



UNIVERSITI PUTRA MALAYSIA

***FACTORS ASSOCIATED WITH COGNITIVE ABILITY AMONG 12- TO 13-
YEAR-OLD MALAY ADOLESCENTS FROM SELECTED URBAN
SCHOOLS IN GOMBAK, MALAYSIA***

NURLIYANA BINTI ABDUL RAZAK

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By

NURLIYANA BINTI ABDUL RAZAK

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfillment of the Requirement for the degree of Master of Science**

July 2013

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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By

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July 2013

Chair: Mohd Nasir Mohd Taib, PhD

Faculty: Medicine and Health Sciences

Adolescence is a transitional period where the brain matures to achieve its adult structure and functions. However, many factors tend to influence cognition in a multidirectional manner during this period. This cross-sectional study aimed to determine factors associated with cognitive ability among 12 to 13 year-old ($M=12.4$, $SD=0.5$) Malay adolescents from selected urban schools in Gombak, Selangor ($N=416$; male=161, female=255). Socio-demographic background including parents' education level and monthly household income was obtained from parents through a short questionnaire. A questionnaire on meal consumption, personality, eating attitudes, sleep quality, chronic sleep reduction, physical activity and pubertal development was administered in class. Height, weight and waist circumference were measured. Body mass index (BMI)-for-age, height-for-age and waist-to-height ratio were determined. A semi-quantitative food frequency questionnaire was used to determine habitual dietary intake and 24-hour dietary recall was used to determine

current nutrient intake. Dietary patterns were constructed using principal component factor analysis. Cognitive ability was assessed using Wechsler Nonverbal Scale of Ability (WNV) in a one-to-one manner.

There were 38.7% boys and 61.3% girls. A majority of the adolescents' fathers attained tertiary education (50.0%), while a majority of their mothers attained secondary education (47.2%). Most boys were in the mid-pubertal development (37.0%), while most girls were in the late pubertal development (70.9%). The prevalence of overweight and obesity were 20.4% and 15.1% respectively. About 38.7% of the adolescents skipped breakfast, 34.4% skipped lunch and 31.2% skipped dinner at least once in a week. The mean energy intake per day was 1748 kcal ($SD=548$). For personality, the mean score for neuroticism ($M=2.9$, $SD=0.6$) was low, while the mean scores for conscientiousness ($M=3.2$, $SD=0.5$), extraversion ($M=3.3$, $SD=0.5$), openness to experience ($M=3.4$, $SD=0.5$) and agreeableness ($M=3.6$, $SD=0.5$) were moderate. It was found that 20.5% of the adolescents were at risk for disordered eating. The mean sleeping duration was 8.8 hours ($SD=1.5$), while the mean score for sleep quality was 13.4 ($SD=2.0$). For chronic sleep reduction, the mean score was 35.2 ($SD=4.9$). Scores for physical activity was moderate ($M=2.4$, $SD=0.6$). Four major dietary patterns were extracted from the principal component factor analysis and labelled as refined-grain pattern, snack-food pattern, plant-based food pattern and high-energy food pattern. The mean score for general cognitive ability was 101.8 ($SD=12.4$).

Monthly household income ($r=0.235$, $p<0.001$), high-energy food pattern ($r=-0.11$, $p<0.05$), carbohydrate intake ($r=0.10$, $p<0.05$), openness to experience ($r=0.212$,

