THE ASSOCIATION BETWEEN NUTRITIONAL STATUS, FRUITS AND VEGETABLES INTAKE AND PHYSICAL ACTIVITY WITH ACADEMIC ACHIEVEMENT AMONG SCHOOL CHILDREN AGED 9 -11 YEARS OLD IN KELANTAN

by

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ABSTRAK

Kajian ini dijalankan adalah bertujuan untuk mengenalpasti perkaitan status nutrisi, pengambilan buah-buahan dan sayur- sayuran dan tahap aktiviti fizikal dengan pencapaian akademik di kalangan murid sekolah rendah berumur 9 – 11 tahun di Kelantan. 273 murid berumur 9 – 11 tahun telah dipilih secara rawak daripada 3 buah sekolah di Kelantan untuk menyertai kajian ini. Pengambilan buah-buahan dan sayur-sayuran dinilai menggunakan borang Soal Selidik *Day in Life Questionnaire (DILQ)* manakala tahap aktiviti fizikal dinilai menggunakan borang soal selidik *Physical Activity Questionnaire for Older Children (PAQ-C)*. Pencapaian akademik murid direkod menggunakan markah peperiksaan akhir tahun sebelumnya bagi empat jenis subjek iaitu Bahasa Melayu, Bahasa Inggeris, Matematik dan Sains. Index Jisim Badan (BMI) murid-murid dikategorikan mengikut carta *body mass index-for-age percentile* yang diwujudkan oleh Pertubuhan Kesihatan Sedunia (WHO) 2007. Kebanyakkan murid-murid mempunyai index jisim badan (BMI) yang normal. Pengambilan buah-buahan dan sayur-sayuran dikalangan murid-murid adalah rendah manakala bagi tahap aktiviti fizikal, kebanyakkannya melibatkan diri dalam aktiviti fizikal sederhana. Berdasarkan kajian ini, pencapaian akademik murid-murid tiada perkaitan dengan status nutrisi, pengambilan buah-buahan dan tahap aktiviti fizikal.

ABSTRACTS

The aim of this study was to determine the association between nutritional status, physical activity level and fruit and vegetable intake level with academic achievement among school children age 9 – 11 years old in Kelantan. Two hundreds and seventy three (273), nine to eleven years of age, were randomly selected from three primary school in Kelantan. Physical activity level was assesed by using Physical Activity Questionnaire for Older Children (PAQ-C). Fruit and vegetables intake level was assessed using Day- In-Life Questionnaire (DILQ). Academic achivement of the respondants was recorded from their school final examination results in four subjects including Malay language, English, Mathematics and Science. BMI of the respondants was categorize according to body mass index-for –age percentile charts developed by World Health Organisation (2007) . There is higher number of children have normal BMI (z-score) . Fruit and vegetable intake among the children is low. There is higher number of children in moderate physical activity level. The study showed that academic achievemet was not associated with fruit and vegetable intake level, physical activity and BMI.

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CHAPTER 1 : INTRODUCTION

1.0 Background of Study

Nutritional Status is defined as condition of a person that can be influenced by the intake and utilisation of nutrients. If there is a lack or excess intake of one or more nutrients and problem in utilisation of nutrients in body it can cause imbalance in the body.This condition is known as malnutrition. The person is called undernutrition if one or more nutrients is lack in the body however if there is excess nutrients intake it can result in overnutrition. Antropometry measurement and dietary assessment are commonly used as the most useful tool to asses and monitor nutritional status of children (Poh *et al.,* 2013).

The important aspects of human resources development is education. Every child have equal chance to achieve his or her academic potential. Previous study before, study have shown that the effects of poor academic achievement during the early school years often continues until adolescent years, with a higher proportion of school drop outs, behavioural problems and even crime among this population (Pagani *et al.,* 2001). It is necessary to find the factors that have impact on school achievement other than identifying children who perform poorly in the early years of school so that this problem can be solved.

