BEVERAGE CONSUMPTION PATTERN AND ITS ASSOCIATION ON WEIGHT STATUS AMONG SCHOOL CHILDREN IN KOTA BHARU

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LIST OF SYMBOL, ABBREVIATION AND ACRONYMN

BMI	Body Mass Index
FFQ	Food Frequency Questionnaire
GI	Glycemic Index
NHANES III	National Health And Nutrition Examination Survey III
SPSS	Statistical Package for the Social Science
WHO	World Health Organization
kcal	Kilocalorie

ABSTRAK

CORAK PENGAMBILAN MINUMAN DI KALANGAN PELAJAR SEKOLAH DI KOTA BHARU DAN KAITAN TERHADAP STATUS BERAT BADAN

Minuman memjadi bahagian yang penting dalam keperluan dietari harian kanak-kanak. Kebelakangan ini, minuman manis dikaitkan dengan peningkatan prevalens obesiti di kalangan kanak-kanak. Walaubagaimanapun, jenis dan kekerapan pengambilan minuman dalam kalangan kanak-kanak sekolah di sekitar Kota Bharu masih lagi tidak diketahui. Maka, tujuan kajian ini adalah untuk menilai pengambilan minuman di kalangan kanak-kanak sekolah dan mengkaji perhubungan pengambilan minuman dan status berat badan di kalangan pelajar Tahun 5. Kajian keratan rentas telah dilakukan dalam kalangan 196 responden (52% lelaki, 48% wanita) di 2 buah sekolah rendah di kawasan Kubang Kerian. Subjek telah ditemuramah menggunakan borang soal selidik yang mengandungi 24 jam ingatan dietari, borang Soal Selidik Kekerapan Makanan (FFQ), dan borang data antropometri. Tinggi dan berat badan diukur untuk mendapatkan bacaan Indeks Jisim Badan (BMI) bagi setiap subjek. Keputusan menunjukkan 11.7% mempunyai berat badan berlebihan (> persentil 85) manakala 14.3% diklasifikasikan sebagai obes (> persentil 97). Walau bagaimanapun, analisis bivariat menunjukkan bahawa pengambilan minuman (seperti yang ditunjukkan oleh jumlah pengambilan tenaga dan tenaga daripada minuman) tidak mempunyai perhubungan dengan status berat badan. Dalam kajian ini, perempuan cenderung untuk mempunyai jumlah tenaga yang tinggi daripada sumber minuman berbanding lelaki dengan purata sebanyak 296 kcal untuk sehari.

Secara keseluruhannya, kebanyakan kanak-kanak memilih teh (10.2%) sebagai minuman utama manakala kopi (5.1%) menjadi pilihan yang terakhir. Teh (10.3%), jus buah-buahan (9.5%) dan susu (9.4%) adalah tiga minuman utama di kalangan subjek wanita manakala lelaki cenderung untuk memilih susu (10.4%), teh (10.1%) dan minuman isotonik (9.7%) sebagai minuman yang paling kerap diambil. Sebagai kesimpulan,pengambilan minuman tidak mempunyai perhubungan dengan status berat badan dalam kalangan kanak-kanak sekolah di Kota Bharu.

ABSTRACT

BEVERAGE CONSUMPTION PATTERN AND ITS ASSOCIATION ON WEIGHT STATUS AMONG SCHOOL CHILDREN IN KOTA BHARU

Beverages contribute an important part in the daily diet of children. Recently, sweetened beverage has been related with the increasing prevalence of obesity among children. However, the type and frequency of beverage consumption among school children in Kota Bharu is unknown. Hence, the aim of this study was to evaluate the beverage intake among school children and investigate the associations of beverage consumption and weight status in Standard 5 school children. This cross sectional study was done with a total of 196 subjects (52% male, 48% female) in 2 primary schools in Kubang Kerian area. Subjects were interviewed using a questionnaire which comprises of 24 hour dietary recall, Food Frequency Questionnaire (FFQ), and anthropometric data form. Body height and weight were measured in order to obtain Body Mass Index (BMI) for each subject. The results showed that 11.7 % were overweight (> 85th percentiles) and 14.3% were classified as obese (> 97th percentiles). However, bivariate analysis showed that beverage consumption (as indicated by total energy intake and energy from beverage) was not associated with weight status. In this study, females tend to have higher values of energy from the beverage compared with males with average 296 kcal per day. It was noted that most of the children choose tea (10.2%) as the main beverage while coffee (5.1%) ranks the least. Tea (10.3%), fruit juice (9.5%) and milk (9.4%) were the top three beverages among the female subjects whereas males tend to choose milk (10.4%), tea (10.1%) and isotonic drink (9.7%) as their main beverages. In

conclusion, there was no association between the beverage consumption and weight status among school children in Kota Bharu.

