid-upper arm circumference
N	Frequency

N/A	Non-applicable
NCCFN	National Coordinating Committee on Food and Nutrition
NCHS	National Centre for Health Statistics
PPKI	Program Pendidikan Khas Integrasi
PWD	Persons with disabilities
RNI	Recommended Nutrient Intake
SD	Standard deviation
SEIP	Special education integration programme
WHO	World Health Organization
WHO/DAR	WHO Disability and Rehabilitation Team

**PENILAIAN STATUS PEMAKANAN, PENGETAHUAN PEMAKANAN,
DAN FAKTOR YANG BERKAITAN KE ATAS KANAK-KANAK MASALAH
PEMBELAJARAN BAGI PROGRAM PENDIDIKAN KHAS INTERGRASI
(PPKI) DI KOTA BHARU, KELANTAN**

ABSTRAK

Malpemakanan merupakan masalah yang sering dihadapi oleh kanak-kanak yang mempunyai masalah pembelajaran (MP). Bagaimanapun, status pemakanan dan tahap pengetahuan berkaitan pemakanan dalam kalangan MP di Malaysia masih tidak jelas. Kajian ini dijalankan bermula dari April 2016 hingga Jun 2017 dengan matlamat untuk menilai status pemakanan, tahap pengetahuan berkaitan pemakanan dan faktor-faktor yang berkaitan dalam kalangan kanak-kanak MP yang mengikuti Program Pendidikan Khas Integrasi (PPKI) di Kota Bharu, Kelantan. Pengesahan dan penilaian kebolehpercayaan soalan bergambar telah dijalankan sebelum digunakan. Kajian ini melibatkan 99 kanak-kanak MP (37.4% perempuan dan 62.6% lelaki) di empat buah PPKI terpilih sekitar Kota Bharu. Purata (SD) umur peserta kajian adalah 10.87 (1.55) tahun. Data antropometri, diet, sosio-demografi, tahap pengetahuan berkaitan pemakanan dan juga faktor-faktor yang berkaitan diperoleh melalui satu set soal selidik berstruktur. Soal selidik pengetahuan berkaitan pemakanan mengandungi 10 item menunjukkan kebolehpercayaan yang baik dengan nilai Cronbach Alpha 0.60. Kebanyakan peserta dapat mengenal pasti makanan yang tidak berkhasiat namun, hanya minoriti yang berjaya mengenal pasti makanan yang tinggi kandungan kalsium. Menurut klasifikasi jisim badan (BMI), hasil kajian

menunjukkan seramai 10.1% kanak-kanak MP (70% lelaki dan 30% perempuan) mempunyai kurang berat badan manakala 37.3% (62.2% lelaki dan 37.8% perempuan) mempunyai berat badan berlebihan atau obes. Purata (SD) skor tahap pengetahuan berkaitan pemakanan kanak-kanak MP adalah 6.07 (2.16). Analisis regresi berganda menunjukkan bilangan adik-beradik ($p=0.006$), peratusan lemak badan ($p<0.001$) dan masalah penyusapan ($p=0.038$) berkait rapat dengan malpemakanan dalam kalangan populasi ini. Sebagai kesimpulan, masalah malpemakanan dalam kalangan kanak-kanak MP masih tinggi, oleh yang demikian, intervensi baru berserta strategi yang lebih efektif termasuklah penambahbaikan topik pendidikan pemakanan dalam silibus sekolah adalah bagi mengelakkan masalah malpemakanan menjadi masalah global terutamanya dalam kalangan kanak-kanak MP yang mempunyai risiko yang lebih tinggi.

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ABSTRACT

Malnutrition has been found to be a common setback among children with learning disability (LD). However, the nutritional status and nutrition related knowledge level among the local LD population are obscure. This study was conducted from April 2016 to June 2017 with the aim to assess the nutrition status, nutrition related knowledge level and its associated factors of LD children studying at Special Education Integration Program (SEIP) in Kota Bharu, Kelantan. Validation and reliability testing was done on the pictorial flipchart questionnaire beforehand. The study involving 99 LD children (37.4% girls and 62.6% boys) at four selected SEIP in Kota Bharu area. Mean (SD) age of study participants were 10.87 (1.55) years. Data on anthropometry, dietary, socio-demography, nutrition related knowledge level and also factors associated were collected using a set of structured questionnaire. The validated nutrition related knowledge questionnaire contained 10 items shows a good reliability with Cronbach Alpha value of 0.60. Most participants are able to identify unhealthy food and minority of them knows which foods are high in calcium. According to the body mass index (BMI) classification, results indicates that the prevalence of 10.1% of LD children (70%

boys and 30% girls) who were underweight while 37.3% (62.2% boys and 37.8% girls) were overweight or obese. The mean (SD) score of nutrition related knowledge questionnaire of LD children are 6.07 (2.16). Multiple regression analysis shows that number of siblings ($p=0.006$), body fat percentage ($p<0.001$) and feeding problems ($p=0.038$) were significantly associated with malnutrition among this population. In conclusion, high prevalence of malnutrition are found in this population thus more effective strategies with new interventions programs including improving the nutrition education syllabus at schools to prevent malnutrition from becoming a worldwide problem particularly among children with LD as they face the risk of being left behind.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