$p < 0.001$), physical activity ($r = 0.097$, $p < 0.05$) and sleep duration ($r = -0.104$, $p < 0.05$) were associated with general cognitive ability. Adolescents whose fathers had tertiary education ($t = 5.28$, $p < 0.001$), not skipping dinner ($t = 4.26$, $p < 0.001$) and rarely snacked ($t = 2.73$, $p < 0.01$) scored better on the cognitive tests compared to adolescents whose fathers had secondary education and below, skipped dinner and snacked. Multiple linear regression analysis showed that monthly household income, consumption of dinner, openness to experience, carbohydrate intake, high-energy food pattern and father's education level explained 21.6% of the variances in cognitive ability ($F = 14.76$, $p < 0.001$). Therefore, adolescents should be encouraged to consume dinner regularly, decrease consumption of high-energy foods and be more open to experience.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**FAKTOR-FAKTOR YANG BERKAITAN DENGAN KEUPAYAAN
KOGNITIF REMAJA MELAYU BERUSIA 12- HINGGA 13- TAHUN DARI
SEKOLAH-SEKOLAH BANDAR YANG TERPILIH DI GOMBAK,
MALAYSIA**

Oleh

NURLIYANA BINTI ABDUL RAZAK

Julai 2013

Pengerusi: Mohd Nasir Mohd Taib, PhD

Fakulti: Perubatan dan Sains Kesihatan

Peringkat remaja merupakan peringkat peralihan di mana kematangan otak berlaku bagi mencapai struktur dan fungsi otak dewasa. Walau bagaimanapun, terdapat banyak faktor yang mempengaruhi keupayaan kognitif dari pelbagai segi di peringkat ini. Kajian keratan rentas ini dijalankan bagi mengenalpasti faktor-faktor yang berkaitan dengan keupayaan kognitif remaja Melayu berusia 12 hingga 13 tahun ($M=12.4$, $SD=0.5$) dari sekolah-sekolah bandar yang terpilih di Gombak, Selangor ($N=416$; lelaki=161, perempuan=255). Latar belakang sosio-demografi yang merangkumi tahap pendidikan ibubapa dan jumlah pendapatan bulanan telah diambil daripada ibubapa melalui borang soal selidik ringkas. Soal selidik mengenai perihal makan, personaliti, tingkahlaku makan, kualiti tidur, kekurangan tidur yang kronik, aktiviti fizikal dan perkembangan akil baligh telah dijalankan di dalam kelas. Tinggi, berat dan lilitan pinggang telah diukur. Indeks jisim tubuh (IJT)-untuk-umur, ketinggian-untuk-umur dan nisbah pinggang-ke-ketinggian telah ditentukan.

Kekerapan pengambilan makanan berbentuk semi-kuantitatif telah digunakan bagi menentukan pengambilan diet yang lazim dan ingatan diet 24-jam telah digunakan bagi menentukan pengambilan nutrisi semasa. Corak pengambilan diet dikenalpasti melalui analisis faktor komponen utama. Keupayaan kognitif telah diuji dengan menggunakan *Wechsler Nonverbal Scale of Ability* (WNV) secara perseorangan.

Seramai 38.7% lelaki dan 61.3% perempuan telah terlibat di dalam kajian ini. Majoriti bapa remaja ini telah mencapai pendidikan tinggi (50.0%), manakala majoriti ibu mereka telah mencapai pendidikan menengah (47.2%). Kebanyakan remaja lelaki berada dalam peringkat pertengahan akil baligh (37.0%), manakala kebanyakan remaja perempuan berada dalam peringkat lewat akil baligh (70.9%). Peratus berat badan berlebihan dan obesiti adalah 20.4% dan 15.1% masing-masing. Sebanyak 38.7% daripada remaja-remaja tersebut tidak mengambil sarapan, 34.4% tidak mengambil makan tengahari dan 31.2% tidak mengambil makan malam sekurang-kurangnya sekali seminggu. Min pengambilan tenaga sehari adalah 1748 kcal ($SD=548$). Bagi personaliti, min markah untuk *neuroticism* ($M=2.9$, $SD=0.6$) adalah rendah, manakala min markah untuk *conscientiousness* ($M=3.4$, $SD=0.5$), *extraversion* ($M=3.3$, $SD=0.5$), *openness to experience* ($M=3.4$, $SD=0.5$) dan *agreeableness* ($M=3.6$, $SD=0.5$) adalah sederhana. Didapati 20.5% daripada remaja-remaja tersebut berisiko untuk gangguan tingkahlaku makan. Min jangkamasa tidur adalah 8.8 jam ($SD=1.5$), sementara min markah untuk kualiti tidur adalah 13.4 ($SD=2.0$). Untuk kekurangan tidur yang kronik, min markah adalah 35.2 ($SD=4.9$). Markah untuk aktiviti fizikal adalah sederhana ($M=2.4$, $SD=0.6$). Empat corak pengambilan diet utama telah dikenalpasti iaitu corak makanan bijirin terproses,