There are many causes lead to poor school performance such as medical problems, below average intelligence, specific learning disability, attention deficit hyperactivity disorder, emotional problems, poor sociocultural home environment, psychiatric disorders, or even environmental causes. Poor performance should be seen as sypmtom reflecting a problem in children. Poor performance can cause children to become low self-esteem other than cause stress to parent (Karande & Kulkarni, 2005).

There were many studies have been carried out to study the relationship between poor health, nutrition and school achievement. Furthemore, low anthropometric measurements (height-for-age, weight-for-height and head circumference) have been frequently associated with poor school outcomes. Even after controling for socioeconomic variables, the relationship remained significant. Other than factors mentioned before, school performance also can be affected by other factors such as iron-deficiency anemia, skipping breakfast and helminthic infections . Poor nutritinal and health status are do not directly affect school performance but because of combination of two other factors such as poverty and malnutrition. Malnutrition among children can hinders intelectual development which is one of the contributing factor to generally poor school outcomes among children from underpriviliged communities. (Shariff, Bond & Johnson, 2000) .

1.1 Problem Statement

Currently, most of the children around the world are at risk of being overnourished. Forty three million children from 35 developing countries were reported overweight or obese in 2010. Undernutrition in Malaysia is still a problem in rural communities especially among young children (Al Mekhlafi *et al.,* 2008). A follow up survey has reported that the prevalence of underweight among school aged children in Malaysia decreased slightly from 9.7% in 2002 to 9.5% in 2008 while for overweight or obesity increased from 20.7% to 26.4% during the same period (Ismail *et al.,* 2009). Poor nutritional status have strong relationship with academic achievement at school.

Socioeconomic benefits of educational attainment continous to future generations as children from socioeconomically advantages backgrounds are more likely to succeed in education attainment and income facilitate increased understanding of nutrition messages and access to healthy food. Besides that, children from this socioeconomically advantages families are more likely to consume healthy diets. When the quality of diet increases, it will provide more benefits to children's academic performance and in term of health, it can contribute to healthy child development thus effects health throughout the life. Healthy eating behaviors practices since childhood are likely to proceed until adolescence and adulthood and result in decreased the risk of chronic disease in future life.

However, children who come from low socioeconomic status might have poor diets and poor academic performance thus lower level of education attainment and poorer health outcome (Florence, Asbridge & Veugelers, 2008). Children whose are non nutritious have more problems fighting infections so may be sick more often, miss more school and fail to keep up up with classmates. Malnutrition in children can lead to poor performance thus affecting children's future health.

1.2 Significance of Study

Published study in the local context focusing on association between physical activity, Body Mass Index (BMI) and fruits and vegetables intake with academic achievement is very limited. This study probably can provide awareness about the important of fruits and vegetables not only for health but also for academic achievement which then can affect children's future. This study also can provide valuable knowledge and information about other factors that can affect academic achievement such as Body Mass Index (BMI) and physical activities.

1.3 Research Questions

1. Is the consumption of fruits and vegetables intake associated with academic performance of the respondents?
2. Is physical activity associated with academic performance of the respondents?

1.4 Objectives

1.4.1 General Objective :

To determine health behaviours that associated with academic achievement among school children age 9 -11 years old in Kelantan.

1.4.2 Specific Objectives :

1. To measure body height and weight among the respondents.

2. To determine fruit and vegetable intake among the respondents.

3. To measure physical activity among the respondents.

4. To determine the association between BMI and academic performance of the respondents.

5. To determine the association between physical activity with academic performance of the respondents.

6. To determine the association between fruit and vegetable intake with academic performance of the respondents.

1.5 Hypotheses

1.5.1 Hypothesis 1

Null hypothesis

There is no association between fruit and vegetable intake with academic performance of the school children.

Alternate Hypothesis

There is an association between fruit and vegetable intake with academic performance of the school children.