CHAPTER 1: INTRODUCTION

1.1 Study Background

Changes in beverage consumption patterns over the past several decades may be related to the high prevalence of obesity among school children (Hill et al., 1998). Obesity is a serious problem for children, which leads to significant short- and long-term health consequences. Overweight and obesity are associated with numerous comorbidities such as hypertension, cardiovascular disease, diabetes, depression, and breast, endometrial, colon, and prostate cancers (Must et al.,1999; Allison et al.,1999).

Based on a Canadian Community Health Survey Nutrition 2004, children and teens get about one-fifth of their daily calories from beverages. As they get older, the children tend to drink sweetened beverages such as soft drinks and fruit drinks (Garriguet, 2008). National survey data in the United States have indicated that, over the past 20 years, there is an increase in the prevalence rates of overweight and obesity due to the increased consumption of carbohydrates, largely in the form of added sugars (Kantor,1998; Anand et al.,1998). In Malaysia, the prevalence of overweight rose from 16.6 per cent in 1996 to almost 30 per cent a decade later. Obese adults tripled from 4.4 per cent to 14 per cent in the same period. High intake of sugar has been identified as one of the factors behind the increase in the incidence of overweight and obesity in Malaysia (National Health and Morbidity Survey,2006).

Between 1977 and 1996, the proportion of energy intake from the consumption of caloric sweeteners rose from 13.1% to 16.0% (a 22% increase), and in 1994–1996, greater than 30% of carbohydrates consumed in the United States by persons aged more than 2 years came from caloric sweeteners (Popkin, 2003).

Malaysians also consume a lot of sweet foods and beverages with an average of 26 teaspoons of sugar per day. In order to reduce the prevalence of overweight and obesity, many national governmental bodies have made efforts to restrict the availability of soft drinks (Kelly et al., 2009). Malaysian Dietary Guidelines recommended that sugar intake should not exceed 50g per day. It also recommends the Malaysian to consume foods and beverages low in sugar as one of the key messages (Malaysian Dietary Guidelines, 2010). WHO also has suggested that added sugar should not provide more than 10% of dietary energy (WHO, 2003).

1.2 Problem Statement

Higher intake of sweetened beverages had become one of the big issues globally as it leads to many types of diseases and illness. A changing environment and increasing affluence have widened food options and changed eating habits among Malaysians. Meanwhile, fast foods and soft drinks which are high in calories, from either fat or sugar, are more accessible especially among children (Ismail, 2002). Besides, the manufacturing sector, particularly the beverage industry is the fastest growing sector and became the dominant force in Malaysia's growth experience (Rohana Kamaruddin, 2009). At this level, Malaysia ranks among the top most countries for the availability of sugar and sweeteners (Geok Lin Khor, 2012). Thus, concomitant with the increased of beverage industry, Malaysian society are more prone to get exposed with many types of beverages available in the market.

Water is essential for human body. Most water is derived from beverages instead of foods. Besides, beverages also provide vitamins and minerals. However, beverages also can contribute a major source of sugar and excess calories. Thus,

sugar sweetened drinks have been linked to weight gain and higher body mass index in children and teenagers (Malik et al., 2006).

Childhood obesity has been emerging as a major problem. It keeps arising in many affluent societies, especially in countries where the children consume unhealthy foods, snacks or beverages every day (Kasmini et al.,1997). Generally, obesity is known as an excess of body fat which results in significant impairment of health (Burton et al., 1985). In Malaysia, the prevalence of overweight in children and adolescents also on the rise. According to National Health and Morbidity Survey (NHMS III) reported a higher prevalence of overweight, which is 15.9% among school-aged children (NHMS III, 2006).