A person is said to have learning disability is when they are having a disorder that may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. Individuals with these disorders will experience difficulties in learning and exhibit at least average abilities essential for thinking and/or reasoning. Impairments in one or more processes related to perceiving, thinking, remembering or learning leads to learning disabilities. These include, but are not limited to: language processing; phonological processing; visual spatial processing; processing speed; memory and attention; and executive functions (e.g. planning and decision-making) (Learning Disabilities Association of Canada, 2015).

In Malaysia, disabilities were categorised into 7 types; physical, hearing, vision, mental, learning, speech and multiple disabilities (JKM, 2016). Registered medical officers and specialists are authorised to approve and grouped them into the categories mentioned above. Parents are advised to register their child with Social Welfare Department in order to receive a special card and its benefit. The registration is voluntary basis. Based on data obtained from JKM (2016), total registration of learning disabilities as at the end of 2012 was 165,281 people. While, number of new registration on 2011 of child with learning disabilities aged 7-12 was 5700 and new registration in 2012 was 8856. The number of registration has increased by 55% in a year. Based on data obtained from the Jabatan Kebajikan Masyarakat (JKM), the total number of children registered with learning disabilities (LD) as at the end of

2015 was 75, 152. This shows that the awareness regarding learning disabilities among parents and society has improved over a year.

There are various special education programs have been established in Malaysia by the Ministry of Education in order to generate excellence in intellectually/learning challenged students. A program known as Special Education Integration Program (SEIP) is implemented in regular pre, primary and secondary schools. This program is the most important special education program under the local education system. When a child is assessed as having learning disabilities, the choice of placing the child in inclusive education programmes into mainstream classes or in SEIP was filled in by the specialist. If the child is enrolled in SEIP programme, they will be given 3 months of trial period.

Within this period, respected teachers will assess the child whether they are fit and manageable at school. If not, several discussions with parents, teachers and officers from Department of Education (DOE) and Department of Social Welfare (DSW) were needed for a further action to be taken. Based on their cognitive level or commonly known as mental age, learning disabilities children are then enrolled into special classes. This means children are allocated into learning levels or classes based on their intelligence instead of their chronological age. Only well trained teachers with certification on special education endorsement or early intervention for children, are allowed to teach these students.

Students undergo a near full general education curriculum learning at their pace. In addition, various adaptive skills such as taking care of personal needs, home living, health and safety, communication and social skills has been taught throughout the classes. In Physical education and health, students are taught to classify healthy

and unhealthy food, advantages and disadvantages of healthy and unhealthy food, as well as proper mealtime. Same goes for students in Primary Mainstream schools. Approximately, there were 52,946 children enrolled into the program (30,345 for pre- and primary school; 22,337 for lower secondary school; 264 for upper secondary school) as of 30th June 2013 (MOE, 2013).

There are 90 primary schools and 45 secondary schools in Kelantan which provide Special Education Integration Program to cater for 2,042 children with learning disability in primary schools and 1,692 in secondary schools. Malnutrition is a common setback among population with learning disability. A study conducted by Chen ST *et al.* (2013) shows that the prevalence of 17.8% underweight and 15.2% overweight and obese among children with disabilities as documented in Kelantan community-based rehabilitation centers. Children with intellectual/learning disability are typically experienced troubles in leading a healthy lifestyle due to their cognitive, sensory and physical limitations (Holcomb *et al.*, 2009). These children are unable to prepare food for themselves, requiring help from others. Thus, under-nutrition can be readily caused by inadequate nutrition provision to those individuals who have limited preferences in food consumption (Wong, 2011). In worst case, these children are prone to have poor nutrition that may lead to weight loss and malnourishment due to multiple medical conditions and societal participation issues.

On the other hand, overweight and obesity in current population requires increase attention and immediate intervention as the associated secondary medical problems following the excess body weight can adversely affect their functional status. Children with learning disability are more likely to engage in sedentary activities such as watching television, playing computer games or sleeping as their disabilities inhibit them from joining or competing in sports or recreational games

that require higher level of physical fitness, cognition and more refined motor skills (Kasser and Lytle, 2005).

1.2 Statement of the problem

The prevalence of childhood malnutrition among disabilities has increasing day by day. As mentioned earlier, the total number of children registered with LD as at the end of 2015 was 75, 152 (JKM, 2016). Poor knowledge on healthy lifestyle behaviours may predispose youth with disabilities to a higher risk of weight gain (Rimmer et al., 2007). This due to cognitive incompetence or difficulty in generalized motor functioning that may cause significant challenges in teaching this population, which, in this case, nutrition topics. According to Rimmer et al. (2007), in order to be able to design future interventions that address these important issues, a critical area of research is needed, include well understandings of the personal and environmental contextual factors associated with overweight/obesity in adolescents with disabilities, and determining the potential secondary conditions associated with these factors. To our best knowledge, limited study has been done in assessing the nutritional status and nutrition knowledge level among local disability population and its relationship with associated factors.