1.5.2 Hypothesis 2

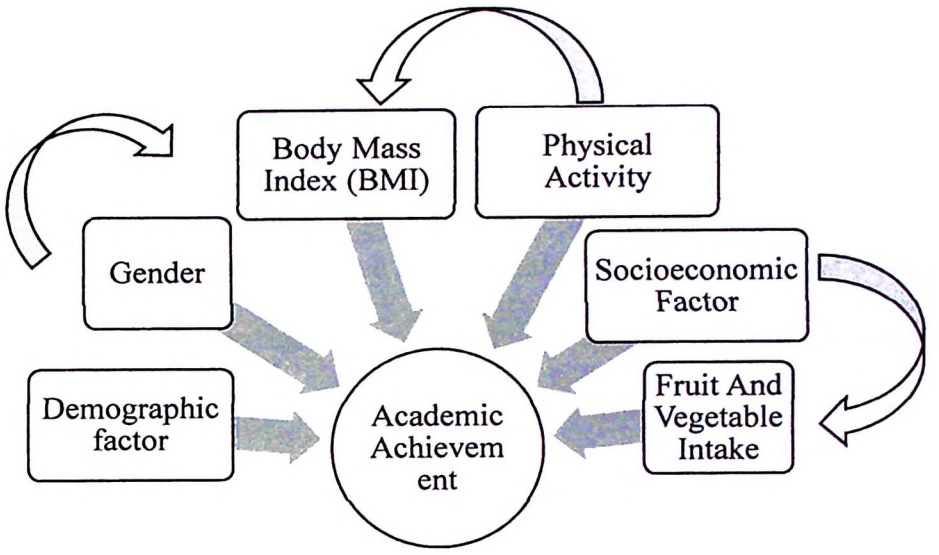
Null hypothesis

There is no association between physical activity with academic performance of the school children.

Alternate Hypothesis

There is an association between physical activity with academic performance of the school children.

1.6 Conceptual Framework



There are many factors that associated with academic achievement such as gender, Body Mass Index, physical activity, socioeconomic factor,demographic factor and fruits and vegetables intake. Malay language, English, mathematics and science and total academic score were higher in female than male and other studies also supported this finding. Research shown that, children whose engage in physical activities, consume nutritious diet and have normal body weight will perform better in academic achievement. Taras and Potts-Datema as cited in Sigfusdottir, (Kristjansson, & Allegrante, 2007) suggested that malnourished and overweight or obese children generally do not perform in their academic performance. The intake of fruits and vegetables have positive effect on grades ((Sigfusdottir, Kristjansson, & Allegrante, 2007). According to (Florence, Asbridge, & Veugelers, 2008), children who are from low socioeconomic status have possibility to have poor diets and poor academic performance thus lower level of education attainment and poorer health outcome.

CHAPTER 2 : LITERATURE REVIEW

2.0 Children Growth And Development

School-age children make up a considerable portion of the world's population and in developing countries, more than three quarters are represented by these children. The active growing phase of childhood starts during school age. According to Srivastava, Mahmood, Srivastava & Kumar (2012), primary school age is a dynamic period of physical growth as well as of mental development of the child. The needs for nutrient also increased during this important phase. This dynamic period of growth and development forms a basic foundation for good adult health as children go through physical, emotional and social changes.

2.1 Important of Good Nutrition to Children

Good nutrition is important for health, physical growth, development and educational performance of school children. Poh *et al.*, (2013), also stated the same findings about the important of nutrition in the continous growth and development that occur throughout the children period. Nutrients from diet are essential during developmental stage as it is needed for brain structure as well as its function. Brain is a metabolically active organ with very limited energy storage therefore energy needed should be derived from diet. Low nutritional status in childhood can affect the brain development that control the fine motor functions (Chang *et al.*, 2010). Poor nutrition status of the children can become a risk for them to develop a disease in their future life. Other than

that, nutrition is one of the most vital environmental factor influencing cognitive performance as it can provides the building blocks for neural formation and brain development thus inadequate nutrient intakes during development stages of a child may adversely affect cognition. (Benton,2010) . In research conducted by De Onis & Blossner (2003), Body Mass Index is acknowledged as marker of malnutrition in population research. When children do not have sufficient energy and protein it may causes thinness. Protein-energy malnutrition often comes together with other nutrition problems such as deficiency in micronutrients. In other meaning of BMI spectrum, overweight and obesity reflect an excess of the energy needed for childhood growth and activity . Although obese individual have been said to have overconsumption of energy they may still lacking in some macro and micronutrients such as protein and iron which are neede for healthy development. (Pearce, Scalzi, Lync, & Smithers, 2015)