corak makanan snek, corak makanan berasakan tumbuhan dan corak makanan tinggi tenaga. Min markah untuk keupayaan kognitif umum adalah 101.8 ($SD=12.4$).

Jumlah pendapatan bulanan ($r=0.235$, $p<0.001$), corak makanan tinggi tenaga ($r=-0.11$, $p<0.05$), pengambilan karbohidrat ($r=0.10$, $p<0.05$), *openness to experience* ($r=0.212$, $p<0.001$), aktiviti fizikal ($r=0.097$, $p<0.05$) dan jangkamasa tidur ($r=-0.104$, $p<0.05$) telah didapati mempunyai kaitan dengan keupayaan kognitif umum. Remaja-remaja yang mempunyai bapa yang berpendidikan tinggi ($t=5.28$, $p<0.001$), tidak meninggalkan makan malam ($t=4.26$, $p<0.001$) dan jarang mengambil snek ($t=2.73$, $p<0.01$) mempunyai markah yang lebih baik dalam ujian kognitif berbanding remaja-remaja yang mempunyai bapa yang berpendidikan menengah dan kebawah, meninggalkan makan malam dan mengambil snek. Analisis regresi linear berganda menunjukkan jumlah pendapatan bulanan, pengambilan makan malam, *openness to experience*, pengambilan karbohidrat, corak makanan tinggi tenaga dan tahap pendidikan bapa menjelaskan 21.6% daripada variasi dalam keupayaan kognitif ($F=14.76$, $p<0.001$). Oleh itu, remaja-remaja perlu digalakkan untuk mengambil makan malam, mengurangkan pengambilan makanan bertenaga tinggi and bersifat lebih terbuka kepada pengalaman.

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I certify that a Thesis Examination Committee has met on (the date of viva voce) to conduct the final examination of Nurliyana binti Abdul Razak on her thesis entitled “Factors associated with cognitive ability among 12 to 13 year-old adolescents from selected urban schools in Gombak, Selangor” in accordance with Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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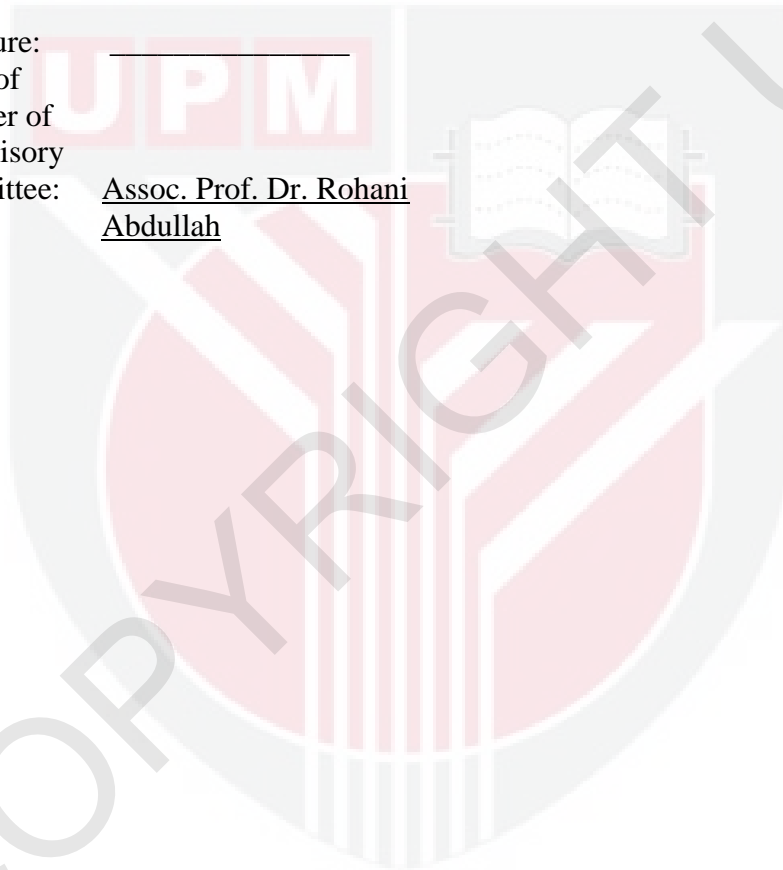