Nutrition knowledge is important for each individual as it influence one's food choices. If the children knows what is good and what is not good for them, they can decide on their own on what to be eaten and what is not especially when the caregiver are not around such as during school time. Therefore, this study closes the gap with previous study done as it includes various factors that influence the

nutritional status of LD children in SEIP and at the same time, future intervention can be done based on the child's nutrition related knowledge level.

1.3 Significance of the study

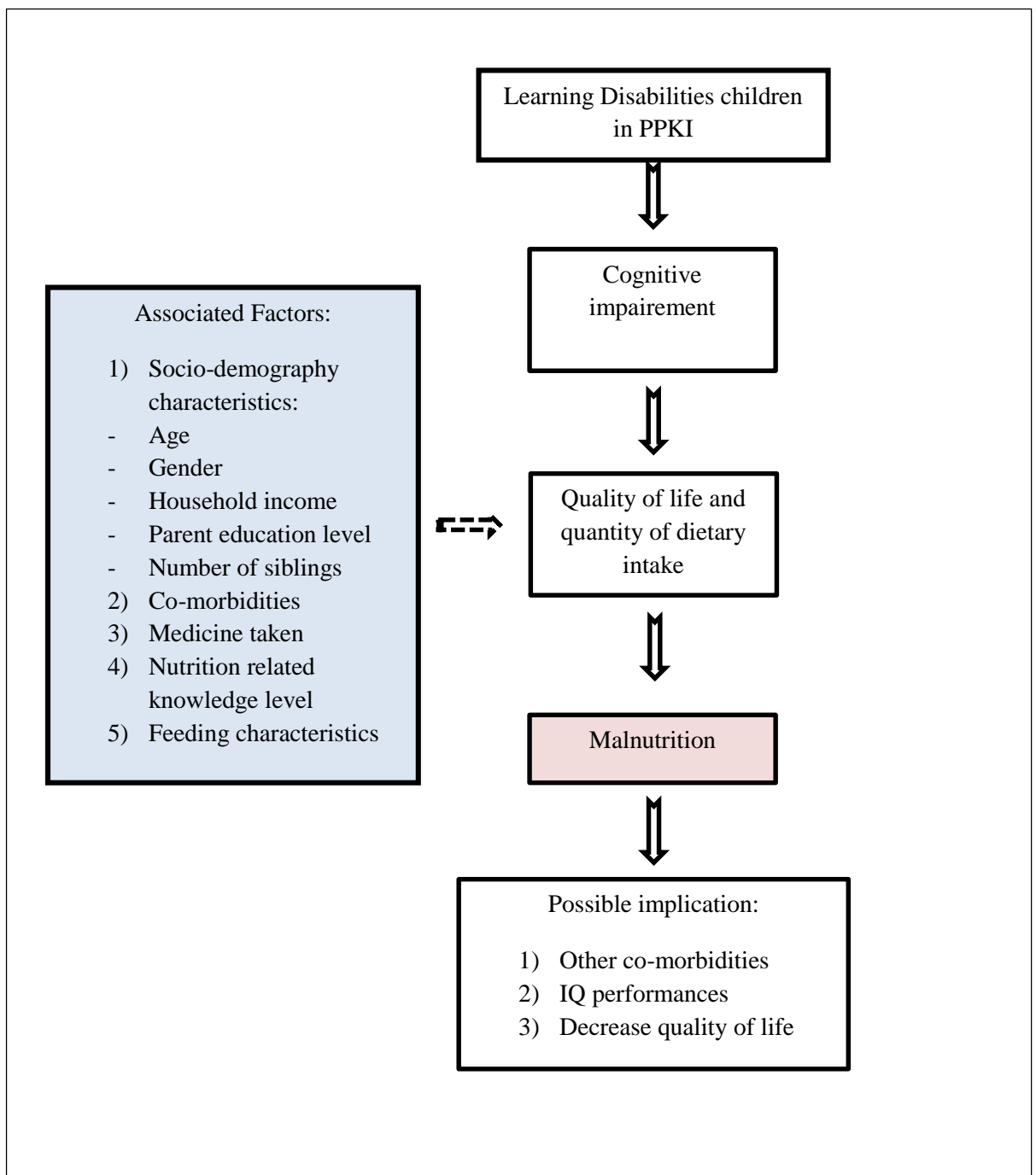
The results from this study will allow a reappraisal of the current syllabus on health and fitness especially on nutrition topics among learning disabilities children in schools in Malaysia. This population has gain lots of attention, not only in Malaysia, but globally, as testified by the number of recently published papers, books and international conferences on this population that have taken place over the last few years. Thus, improving the nutritional status of this population is best done by improving their knowledge on nutrition as 'prevention is better than cure'. A better nutritional status leads to a better health and quality of life which indirectly will improve the economy by spending less money on treating illness. The development of nutrition related questionnaire will help in determining the child level of knowledge on nutrition and therefore can be improved later by the caregiver or learning at school. Therefore it is anticipated that this study would generate a great deal of interest, not only among researchers for further research innovation, but also among the general public.