2.1.1 Nutrition And Brain Function

To increase function of the brain, neurotransmitter link chemical messages to the brain and each chemical have different role in maximizing neuron capabilities. Dietary intake from outside of the body provide amino acids and choline for the brain to maintain brain's necessary amount of neuron so that it can release another chemicals such as serotonin, acetylcholine and norepinephrine (Colby-Morley,1981).The functions of serotonin are controling appetite, sleep , memory and learning, temperature regulation, mood, behavior, cardiovascular function, muscle contraction, endocrine regulation and depression. For central nervous system, heart contractions and attention is control by acetylcholine and norepinephrine.

Zinc is have an important effect on brain. Study carried out by Wood (2001) suggested that the ability of the brain to recall information become slow with the decreased of amount of zinc in the diet. Protein found in meat, fish, milk and cheese able to create the neurotrasmitter and carry chemical messages to the brain thus maintain cognitive capabilities. Protein energy malnutrition can occur as a result of lack of neurotransmitter may lead to poor student performance. Other than that, this problem also can cause lethargy and children become passive thus withdrawn.

Other than protein, brain also needs energy from carbohydrates. Carbohydrates can be found in grains, fruits and vegetables and it can be breakdown into glucose or also known as sugar to provide energy for the brain. With the presence of carbohydrates, its enable the brain to absorb tryptophan and turned into serotonin. As mention before, serotonin plays an important role in helping children as well as adult to utilize brain capabilities (Rausch, 2013).

Certain fats such as Omega-3 are necessary to keep the brain well-nourished and prevent depression and inflammation other than can icrease memory and mood with the increase in serotonin thus creating the feeling of pleasure. Brain is compromised of 60% of fat and help to regulate aspects of the immune system (Erikson, 2006). According to Gomez-Pinilla, he stated that omega-3 can be derived from certain type of fish such as salmon, walnuts and kiwi. He also suggested that dietary deficiency of omega-3 fatty acid in humans are associated with increased risk of several mental disorder like attention-deficit disorde, dyslexia, dementia, depression, bipolar disorder and schizophrenia (Wolpert and Wheeler,2008).

Moreover, certain vitamins and minerals are important for healthy brain growth and functions. Vitamin A,B and E known as antioxidant and can be found in green tea. Vitamin B is needed in creating energy for the brain function (Rausch, 2013).

2.1.2.Recommended Nutrition For Children

According to Malaysian Dietary Guideline for Children and Adolescents 2013, the nutritional needs is differ at different stages of life. There are 15 key messages are highlighter in Malaysian Dietary Guidelines and recommended for children and adolescent such as :

- Exclusive breastfeeding for babies below 6 months and continue to breastfeed until 2 years of age.
- Appropriate complementary foods to children between the aged of 6 months to 2 years.
- Eating a variety of foods within your recommended intake.
- Attaining healthy weight for optimum growth.
- Being physically active everyday.
- Eating adequate amounts of rice, cereals or tubers.
- Eating fruits and vegetables every day.
- Consuming moderate amounts of fish, meat, poultry, egg, legumes and nuts.
- Consuming milk and milk products everyday.
- Including appropriate amounts and types of fats in the diet.
- Limiting the intake of salt and sauce.
- Consuming foods and beverages low in sugar.

- Drinking plenty of water daily.
- Consuming safe and clean foods and beverages.
- Educating children on the use of nutrition information on food label.