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LIST OF ABBREVIATIONS

| | |
|--------------------------------------|---|
| \approx | Approximately equal to |
| = | Equal to |
| df | Degree of freedom |
| et al., | And others |
| F | F-test |
| M | Mean |
| N | Sample size |
| p | p-value |
| r | Pearson Product-Moment Correlation |
| R | Regression coefficient |
| R ² | Coefficient of determination |
| ΔR^2 | Coefficient of determination change |
| SD | Standard deviation |
| t | Independent sample t-test |
| Z _{1-α/2} | Standard errors associated with confidence interval |
| Z _{1-β} | Standard errors associated with power |
| α | Alpha error |
| χ^2 | Chi-square test |
| BFI | Big Five Inventory |
| BMI | Body Mass Index |
| ChEAT | Children's version of the Eating Attitude Test |
| CSRQ | Chronic Sleep Reduction Questionnaire |
| IQ | Intellectual Quotient |

| | |
|-------|--|
| LBW | Low Birth Weight |
| PAQ-C | Physical Activity Questionnaire for Older Children |
| PDS | Pubertal Development Scale |
| RNI | Recommended Nutrient Intakes |
| SES | Socio-economic status |
| S-FFQ | Semi-quantitative Food Frequency Questionnaire |
| WHO | World Health Organization |
| WHtR | Waist-to-height ratio |
| WNV | Wechsler Nonverbal Test of Ability |

CHAPTER 1

INTRODUCTION

1.1 Introduction

Cognition is the mental process involving perception, attention, memory, problem solving, reasoning and decision making (Goldstein, 2008). These processes depend on the capacity to focus and sustain attention, ability to hold information in the working memory, ability to abstract the information, and deciding on the appropriate motor response to be executed (Wainwright & Colombo, 2006). Cognitive abilities are the observable outcomes of these processes (Hughes & Bryan, 2003).

The development of cognitive abilities is associated with the development of the brain (Hughes & Bryan, 2003). The most critical period is during gestation, where the closure of the neural tube occurs at about day 22 of embryonic life, completion of neurogenesis at about 16 weeks of gestation, followed by neuronal migration, glial cell proliferation and dendritic sprouting (Gale, O'Callaghan, Godfrey, Law, & Martyn, 2004). However, myelination of neurons continues throughout childhood, while synaptic density in the cerebral and cerebellar cortex increases until early adulthood (Gale et al., 2004). The rate of myelination of different regions of the brain is associated with the emerging cognitive abilities observed in infants and children (Hughes & Bryan, 2003).

The earliest regions of the brain to mature are those that are associated with visual control, balance and motor abilities, followed by the hippocampus, left temporal lobes and right hemisphere of the brain that support learning, memory, language acquisition and spatial ability (Hughes & Bryan, 2003). The frontal lobes are the slowest regions to mature and are associated with higher-order cognitive abilities, which include planning, strategy making, problem solving and executive functioning (Hughes & Bryan, 2003). Thus, individuals become more capable of abstract, multidimensional, planned and hypothetical thinking as they grow from late childhood into middle adolescence (Steinberg, 2005).