1.4 Conceptual framework

Figure 1.1 illustrates the conceptual framework for the present study. This framework is modified and adopted from UNICEF Nutrition strategy 1998 (UNICEF, 1998) for a better understanding that causes of malnutrition are multisectoral, embracing food, health and caring practices. The original framework

classified the causes into immediate, underlying, and basic, whereby factors at one level influence other levels. The framework is used to help plan effective actions to improve nutrition and been used at national district and local levels. It provides guide in assessing and analysing the causes of the nutrition problem and helps in identifying the most appropriate actions to be taken.

This conceptual framework hypothesized that, due to listed associated factors of malnutrition among learning disabilities children identified in previous studies, the nutritional status (in terms of anthropometry and dietary) of learning disabilities children became affected as well as their quality of life. Therefore, burdens are produced either to the child, or to the population. Other possible implications for instance obtaining other co-morbidities, poor IQ performances and decrease in quality of life might as also occur. Hence, by discovering the associated factors that relates to this particular research population, more effective intervention can be proposed in the future. Thus, the nutritional status of this population can be improved and burden could be reduced. However, the proposed intervention will not be further discussed in this study. The associated factors identified by previous studies were discussed in details in chapter 2.



Note: Associated factors listed are the variables included in the study and Source: UNICEF (1998) only the box with colour are studied

Figure 1.1 Conceptual framework of the study

1.5 Research questions

- 1) What is the nutritional status of children with learning disabilities?
- 2) What is the nutrition related knowledge level of children with learning disabilities?
- 3) What are the factors associated with the nutritional status among children with learning disabilities?

1.6 Objectives of the study

1.6.1 General objectives

To study the nutritional status, nutrition related knowledge level and its associated factors among children with learning disabilities in Special Education Integration Program (SEIP) in Kota Bharu, Kelantan.

1.6.2 Specific Objectives:

- 1) To determine the nutritional status (anthropometry, dietary and feeding characteristics) of children with learning disability in SEIP, Kota Baru, Kelantan.
- 2) To identify the nutrition related knowledge score of children with learning disability.
- 3) To determine the factors associated with the nutritional status among children with learning disability.

1.7 Hypothesis

Null Hypothesis, Ho

There is no association between nutritional status with nutrition related knowledge score, socio-demography factors, and feeding characteristics among children with learning disability.

Alternative Hypothesis, HA

There is an association between nutritional status with nutrition related knowledge score, socio-demography factors, and feeding characteristics among children with learning disability.

1.8 Definition of terms

Learning disabilities: Someone with intelligence level that is not consistent with their biological age. Those who fall into this category are inert, Down Syndrome, Intellectual disabilities, Autism, Attention Deficit Hyperactive Disorder (ADHD), Specific learning disabilities (dyslexia, dyscalculia, dysgraphia) and through global developments (global development delay) (JKM,2016).

Special Education Integration program: Special education program under Malaysian Ministry of Education for disabilities children that provide general education curriculum learning at their pace.

Children: Children aged seven to 14 years old.

Malnourished: Someone who is categorised as either underweight or overweight according to BMI classification by WHO charts and Down syndrome charts by Zemel *et al.* (2015).

Nutritional status: Anthropometry data including body mass index, waist circumference, mid-upper arm circumference and body fat percentage; dietary intake and feeding characteristics of LD children.

CHAPTER 2

LITERATURE REVIEW

2.1 Disability

According to World Health Organization (2011), about 15% of the world population are estimated to live with some forms of disabilities and the number may reach over a billion people. They further discover that among 110 million (2.2%) to 190 million (3.8%) people aged 15 years and older experience significant functioning difficulties. The increasing number of disabilities rate is partly due to ageing populations and the increase in chronic health conditions.

As in Malaysia, there is an increase in the trend on the number of registered PWD since 2013. This corresponds with the data obtained by Department of Social Welfare whereby the number of registered PWD increased by 20.3% in 2014 and 14.9% in 2015. The Malay accounts for 60.7% from the total number, the Chinese accounts 19.5%, while the Indian accounts for 9.7% of the total number and other races account for 10.1%. Meanwhile, around 28.7% from the total number were children. However, the numbers given do not represent well the real population as there are still many unregistered PWD whose caregivers refuse to acknowledge or those who lack awareness about PWD.