For newborn, there is no other better food instead of breastmilk. Proper balance of food is needed by older children to make sure good health and development. During adolescent stage, dietary habits and food preferences which affect energy consumption and nutrient intake are generally developed in this period. Children and adolescent should consume food that is well handled and safe to eat other than enjoy a wide variety of nutritious foods. The daily food diet should consists of food based on the Malaysian Food Pyramid and eat variety of food in each food group and vary the food choices in the same group as they are interchangeable. This Malaysian Dietary Guideline also recommended to choose and ensure the number of serving consume are based on caloric needs and adequate amount of nutrients and calories should be consumed by children and adolescents for healthy growth. The growth of children need to be monitor by using appropriate growth standards or charts to ensure healthy growth. Healthy body weight should be monitor in order to identify their nutritional status thus prevent from becoming underweight or obese. For children who overweight and obese, their weight should be reduced by gradually adopting a healthy diet and increase physical activity. Other than practicing healthy eating to prevent malnutritiona and obesity, physical activity also need to be included in daily life.

2.2 Effects Of dietary intake, physical activity and weight status on Academic Performance.

2.2.1 Junk Food And Iron Deficiency

Children's cognitive processing can be inhibit by the consumption of junk food as this food is considered unhealthy. Academic performance of the student become affected when the cognitive processing is inhibit. In one study by Zhang et. al (2005), they identified American diet as diet that is high in fat, saturated fat, and cholesterol. This study showed that the consumption of Polyunsaturated Fatty Acids (PUFAs) was associated with a decreased in academic performance and increasing cholesterol showed an increase in poor performance. (Rausch, 2013)

From study carried out by Wood (2001), he stated that low iron levels in children has direct effect on the ability to pay attention to information. In another study by Halterman (2001) among sample of school aged children, it showed that iron deficiency have an effect on infant's developmental process. They also stated that, low level of iron preceding the diagnosis of anemia can also have important effect on cognitive (Rausch, 2013).

2.2.2 Food Insecurity And Insufficiency

In study which investigate the long term effects of food insecurity on academic performance by Zhang et al (2005), it showed that children from persistently food insufficient homes have a smaller increase in both reading and mathematics performance and greater increase in BMI over 3 years. They also explained about why there is an association between food insufficiency and academic performance. They explained when a person has a low household income, it would affect the quality of the food purchased, make a poor decisions like consuming fast food, food high in sugar and little nutritional value. Stress from food insecurity also can lead to increasing of cortisol level which in turned can cause depression, decreased in cognitive functioning and the atrophy in synapses involved in learning and memory.

Alaimo et al., (2001), they found there is relationship between food insecurity, poor academic performance and poverty. The children and teenagers who experienced food insufficiency were more likely to miss school and repeat grade compared to sufficient children. Food insufficiency on a child can lead to micronutrient deficiency, reduced food intake, and feelings of deprivation, stress and worry. Lower income family also been associated with food insufficient in children as it can inhibit the ability to eat healthfully, affects the amount of health care a child can receive thus inable to diagnose iron deficiency and malnutirion in children (Rausch, 2013).

There is evidence on dietary behaviors and academic achievement have been found which are student whose participated in the United State Department of Agriculture (USDA) School Breakfast Program (SBP) is associated with increased academic grades and standardised test score, reduced absenteeism and improved cognitive performance. Skipping breakfast also have relatinship with decreased cognitive performance such as alertness, attention, memory, processing of complex visual display and problem solving among students. Low consumption of adequate specific foods such as fruits, vegetables or dairy products also associated with lower grades among students (National Centre for Chronic Disease Preventation And Health Promotion, n.d).

2.2.3 Body Mass Index (BMI) and Physical Activties

There is strong relationship between BMI of the school children and academic achievement. Malnourished children or children who eat unhealthy diet can manifest some behaviours like irritability, apathy and lower self-esteem which can interfere with learning and academic performance. Poor diet and lack of physical activities can increase the risk of being overweight and obese among children which in turned can influence future health. Overweight and obese children and adolescents basically do not perform as well or attend school as others who have healthy BMI.