By consuming sweetened beverages, it is hypothesized that the calories within it have a little effect on satiety and lead to overconsumption (DiMeglio et al., 2000). Liquid foods may have a different effect on satiety and food intake compared with solid foods. With the absence of chewing, ingesting beverages may result in decreased pancreatic exocrine and endocrine responses which decrease the satiety. Apart from that, beverages are also emptied from the stomach at a higher rate and may induce weaker signals in the gastrointestinal tract that would lead to inhibition of food intake (Chen et al., 2009). Due to the insensitivity of gastrointestinal tract to produce the signal to the brain, it will lead to overconsumption and weight gain.

In order to test the validity of the theory, a study has been conducted on school children. The purpose of this study was to investigate the association of sweetened beverage consumption and weight status among children. To fulfil this purpose, a cross sectional survey was carried out among school children in Primary Schools around Kota Bharu

1.3 Research Objective

General objective

To determine the beverage consumption and its influence on the weight status of school children in Kota Bharu.

Specific objectives

1) To identify the pattern of beverage consumption among school children
2) To investigate the common choices of beverage consumption among school children
3) To determine the pattern of beverage consumption among male and female school children.

1.4 Research Hypothesis

1. Null hypothesis (H_0) : There is no association between consumption of beverages and weight status among school children.

Alternative hypothesis (H_A) : There is an association between consumption of beverages and weight status among school children.

2. Null hypothesis (H_0) : There is no correlation between BMI value and total energy from beverage intake among school children

Alternative hypothesis (H_A) : There is a correlation between BMI value and total energy from beverage intake among school children

3. Null hypothesis (H_0) : There is no correlation between BMI value and total energy intake among school children

Alternative hypothesis (H_A) : There is a correlation between BMI value and total energy intake among school children

4. Null hypothesis (H_0) : There is no difference in median BMI value between physical activity.

Alternative hypothesis (H_A) : There is a difference in median BMI value between physical activity.

5. Null hypothesis (H_0) : There is no difference in median of energy from beverages between male and female students.

Alternative hypothesis (H_A) : There is difference in median of energy from beverages between male and female students.

1.5 Significance of the Study

The research of this study was to investigate if there is an association between beverage consumption and weight status among school children. As there limited studies done in Malaysia to determine the association of beverage consumption with the weight status among school children, the result of this study will be very useful to do further intervention studies in the future, if required.

CHAPTER 2 : LITERATURE REVIEW

2.1 Trends of Sweetened Beverage Consumption

In United State, the per capita intake of caloric beverages doubled between 1977 and 2002, (Brownell et al., 2009; Duffey & Popkin, 2002.). The most recent data from 2005–2006, in the United States found that children and adults consumed about 172 and 175 kcal of daily sweetened beverages respectively (Brownell et al., 2009). It is estimated that these types of beverages account for 10% of total energy intake in adults (Nielsen & Popkin, 2004). While among British schoolchildren, most of the children had total sugar intakes greater than recommended and it is shown that there is a strong relationship between consumption of beverages and energy intake. However, there was no relationship between the beverage type and BMI score (Coppinger et al., 2011). According to results from the 2004 Canadian Community Health Survey (CCHS), beverages make up almost 20% of the calories consumed by children and teens aged 4 to 18. Beverages account even became higher 30% among children at ages 1 to 3.

Sweetened beverages include soda, fruit drinks with added sugar, sports drinks, carbonated beverages with added sugar, sweet tea, energy drinks and other drinks with added sugar. In the past 50 years, fruit juice consumption has increased among children and it has been associated with overweight. Other changes in beverage intakes include an increase in soft drink consumption and decrease in milk consumption (Hill et al., 1998). Increase in consumption of sweetened beverages such as non-diet soda and fruit drinks were positively related to obesity among children age 11 to 12 years while diet soda was inversely related (Ludwig, Peterson & Gortmaker, 2001). Among children and adolescents, sugar-sweetened beverages

are primarily responsible for the higher caloric intakes of sweetened beverage consumers. Among adolescents, sweetened beverage consumption is associated with intake of a select number of food and beverage groups, some of which are often unhealthy, such as pizza, burgers, fried potatoes, savoury snacks, and grain-based desserts (Mathias et al., 2013).