The interaction between the brain and the environment is an important factor in cognitive development of children (Isaacs & Oates, 2008). Nutrition, health care, housing, parenting and cognitive stimulating environment and social experiences play important role in cognitive development (Rosales, Reznick, & Zeisel, 2009). Early cognitive ability was found to predict later school outcomes (Grantham-McGregor et al., 2007). However, it was found that 200 million of children below the aged of 5 years failed to reach their cognitive potentials due to poverty, poor health and nutrition, and lack of care (Grantham-McGregor et al., 2007). For example, stunting in early childhood is due to poor nutrition rather than genetic factor, and has been found to predict later cognitive ability and school outcomes (Grantham-McGrgeor et al., 2007). In Malaysia, significantly stunted children were found to have lower educational achievement compared to children who were not stunted (Mohd Shariff, Bond, & Johnson, 2000).

The brain is a very metabolically active organ that accounts for a high percentage of metabolic rates (Benton, 2008). Although by the age of 6 years the brain is about 95% of its final size, the gray matter of the frontal lobe continues to thicken and peaks around puberty (Benton, 2008). Thus, provision of nutrients is of great demands during this period and inadequacy that prevents optimal metabolic functioning may have lasting negative effects on cognition (Benton, 2008). For example, low birth weight children were found to have persistently lower cognitive ability throughout their childhood and adolescence compared to their normal birth weight counterparts (Breslau, Dickens, Flynn, Peterson, & Lucia, 2006). Underweight girls aged 6 to 19 years had poorer memory compared to normal weight and overweight girls (Gunstad et al., 2008). In a local study by Hamid Jan, Amal, Rohani and Norimah (2010), cognitive ability was also found to be lower among iron deficient children both with and without anemia compared to healthy children.

Puberty that occurs in early adolescence triggers dramatic physical, social and psychological changes (Ladouceur, Peper, Crone, & Dahl, 2012). Many factors including lifestyle and psychological factors may influence cognitive ability during this period. Lifestyle factors such as physical activity have been found to benefit cognitive ability among children and adolescents (Pesce, Crova, Cereatti, Casella, & Belucci, 2009; Ellemberg & St-Louis Deschenênes, 2010; Travlos, 2010; Pirrie & Lodewyk, 2012). Sleep difficulty on the other hand has been found to be negatively associated with both cognitive ability and academic achievement (Johnston, Gradisar, Dohnt, Billows, & McCappin, 2010).

Psychological factors such as personality is also associated with cognitive ability, in which neuroticism has been found to be associated with lower cognitive ability and openness to experience is associated with higher cognitive ability (Moutafi, Furnham, & Paltiel, 2005). Eating attitudes is also associated with cognitive ability, in which girls who highly restrained their diet tend to have poor cognitive ability (Brunstrom, Davidson, & Mitchell, 2005).

1.2 Problem Statement

Adolescence is the transitional period in which the brain matures to achieve its adult structure and functions (Spear, 2000). The major transformation of cognitive abilities during early adolescence include abstract and formal reasoning, while decision making capacity increases from mid-adolescence onward (Spear, 2000). Increasing cognitive abilities during adolescence are associated with increasing ability to control emotion (Steinberg, 2005). However, just as cognitive maturation increases emotional regulation during adolescence, emotion also plays an important role in cognitive processes such as in decision making (Steinberg, 2005).

Puberty that occurs during this period increases the vulnerability of emotion, cognition and behavior simultaneously, thus making it a sensitive period of development similar to the early childhood (Steinberg, 2005). Adolescents with higher puberty scores tend to prefer later bedtimes due to biological timing mechanisms that are related to the maturational processes compared to adolescents with lower puberty scores which may lead to sleep deprivation (Carskadon, Vieira, &

Acebo, 1993). Memory encoding, working memory and long-term memory are facilitated during sleep, and sleep deprivation has been found to impair abstract and complex tasks involving higher cognitive functioning (Kopasz et al., 2010).