Results from 6 of 7 studies indicated that higher BMI have relationship with lower academic achievement. Scores for maths, reading, and language tests are lower in children who exceeded CDC sex and age specific BMI standards. However,

Kristjansson et al., (2008), showed a negative association between self-reported BMI and academic achievement and this supported by other study which is by Gunstad et. al (2008) when there is no relation between BMI and cognitive tets performance in a sample of 478 children and adolescents. (Donnelly & Lambourne, 2011). In one study conducted by (Abdelalim et al., 2010), they found that there was no association between childhood obesity and academic performance in mathematics, science, Arabic literature or total performance among male students in primary schools in Kuwait. When comparing between obese and non-obese children, overweight children performed better than this group and the reason is maybe because of parental education level. Although some studies found that children obesity is inversely related to students' academic performance but in other studies it showed that obese children perform better in school.

There is another evidence on physical activity and academic achievement. Students who are physically active have the tendency to get better grades, school attendance, cognitive performance (memory) and classroom behavior. Cognitive performance can be improved among student with higher physical activites and fitness. Children whose participation in physical activities and eat nutritious food tend to perform better on various measures of cognitive performance (Sigfusdottir, Kristjansson & Allegrante, 2007). Other than that, executive function in overweight children between the ages of 7 and 11 years can be improved by aerobic exercise. (Donnelly & Lambourne, 2011) Moreover,participation of the student in extracurricular physical activities such as interscholastic sport have been linked with higher grade point average (GPAs) other than lower drop-out rates and fewer

disciplinary problems among students (National Centre for Chronic Disease Preventation And Health Promotion, n.d).

Physical activity can affects the brain, This is done when cognitive skills and motor skills appear to develop through dynamic interaction. The brain's physiology can be effected by physical movement when there is increasing in blood flow, growth of nerve cells in the hippocampus site where center of learning and emory, increases neurotrasmitter level and high oxygen supply. These physiological changes may be associated with improved attention,increase information processing, storage, and retrieval,enhanced coping, enhanced positive affect and reduced sensations of cravings and pain (Centers for Disease Control and Prevention, 2010).

According to Donnelly & Lambourne (2011), there is positive association between physical activity and cognitive function including perceptual skills, intelligence quotient, academic achivement , verbal texts, mathematics tests, developmental level, and academic readiness in school age children age 4 -18 years old. However, in another study by Coe et. al (2006), there is no impact of physical activity on standardized test score was observed. Student with higher level of physical activity outside of school had significantly higher grades compared to studens whose do not do vigorous physical activity.

2.3 Problems in Children

According to Popkin (2001) as cited in (Poh, et al., 2013), global changes in economic development and sociodemography have resulted in dietary and and lifestyle changes thus have implications for nutritional and health status of the children around the world. In Malaysia which also known as developing country, the dual burden of malnutrition is exist.

The prevalence of underweight among school-aged children in Malaysia decreased slightly from 9.7 % in 2001 to 9.5 % in 2008, while for overweight or obesity increased from 20.7% to 26.4 % during the same period (Ismail, Ruzita and Norimah, 2009) as cited in (Poh, et al., 2013). School aged children also had low serum 25-hydroxyvitamin D concentartions which indicates that Vitamin D deficiency (Khor, Noor Safiza, Jamaluddin, et al ,2009 as cited in (Poh, et al., 2013) . Overall, the prevalence of overweight (9.8%) and obesity (11.8%) was higher than the thinnest (5.4%) and stunting (8.4%) (Poh, et al., 2013). However, National Health Malaysia Survey 2011 reported opposite result which is the prevalence of thinness (12.2%) was higher than obesity (6.1%) among children who aged less than 18 while prevalence for underweight (13.2%) was higher than overweight (5.4%). The differences in the result is because difference growth charts are used in each study (WHO, 2007 as cited in (Poh, et al., 2013). According to Naidu et. al (2013), based on secondary data anaysis from National Health Morbidity survey III, the overall prevalence of overweight including obesity children in Malaysia was 19.9%.