Despite being given the special attention and deserving the highest standard of health care as reinforced by UN Convention on the Rights of Persons with Disabilities (CRPD) in Article 25, however, health promotion and prevention activities rarely target people with disabilities. In addition, this population is particularly vulnerable to deficiencies in health care services which then, exposing

them to greater vulnerability to secondary conditions, co-morbid conditions, age-related conditions, engagement in health risk behaviours and higher rates of premature death depending on the group and setting.

2.2 Special education integration programme (PPKI)

There are various special education programs that have been established in Malaysia by the Ministry of Education in order to promote excellence among intellectually/learning challenged students. A program known as Special Education Integration Program (SEIP) is implemented in regular pre, primary and secondary schools. This program is the most important special education program under the local education system. SEIP was first started on 1962, involving only visual impaired students in primary and secondary schools. A year later, the integration programme included children with hearing impairments, however they were taught in separated classes. Later in 1988, the Ministry of Education started pioneer classes in primary schools for learning disabilities children and the number is increasing until now.

The aims of this programme are to ensure that: 1) each special needs student (SNS) obtains the access to education that is relevant and suitable for them; 2) each of their talent and potential should be further expanded through vocational education that will produce skilful individuals towards improving their quality of life; 3) each student should be given the chance to enrol in the Early Intervention Programme so that their capacity level can be optimised; 4) provide the opportunity for each student to enrol in education programme that focuses on self-potential enhancement to produce half-skilled groups that will later become state assets; 5) potential students

should be placed inclusively in the mainstream classes (Ministry of Education Malaysia (MOE), 2017).

When a child is diagnosed as having learning disabilities, the choice of placing the child in inclusive education programmes (integration into mainstream classes) or in SEIP lies in the hands of the special education coordinator or the school principal of the school concerned. Based on their cognitive level or commonly known as mental age, learning disabilities children are then enrolled into special classes. This means children are allocated into learning levels or classes based on their intelligence instead of their chronological age. Only well trained teachers with certification on special education endorsement or early intervention for children, are allowed to teach these students. Students undergo a near-full general education curriculum learning according to their pace. In addition, various adaptive skills such as taking care of personal needs, home living, health and safety, communication and social skills are taught throughout the lessons.

In the subject of Physical education and Health, students are taught to classify healthy and unhealthy food, advantages and disadvantages of healthy and unhealthy food, as well as proper mealtime. The same goes for students in Primary Mainstream schools. Approximately, there were 52,946 children enrolled into the program (30,345 for pre- and primary school; 22,337 for lower secondary school; 264 for upper secondary school) as of 30th June 2013 (MOE, 2017). There are 98 primary schools and 45 secondary schools in Kelantan which provide Special Education Integration Program to cater the needs of 2,450 children with learning disabilities in primary schools and 1,692 in secondary schools. Table 2.1 lists the SEIP schools in Kota Bharu.

Table 2.1 List of SEIP schools in Kota Bharu

No.	Program type	School
1	SEIP Vision Disability	SK Kampong Sireh
2	SEIP Learning Disability	SK Che Latiff
3	SEIP Learning Disability	SK Demit 2
4	SEIP Learning Disability	SK Raja Abdullah
5	SEIP Hearing Disability	SK Tengku Indera Petra
6	SEIP Learning Disability	SK Pauh Lima
7	SEIP Learning Disability	SK Seri Ketereh
8	SEIP Learning Disability	SK Seri Kota
9	SEIP Learning Disability	SK Kubang Kerian 1
10	SEIP Learning Disability	SK Tanjong Mas
11	SEIP Learning Disability	SK Kok Lanas
12	SEIP Learning Disability	SK Kedai Buloh 2
13	SEIP Learning Disability	SK Padang Garong
14	SEIP Learning Disability	SK Padang Kala
15	SEIP Learning Disability	SK Raja Bahar
16	SEIP Learning Disability	SK Datu' Hashim
17	SEIP Dyslexia	SK Kubang Kerian 3
18	SEIP Learning Disability	SK Dewan Beta

2.3 Disabilities and nutritional concerns

Disability is extremely diverse. It can occur at any stage of life unnecessarily, be it during pre-natal stage or during infancy. Even a healthy adult can become disabled after experiencing fatal injury or involving in tragic accidents. All disabilities are permanent and are not reversible. There are some PWD which had associated health conditions that require extensive health care and some does not. However, they still have the same general health care needs as normal people and therefore require access to mainstream health care services.

In addition, PWD may experience greater vulnerability to preventable secondary conditions, co-morbidities and age-related conditions, and may require specialist health care services (WHO, 2016). For instance, a study done by Gungor *et al.* (2016) explains that nutritional deficit in ADHD children might due to behavioural problem. The following section discusses the types of most prevalent disability in SEIP in Malaysia and their related nutritional concerns.