In Australia, it has been proposed the weight of evidence indicates that soft drinks are a major issue in childhood and adolescent obesity, and that the doubling of consumption of soft drinks from 47L/head in 1969 to 113L/head in 1999 is related to increases in childhood obesity (Gill, Rangan & Webb, 2006). Increased intake of sweetened beverages such as soft drinks and commercially available fruit juices, amongst a number of other factors such as fast food eating, breakfast skipping, inactivity, and increased TV viewing hours, is thought to contribute to weight gain and risk of obesity in childhood and adolescence (Ariza, Chen, Binns et al., 2004).

2.2 Patterns of Beverage Consumption among Chidren

Based on the article written by Garriguet (2008), more than 85% of all the beverages consumed by children and teens fall into five categories, which are water, milk, fruit juice, fruit drinks and regular soft drinks which are high in glycemic index. At least 70% of children drink water on a typical day and the amount consumed rises steadily with age. At lower ages, children drink less water than milk and the amount of water consumed will increase with ages. According to Canadian Community Health Survey 2004, boys drink more water compared with the girls. An average of 780 grams of water consumed by the boys while 694 grams for girls. At older ages, children's beverage consumption increases and becomes more varied. More children choose sweetened beverages which include soft drinks and fruit

drinks. Consumption of fruit drinks peaks at ages 9 to 13, with boys averaging 211 grams a day, and girls, 192 grams.

While, fruit juices and smoothies were consumed more frequently by all girls and 9-10 year old boys based on the study done on British schoolchildren. Milk and plain water as the beverages were less popular. Boys were found to obtain more of their energy from beverages and were consuming greater amounts of sugar and drinking more soft drinks than girls (Coppinger et al., 2011). Adolescent girls showed a decreased consumption of milk and increase in soda consumption over time, with a 10 year period. Increasing soda consumption predicted the greatest increase in calories, and of BMI, and the lowest increase in calcium intake (Striegel et al., 2006).

Sweetened beverage classified as high-glycemic index (GI) liquids which can increase postprandial blood glucose levels and decrease insulin sensitivity. Additionally, high-GI drinks submit to a decreased satiety level and subsequent overeating. Low-GI beverages stimulate a delayed return of hunger, thereby prompting an increased flexibility in amounts and frequencies of servings. Single intervention manipulation, elimination, or marked reduction of sweetened beverage consumption may serve to decrease caloric intake, increase satiety levels, decrease tendencies towards insulin resistance, and simplify the process of weight management in obese population (Harrington, 2008). Table 1 shows the glycemic index ranking for beverage commonly consumed by younger children. Most of the children nowadays more prefer to consume high glycemic beverages rather than with low glycemic beverages.

Table 1: Glycemic Index ranking for beverages

Beverage	GI value	Category
Milk	27	Low glycemic
Soy	30	Low glycemic
Fruit juices		
- Orange	50	Moderate glycemic
- Apple	44	Low glycemic
- Grape	48	Low glycemic
Malted drink	45	Low glycemic
Chocolate drink	55	Moderate glycemic
Isotonic drink	78	High glycemic
Syrup/cordial	94	High glycemic
Soft drink	97	High glycemic

(Kaye et al., 2002)

Factors such as taste preferences, soft drink consumption habits of parents and friends, soft drinks availibility in the home and school, and television viewing, play an influential role in beverage intake of school children (Grimm, Harnack & Story, 2004). The previous study done by Shang et al among school children in China showed that 46.1% of the children regularly consumed sweetened beverages. Regular sweetened beverage consumption which is higher in fructose can increase the total daily energy intake. Both increased fructose and caloric intake may contribute to the development of obesity. It is believed that children whose parents had a low education level or whose family had a low income were more prone to becoming regular sweet beverage drinkers. It has been suggested that this finding maybe because children of low socioeconomic status do not receive health related nutrition at home, but have easy access to sweetened beverages supplied by their parents (Shang, Liu, Zhang et al., 2012).

The availability of sweetened beverage in schools did not affect consumption overall. However, males, minority youth, and youth in households below the poverty line were adversely affected. Males who gained access to sweetened beverage in school increased their consumption by 20.7% per week compared with males in schools with no access to them. Minority youth consumed sweetened beverage 61.4% and youths in households below the poverty line 68.6% more times per week than their counterparts in schools that did not offer sweetened beverage (Vericker, 2013). While, Ogden et al (2011) reveals an increase in consumption of sweetened beverage in United State. In addition, data showed that males consume more sweetened beverage than females, teenagers and young adults drink more sweetened beverage than other age groups, low-income persons consume more sweetened beverage in relation to their overall diet than those with higher income, and most the sweetened beverage consumed away from home are obtained from stores and not restaurants or schools.