2.3.1 Nutritional Status and Eating Pratices Among Children in Rural and Urban Area

There is differences in nutritional status and eating practices among children whose live in urban and rural area. This is because of differences in environment and socioeconomic status. Urban children in Thailand had higher prevalence of obesity compared to children that live in rural area as urban children had better socioecomic status, sanitation and television coverage which can influence their eating practice (Aziz & Devi, 2012). In West Bengal, the incidence of thinness is in chronic condition and the frequency of thinness becomes higher with the increase of age until the children age 5.5 years old (Aziz & Devi, 2012). Maternal , socioeconomical and environmental factors were major factors that result in malnutrion among children in rural Vietnam. These factors are identified through study which been carried out by Hien and Kam (2008) as cited in (Aziz & Devi, 2012).

In this study Aziz & Devi (2012), they have been suggested that children from urban area were underweight rather than overweight. In study carried out by Maddah et al (2010) the result shown that the most children in the urban area in Zahedan, Iran were underweight for both boys and girls. In Sweeden, the most of children in urban area were overweight. Opara et al (2010) as cited in (Aziz & Devi, 2012) also found that the most urban children in Nigeria had higher prevalence of underweight and obesity.Factors which can cause underweight problem among children were birth interval, size at birth, mother's body mass index at birth and parent education level.

2.3.2 Consequences Being Underweight and Overweight or Obesity

Undernutrition during early childhood can caused poor cognitive, behavioral development and school achievement (Benton, 2008) as cited in (Nasir, Norimah, Hazizi, Nurliyana, & Suraya, 2012) . In previous study carried out by Zalilah, Bond and Johnson (2000) as cited in (Nasir, Norimah, Hazizi, Nurliyana, & Suraya, 2012), they found that stunted children scored lower on three educational achievement tests which included the Malay language , English and Mathematics than children who are not stunted. However, in another study carried out by Ong, Chandran,Lim Chen, and Poh (2010) there is no association between poor nutritional status and school achievement on the Malay language and Mathematics.

Besides that, Anuar Zaini et al., (2005) have stated that underweight children poorly performed in academic tests which include Malay language, English language, Mathematics and science and cognitive ability test as measured by Raven's CPM. They also found that, as body weight increases, the performance on academic tests and cognitive ability test also improved. Children who have normal weight scored significantly higher than underweight children. However, when comparing the scores between obese children and children with normal weight, obese children have lower scores on academic test. This result indicate that when children become underweight or obesity, the cognitive perfomance will be effected.

2.3.3 Fruit and Vegetable Intake Among Children

In United States, fruit and vegetables intakes are still below recommended level. Intake of food which is low in fruits and vegetables are mostly low in essential nutrients and substances like phytochemicals can increased the risk of certain disease Nutrient dense fruits and vegetables, which have relationship to lower risk for multiple chronic diseases include green leafy, yellow or orange and cruciferous vegetables as well as citrus fruits ((Lorson, Melgar-Quinonez, & Taylor, 2009).

Present study found that most of the urban and rural children in Selangor consumed vegetables everyday and their consumption. Their consumption of fruit and vegetables increases because of availability of fruits and vegetables in their house, parent's encouragement, and family meal frequency that influence their intake (Aziz & Devi, 2012).

2.4 Health Benefits Of Fruit and Vegetable Consumption

Consumption of fruits and vegetables have its own health benefits other than act as protective role against cancer. Other than prevent cancer, fruits and vegetables intake also can protect from heart disease, stroke, cataracts, chronic obstructive pulmonary disease, diverticulosis and hypertension (Pivonka, 2000). Furthemore, comsumption of fruits and vegetables is vital for prevention of childhood diabetes and obesity (Sadlik, et al., 2015).