2.3.1 Down's Syndrome

Down's Syndrome (DS) is typically defined as the presence of an extra 21st chromosome and occurs in approximately in 1 per 800 birth in Malaysia and the risk increases with maternal age (Jimmy and Leow, 2012). In recent years, the life expectancy of people with Down's syndrome had improved dramatically and some of them are able to work and earn money for living. However, due to the genetic defects, some children with Down's Syndrome are at risk for heart defects, visual impairments, hypothyroidism, and obesity (Roizen and Patterson, 2003). Improvement in life expectancy is related to the growth of research and services provided to this population (Day *et al.*, 2005). It is proven that the life expectancy of individuals with DS has increased greatly in recent years. A study done in 2011 suggested that 94.4% of children with DS born in 2000 will survive up to 2020, 90.8% up to 2030, and 76.3% up to 2050 (De Graaf *et al.*, 2011).

The cases of congenital heart disease (CHD) increase from 0.8% in the general population of Egypt to approximately 40%-65% in patients with DS. At the same time, children with DS comprise approximately 10% of all children with CHD in the country (Al-Biltagi, 2013). In Malaysia, a study done by Azman B Z *et al.*

(2007) reported that 49% of their study subjects involving DS children were diagnosed having heart defects. These children are at risk of getting congestive heart failure, pulmonary vascular disease, pneumonia, or failure to thrive. Moreover, few studies reported that the most common cause of death in children with DS during the first two years of life was CHDs (Hoffman and Kaplan, 2002).

As mentioned previously, people with DS are at risk of having thyroid disorder. Previous studies reported that compared to general population, people with DS are prone to develop both hyper and hypothyroidism (Goday-Arno *et al.*, 2009; Gruneiro de Papendieck *et al.*, 2002). In addition, an increased prevalence of both congenital hypothyroidism and acquired thyroid dysfunction are found in a number of cross-sectional studies of thyroid function in this population (Fort *et al.*, 1984; Pueschel and Pezzullo, 1985). A recent longitudinal study has demonstrated that the likelihood of acquired thyroid dysfunction increased from 30% at birth to 49% at 10 years whereas, the probability of hypothyroidism increased from 7 to 24% at 10 years (Iughetti *et al.*, 2014). The authors later suggested that this population should be followed yearly for early identification of thyroid dysfunction. Early diagnosis of thyroid dysfunctions is important as thyroid hormones play an important role in development during childhood. For instance, they act as regulators of neurodevelopment, growth and skeletal development, and metabolism (Roberts and Ladenson, 2004).

The association between obesity and Down Syndrome is well recognized by many studies. Children with Down Syndrome are at substantial risk of getting obesity (Basil *et al.*, 2016; Begarie *et al.*, 2013; Murray and Ryan-Krause, 2010; Rimmer *et al.*, 2010). Study done by Harris and colleague in 2003 stated that up to 30% to 50% of children with Down syndrome are obese (Harris *et al.*, 2003). Recent

study done by Basil *et al.* (2016) found out that 47.8% of their DS subjects are obese and the number was significantly higher than the general paediatric population, which had a 12.1% obesity rate. Murray and Ryan-Krause (2010) further explain that there are a few physiological mechanisms that are associated with obesity in Down syndrome such as; hypothyroidism, decreased metabolic rate, increased leptin which leads the body becomes insensitive to the hormone thus experiences decreased satiety and also poor mastication .

2.3.2 Autism Spectrum Disorder (DSM-IV)

Autistic spectrum disorder is a relatively new term which reflects that there are a number of conditions encompassed by the term 'autism' (Crawley, 2007). ASD is a type of neurodevelopmental disorder which affects the mental, emotion, learning and memory of a person (Grefer *et al.*, 2012). People with ASD experience difficulties in understanding social behaviour and are problematic with verbal or non-verbal communication. Their ability to form relationships becomes affected due to these difficulties. Besides, people with ASD usually display a restrictive, obsessional or repetitive behaviour and often reflected in food or drink choices and around mealtimes (Crawley, 2007). In common cases, ASD co-occurs with other developmental, psychiatric, neurologic, chromosomal, and genetic diagnoses. The co-occurrence of one or more non-ASD developmental diagnoses is 83% whereas the co-occurrence of one or more psychiatric diagnoses is 10% (Levy *et al.*, 2010).

CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network estimated that, about 1 in 68 children had been identified with autism spectrum disorder (ASD) in 2012 (Christensen *et al.*, 2016). While in Malaysia, there

is no latest prevalence on the number of ASD cases. However, based on the 2013 Final Mapping Report, the number of registered ASD in 2012 was 117 and according to National Autism Society of Malaysia (2017), NASOM in recent years, the number of those seeking its services across all age groups has increased up to 30%. ASD is reported to occur in all racial, ethnic, and socioeconomic groups and it is 4.5 times more common among boys (1 in 42) compared to girls (1 in 189) (Christensen *et al.*, 2016).