Cognitive development is much affected by the interaction between the brain and both biological and physical environments during growth, however, nutrition is the most important environmental factor because it is changeable and continues to influence cognition throughout life (Isaacs & Oates, 2008). During rapid growth period, nutrition affects cognition through its contribution on the development of the brain structure, and continues to influence short-term cognition through provision of energy and nutrients to support cognitive functioning throughout life (Benton, 2008).

Increased awareness on the importance of regular physical activity in maintenance of health has led to growing interest in the association between physical activity and cognitive performance. Travlos (2010) has found that in 13 to 15 year old adolescents, processing speed and accuracy improved after a 40-minute intense physical education class in the morning and early afternoon. A 30-minute aerobic exercise was also found to improve reaction time among children aged 7 to 10 year-old in the study by Ellemberg and St-Louis-Deschênes (2010). In a study by Pesce et al. (2009), team games were found to improve both immediate and delayed recall memory among pre-adolescents aged 11 to 12 years.

Early adolescence is the stage of identity formation, and just as cognitive development proceeds to the final stage, personality development also progresses towards higher stages and becomes more stable (McCrae et al., 2002). The five-factor model of personality includes neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (Digman, 1990).

Neuroticism is related to low cognitive performance due to anxiety, in which people who are neurotic tend to be nervous, thus, anxiety impairs their cognitive ability (Moutafi et al., 2005). Extraversion is associated with better performance under medium and high cortical arousal or task that requires speed and short in length (Moutafi et al., 2005). Openness to experience is related to better cognitive ability as these individuals tend to involve more in intellectual activities (Moutafi et al., 2005). Conscientiousness however is associated with low cognitive ability because a person with lower cognitive ability requires more effort in accomplishing similar tasks compared to a person with higher cognitive ability (Moutafi et al., 2005). Agreeableness is the only personality factor that has not been found to be associated with cognitive ability (Moutafi et al., 2005).

1.3 Significance of the Study

During adolescence, biological, physical, psychological and social factors tend to influence cognition in a multidirectional manner (Spear, 2000). Therefore, there is a need to determine factors associated with cognitive ability in adolescents, as when these factors are determined they can be used to direct promotion activities to

enhance cognitive ability among this population. The findings of this study can also be used in providing basis for future experimental studies on a specific factor and its effect on cognitive ability.

1.4 General Objective

To determine factors associated with cognitive ability among 12 to 13 year-old Malay adolescents from selected urban schools in Gombak, Selangor.

1.5 Specific Objectives

1. To determine the socio-demographic background (age, sex, number of siblings and socio-economic status), physiological factors (pubertal status and body weight status), nutritional factors (meal skipping, nutrient intake and dietary patterns), lifestyle factors (physical activity, sleep duration and quality, and chronic sleep reduction), psychological factors (personality and eating attitudes) and cognitive ability of the adolescents.
2. To determine the association between the following factors with cognitive ability:
 - i. Socio-demographic factors
 - ii. Physiological factors
 - iii. Nutritional factors
 - iv. Lifestyle factors
 - v. Psychological factors

3. To determine the contribution of socio-demographic factors, physiological factors, nutritional factors, lifestyle factors and psychological factors towards cognitive ability.

1.6 Null Hypotheses

1. There is no association between socio-demographic factors (age, sex, number of siblings and socio-economic status) and cognitive ability.
2. There is no association between physiological factors (pubertal status and body weight status) and cognitive ability
3. There is no association between nutritional factors (meal skipping, nutrient intake and dietary patterns) and cognitive ability.
4. There is no association between lifestyle factors (physical activity, sleep duration and quality, and chronic sleep reduction) and cognitive ability.
5. There is no association between psychological factors (personality and eating attitudes) and cognitive ability.
6. There is no contribution of socio-demographic factors, physiological factors, nutritional factors, lifestyle factors and psychological factors towards cognitive ability.