2.4.1 Obesity

According to Tamers et. al (2009),comparison study between French and Americans shown that childhood obesity and overweight rates in Frances are among the lowest in the developed world which is 14% while the rates in the U.S are among the highest which is 35% (OECD,2014) as cited in (Sadlik, et al., 2015). This is because French children in the study ate more fruits and vegetables than American children. The researchers revealed that consumption of fruits and vegetables have relationship with cultural preferences (Sadlik, et al., 2015).

2.4.2 Cancer

Based on report by World Cancer Research Fund and American Institute for Cancer Research (AICR), it have been estimated that consumption of fruits and vegetables which is more than 400g per day could prevent at least 20% of all cancer incidence (Pivonka, 2000). Fruits and vegetables can prevent cancer as it contains more than 100 beneficial vitamins, minerals,fiber and other dietary component (The American Cancer Society 1996 Advisory Comitte on Diet as cited in (Pivonka, 2000).There are many common phytochemicals and other potential anticarcinogenic compound presence in fruits and vegetables which have its own function in preventing cancer. Some of phytochemical exist are carotenoid, flavonoids,phytoestrogen, phenols and protease inhibitor. With the presence of these compound in diet, it can act as antioxidant, reduce cell proliferation, nhibit blot clot, inhibots growth of cancer cells and prevent cancer-causing nitroamines.

A beta carotene, a carotenoid that contains in deep yellow vegetables and fruits such as carrots, sweet potatoes, winter squash, cantaloupe and mango can protect cell membranes and DNA from oxidative damage. Other than carotenoid, vitamin C that is found in citrus fruits, lutein which is found in green leafy vegetables like spinach and lycopene that is found in deep red color fruits and vegetables are also act as antioxidants. Folic acid can be also presence in dark green leafy vegetables and some citrus fruits may ahve protective role at the molecular level during cancer development. Enzyme activity involved in detoxifying carcinogens and other harmful foreign substances can be increases by sulphur-containing compound that can be found in cruciferous vegetables like broccoli, cauliflower and cabbage. In animas studies, the production of tumor can be avoided by indoles that is rich in cruciferous vegetables. Besides that, onions, garlics, and scallions contain sulphur compund and this compound can activate enzyme detoxification system in the body. Carcinogens from the body can be remove by flavonoids such as quercetin. Phytoestrogen have a protetcive roles in blocking binding to the cell receptor. (Pivonka, 2000)

2.4.3 Heart Disease

The risk of coronary heart disease can be reduced by antioxidant found in fruits and vegetables. This is done when the antioxidant such as vitamin C , beta carotene, other carotenoids, and flavonoid reduce oxidation of cholesterol in the arteries. Selenium , zinc as antioxidant mineral and sulphur-containing compound as antioxidant compound also have their own protective effects in coronary heart disease same like vitamin C. High blood homocystein is one of risk factor for cardiovascular disease.

Presence of folic acid in fruits and vegetables such as dried beans, green leafy vegetables, melons and orange can lowering blood homocystein level. Vitamin B-6 and B-12 also have the same effects on blood homocystein level. Serum cholesterol level also can be controlled by soluble fiber in fruits and vegetable as high level of cholesterol is one of the risk factor for cardiovascular disease. (Pivonka, 2000)

2.4.4 Stroke

Rancho Bernard Study suggested that the intake of potassium may have relationship between high intake of fruits and vegetables and low mortality from stroke (Khaw and Barret,1987 as cited in (Pivonka, 2000). In another study which is Dutch prospective study on stroke, it have been suggested that low levels of detary flavonoids are associated with higher risk of stroke (Keli and Hertog, 1996 as cited in (Pivonka, 2000). Fiber and folic acid presence in fruits and vegetables intake have been associated with protection against stroke. (Pivonka, 2000)

2.4.5 Cataracts

Development of various form of cataracts can be slower with the consumption of fruits and vegetables intake as it contains vitamin C, vitamin E and carotenoids. Many studies vefore proved the beneficial of fruits and vegetables intake in cataract. Risk of cataract was reduced 5 fold among individual who eat at least 1.5 serving of fruits and vegetables. (Pivonka, 2000)