There are significant roles played by the children's behaviour condition, communication skills as well as social adaptation that will influence the pattern of dietary intake of the children. Different authors suggested several etiologies regarding this connection including idiosyncratic focus on detail, behavioural rigidity, sensory impairments, social skills deficits, and/or communication deficits (Ahearn *et al.*, 2001). In recent years, the growing interest regarding the usage of dietary influence (e.g., gluten and/or casein free, GFCF diet) for this population is due to the increase in number of researches done on feeding problems among ASD and their related dietary susceptibilities (Cannell, 2008).

Children with ASD are well known to have unusual feeding patterns and some are highly selective in regards of the food preparation or presentation. They tend to refuse new food and sometimes display strong emotional responses to it (Ahearn *et al.*, 2001). The most common feeding problem when it comes to ASD is food selectivity regardless by its type, texture, and/or presentation. According to previous article, these children have strong preferences for carbohydrates, snacks, and/or processed foods, however rejecting fruits and vegetables (Ahearn *et al.*, 2001; Schreck *et al.*, 2004). Numerous studies did an intervention in combating severe food selectivity among this children and mostly involving behavioural intervention aimed

to increase dietary variety for instance in a study done by (Sharp *et al.*, 2013); furthermore, issues regarding the eating patterns and nutritional status of all children with ASD has to further unfold making it crystal clear in the future.

2.3.3 Attention Deficit Hyperactive Disorder

Attention-deficit/hyperactivity disorder (ADHD) is another type of brain disorder with the presence of constant symptoms of ongoing pattern of inattention and/or hyperactivity-impulsivity that interfere with body functioning or development (National Institute of Mental Health, 2016). In general population, 1.7% of children have ADHD and boys are more likely to be affected than girls (Froehlich *et al.*, 2007). It was found that among 3-5% of school age children were diagnosed to have ADHD and the disorder exists before the age of seven and may last until adulthood. In a community survey done amongst Malaysian children and adolescents between the ages of 5 – 15 years the prevalence rate of ADHD was 3.9 %. ADHD runs in families with about 25% of biological parents also having this medical condition (Institute for Public Health (IPH), 2015; Malaysian Psychiatric Association (MPA), 2008).

The symptoms of ADHD usually appear before the age of six and are well defined in children and teenagers. It may occur in more than one situation and happen at anytime, anywhere. The main signs of each behavioural problem include; inattentiveness, hyperactivity and impulsiveness. Examples of inattentiveness are having a short attention span and easily being distracted by their surrounding, making careless mistakes, being forgetful, being unable to anticipate in tedious tasks, having difficulty to listen and carry out instructions, frequently changing activity and

finding it difficult in organizing tasks. Whereas, the children are said to have hyperactivity behaviour when they are unable to sit still for a period of time, do not focus on a task given, excessive physical movement and talking, impatient and have no sense of danger (International Psychology Centre, 2014).

To add, these symptoms will then affect the child's school achievements, social interactions with people surroundings and also discipline problem. Certain children may also have signs of other problems or conditions together with ADHD, such as anxiety disorder, oppositional defiant disorder (ODD), conduct disorder, depression, sleep problems, autistic spectrum disorder (ASD), epilepsy, Tourette's syndrome and also learning difficulties such as dyslexia (International Psychology Centre, 2014). Furthermore, several studies found significant association between sweet and fast food dietary pattern with ADHD (Azadbakht and Esmailzadeh, 2012; Park *et al.*, 2012). Park and his colleague (2012) further verified that high intake of sweetened desserts, fried food and salt are associated with more problems related to learning, attention and behaviour. Whereas, a balanced diet, regular meals and high intake of dairy products and vegetables are associated with less problems in learning, attention and behaviour. Another study done by Gungor *et al.* (2016) found that behavioural problems among ADHD population are the main culprit of the nutritional deficits issue.

It is proven by various study that medication can help improve attention, focus, goal directed behaviour, and organizational skills. Such medications include the stimulants (various methylphenidate and amphetamine preparations) and the non-stimulant, atomoxetine. Besides that, other medications such as guanfacine, clonidine, and some antidepressants may also show a positive result. There are also other treatment approaches that may benefit this population and also drug-free for

instance, cognitive-behavioural therapy, social skills training, parent education, and modifications to the child's education program. With the help of behavioural therapy, the child may be able to control aggression, modulate social behaviour, thus becoming more productive. While, cognitive therapy may help building their self-esteem, reduce negative thoughts, and improve problem-solving skills (Malaysian Psychiatric Association (MPA), 2008).

2.3.4 Intellectual Disability

According to the definition provided by Medical Subject Headings, MeSH, intellectual disability (ID) or previously known as "mental retardation" is defined as a poor intellectual functioning that begins during the developmental period. The potential etiologies of ID are varied, including genetic defects and perinatal insults. In order to diagnose an ID in a person, Intelligence quotient (IQ) scores are commonly used and IQ scores between 70 and 79 are in the borderline range while scores below 67 are in the disabled range.