1.7 Research Conceptual Framework

Figure 1.1 shows the conceptual framework of this study, in which the independent variables are grouped into five major factors, namely, socio-demographic, physiological, nutritional, lifestyle and psychological factors.

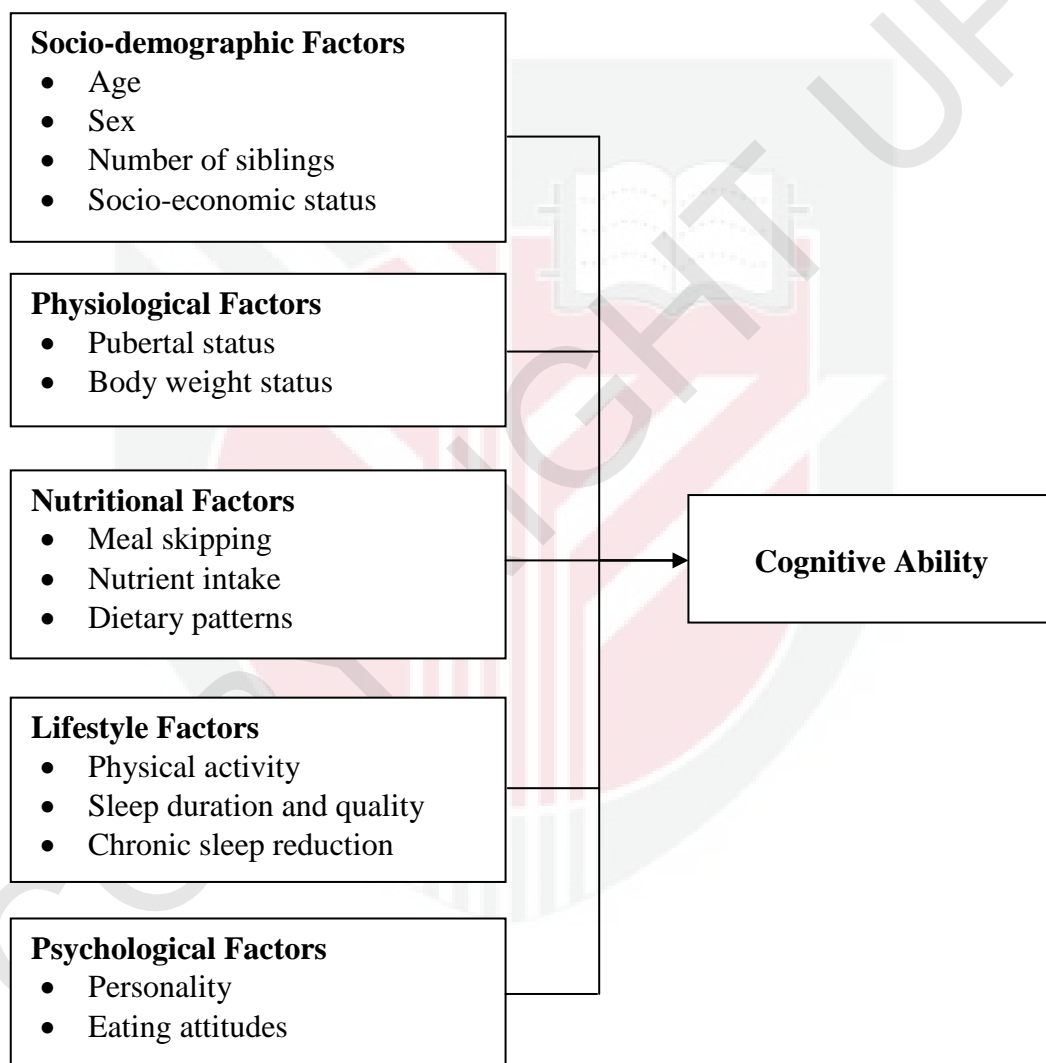


Figure 1.1. Research Conceptual Framework

In this study, cognitive ability was assessed using Wechsler Nonverbal Scale of Ability (WNV) (Wechsler & Naglieri, 2006), which measures general cognitive ability through four subtests that measure ability from different cognitive domains, which are perceptual reasoning, processing speed, working memory and perceptual organization.