On the other hand, the tenth revision of the WHO (World Health Organization) defined ID with the existence of sub-normal or detained mental development, mainly characterized by the decline of concrete functions at each developmental stage and influence the overall level of intelligence, such as cognitive, language, motor and socialization functions, resulting in problems with adaptation to the surroundings environment. For this population, scores for intellectual development levels must be determined based on all of the available information, including clinical signs, adaptive behaviour in the cultural medium of the individual and psychometric findings (Katz and Lazcano-Ponce, 2008).

Ring *et al.* (2007) explained that this population had higher risk for developing a psychiatric abnormality. They also experience two or three times more mood disorders, anxiety disorders and behavioural problems than persons without intellectual disability. In addition, ID was also co-morbidly exist with other disorder, the most common are epilepsy, attention deficit disorder and hyperactivity, Down Syndrome and cerebral palsy(Ring *et al.*, 2007; Voigt *et al.*, 2006).

According to Holcomb *et al.* (2009), children with intellectual disability typically experience trouble in leading a healthy lifestyle due to their cognitive, sensory, and physical limitations. For instance, these children are unable to feed themselves and require help from others. Thus, under-nutrition can be readily caused by inadequate nutrition provision to these children, resulting in limited preferences in food consumption (Wong, 2011). In the worst case scenario, the poor nutrition status of these children may lead to weight loss, as well as malnourishment due to multiple medical conditions and societal participation issues.

2.4 Malnutrition

2.4.1 General population

Malnutrition is among one of the biggest problems in Asia, especially in Malaysia. The percentage of malnourished population who is suffering from food insecurity was still high despite Malaysia's economic wealth and affluent resources (Sewidan, 2015). This 'double burden of malnutrition', identified in a recent report from UNICEF, WHO and ASEAN, is also happening in other middle income countries such as Indonesia, the Philippines and Thailand (UNICEF, 2016b). Globally, the World Health Organization (WHO, 2016) estimates that 23 percent of all children

under five years were stunted in 2016 while, 17 million out of 52 million children under five years were severely wasted in 2016. However, referring to the trends, the number of stunted children was decreasing from 39.5% in 1990 to 22.9% in 2016.

According to the latest statistics from the National Health Morbidity Survey (Institute for Public Health (IPH), 2015) as quoted in the report, more than 7% of children in Malaysia under 5 had been identified as overweight. The same survey also found that 8% of children under 5 suffered acute malnutrition, or wasting. On the other hand, the 2016 National Health and Morbidity (NHMS) survey on maternal and child health (NHMS, 2016) found that, 13.7% of Malaysian children were found to be underweight, 6.4% were overweight, 20.7% are stunted, while 11.5% had wasting. Child malnutrition somehow has a huge impact on countries' economies (UNICEF, 2016a). Indirectly, it influences the parents' productivity and creates a burden on health care systems. In addition, non-communicable diseases, disability and even death may come in the way, thus reducing the potential workforce.

In addition, a summary article published by Amina Z. Khambalia *et al.* (2012), reported that, prevalence estimates for underweight of children aged 5-17 years ranged from 1.2% to 58.3% in all 12 studies reviewed. While, the prevalence of overweight ranged from 0% in a sample of native Orang Asli children to 27.4% in a sample of primary school students in Kuala Lumpur. Based on the National Health and Morbidity Survey in 2006, 13.2% of children aged 0 to 18 years were underweight (weight-for-age < -2SD), and 8.0% of those aged 0 to 13 years were overweight (weight-for-height > +2SD) (Khambalia *et al.*, 2012). Males are more prevalent in both underweight and overweight compared to females. Moreover,

children living in rural areas were more likely to be underweight and less likely to be overweight compared to children who live in urbanized areas.

2.4.2 Children with disabilities

Malnutrition had been identified as a common setback among children with disabilities. According to (Holcomb *et al.*, 2009), children with disabilities typically experience trouble in leading a healthy lifestyle due to their cognitive, sensory, and physical limitations. For instance, these children are unable to feed themselves and require help from others. Thus, under-nutrition can be readily caused by inadequate nutrition provision to these children, resulting in limited preferences in food consumption (Wong, 2011). In the worst case scenario, the poor nutrition status of these children may lead to weight loss, as well as malnourishment due to multiple medical conditions and societal participation issues.

For overweight and obese children with disabilities, increased attention and immediate intervention is required as numerous associated secondary medical problems caused by excess body weight can adversely affect their functional status. Furthermore, children with disabilities are more likely to engage in sedentary activities, such as watching television, playing computer games or sleeping as their disabilities limits them from participating in sports or recreational games that require a higher level of physical fitness, cognition, and more refined motor skills (Kasser and Lytle, 2005).

The findings in Table 2.2 revealed that the overall prevalence of underweight ranged from 3.4% to a median of 36%. Meanwhile, the prevalence of overweight ranged from 9.4% to 37%, and the prevalence of obesity in children ranged from