Socio-demographic factors provide backgrounds on the adolescents' social and rearing environment. Information pertaining to these factors was obtained through a questionnaire sent to parents. Socio-demographic background influences an individual's experiences from childhood through adulthood and has a substantial effect on emotional and cognitive development (Hackman, Farah, & Meaney, 2010).

Physiological factors in this study include pubertal status and body weight status. Pubertal status was determined using Pubertal Development Scale (Peterson, Crockett, Richards, & Boxer, 1988). Pubertal development is associated with cognitive maturation in which increment in white matter and decrement in gray matter increases the efficiency of information processing (Steinberg, 2005). Body weight status as determined by body mass index (BMI) may be negatively associated with cognitive ability through physiologic brain changes in which subclinical inflammatory changes, vascular changes or dysmyelination of white matter might impair cognitive ability (Guxens et al., 2009).

Nutritional factors influence cognition as nutrients serve as building blocks for the neural development and through provision of energy and nutrients to support cognitive functioning (Benton, 2008). Meal skipping, specifically breakfast has been found to be associated with nutritional profiles, in which children who skipped breakfast tend to have lower total daily energy intakes and more unhealthy dietary habits compared to children who consumed breakfast regularly (Utter, Scragg, Mnurchu, & Schaaf, 2007). Breakfast consumption may be positively associated with cognitive ability through maintenance of energy and nutrients to the brain (Pollitt & Matthews, 1998). Micronutrients play important role as cofactors in key enzymatic processes (le Coutre & Schmitt, 2008). For example, iron is involved the oxidation-reduction reactions, synthesis and catabolism of neurotransmitter and production of myelin (Hulthén, 2003). Iron deficiency has been found to be associated with lower cognitive ability (Hamid Jan et al., 2010). Dietary pattern describes the combination of foods and nutrients consumed together (Hu, 2002). In New Zealand, children who consumed diet consisting of fish, breads and cereals in accordance to the New Zealand nutritional guidelines had higher intellectual quotient (IQ) scores compared to children who did not follow the guidelines (Theodore et al., 2009).

Lifestyle factors include physical activity, sleep duration and quality, as well as chronic sleep reduction. There are two plausible mechanisms associating physical activity and cognitive ability, which are, through maintenance of blood supply to the brain and neural growth stimulation (Keeley & Fox, 2009). In this study, physical activity was measured using Physical Activity Questionnaire for Older Children (PAQ-C) (Crocker, Bailey, Faulkner, Kowalski & McGrath, 1997; Kowalski,

Crocker, & Donen, 2004). Physical activity has been found to be associated with better memory (Pesce et al., 2009), reaction time (Elleberg & St-Louis-Deschênes), processing speed (Travlos, 2010) and academic performance (Reed, Einstein, Hahn, Hooker, Gross, & Kravitz, 2010; Trudeau & Shephard, 2008) among children and adolescents. Sleep is essential to replenish the brain, thus inadequacy might result in sleepiness and tiredness, which may influence cognitive ability (Meijer, 2008). Chronic sleep reduction or having bad sleep quality or too short sleep duration has been found to be negatively associated with school achievement (Meijer, 2008).

Psychological factors in this study include personality and eating attitudes. Personality accounts for emotional, interpersonal, experiential, attitudinal and motivational styles (McCrae et al., 2002). Thus, personality may influence cognitive ability through traits like anxiety, nervousness, high energy, and cautiousness when performing cognitive tasks (Moutafi et al., 2005). Another psychological factor that is assessed in this study is eating attitude. Children who had highly restrained their diet were found to have poorer cognitive ability and longer reaction time (Brunstorm et al., 2005).

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