The consumption pattern of sweetened beverages among children shows that there was an increase in the number of consumers of sweetened soft drinks increasing from 9.7% in the 2-3 year age group to 32.9% in the 14-16 year age group with no differences in the trend between boys and girls. Increasing intake of sweet beverages is associated with sedentary behaviours. Overall, with increasing amounts of television exposure (from < 107 min to > 179 min), there were significantly higher reported mean intakes of soft drinks, which is increasing from 156 g/d to 210 g/d across tertiles of television exposure in all children aged 9-16 years. The consumption of sweetened beverages mostly occurred at home which is about 55% and 10% occurred at school (Peter, Lily et al., 2011). Television viewing for more than 2 hours/day at home is also associated with both high energy drinks and savoury

snack consumption among primary school children in Melbourne (Salmon, Campbell and Crawford, 2006).

Despite sedentary lifestyles, intake of sugar-added beverages also associated with intake of sugar not contained in beverages and sweet or savoury snacks which lead to weight gain. As a sugar-added beverage becomes a favourite choice of children on a daily basis (> 250 g/d), the present study indicates that intakes of milk and yogurt, calcium and vitamin D already decreased. This is because there is low fruit and vegetable consumption in high consumers of sugar-added beverages led to lower intake of vitamin A and E. Lack in micronutrients could have adverse health effects in the long term, since fruit and vegetables consumption is inversely associated with some types of cancer, diabetes and heart diseases (Bazzano, Serdula, Liu, 2003). The most important is healthy dietary habits established in early childhood contribute to similar habits later in life and influence adult health (Mikkila, Rasanen, Raikatari et al., 2004). While, high vitamin C intake of high sugar added-beverages consumers could be explained by the fact that commercially available sweetened fruit juices are usually enriched with vitamins. In order to decrease the rate of overweight and obesity, James et al have done an intervention. After 1 year of a school based education program on nutrition, children reduced their intake of soft drinks and prevalence of overweight declined (Jamese et al., 2004).

2.3 Beverage Consumption and Weight Status

The relationship of sugar-sweetened beverage consumption with an excessive weight gain was generally statistically significant, but the effect varied across groups within the same study. In the study that controlled other influential variable to weight gain, there was association for sugar-sweetened beverage consumption (Ludwig et

al., 2001; Welsh et al., 2005). The potential contributions of sugar-sweetened beverages to weight gain are supported by the results of several controlled clinical trials in adults. Tordoff and Alleva (1990) found that adults fed almost 1135 g/day of high-fructose corn syrup–sweetened beverages gained weight while, when they were fed the same amount of beverages with an artificial sweetener, the men lost weight.

Besides, in a study involving overweight adults who fed supplements of 152 g/day of either sucrose or artificial sweeteners, predominantly in the form of beverages, those who received sucrose gained weight, whereas those who received artificial sweetener lost weight (Raben et al., 2002). While, an alternative approach to longitudinal studies has been done to examine the association between reduced consumption of sugar-sweetened beverages on obesity. A group-randomized, controlled, school-based intervention aimed at reducing students' consumption of sweetened and unsweetened carbonated beverages appeared to reduce the prevalence of overweight, but not of obesity, in 7- to 11 year-old children (James et al., 2004) However, it was not clear whether decreased soda intake mediated the shifts in overweight that occurred.

Similar results have been reported in preschool children (Wilson, 2000). These findings are also supported that the consumption of diet soda is negatively associated with energy intake and weight, whereas the intake of sugar-sweetened beverages are positively associated with energy intake and weight.

2.4 Mechanism of Sweetened Beverage leads to Weight Gain

Sugar-sweetened beverage consumption preceded the effect on the weight-related measures. There was a dose-response effect found in several of the studies (Striegel et al., 2006; Berker et al., 2004). A logical mechanism can explain this association. Consumption of excess calories can produce weight gain. The high fructose content of sugar sweetened beverages may promote hepatic lipogenesis, and the reduced insulinogenic response may decrease the inhibitory effects of these sugar-sweetened beverages on food intake (Bray et al., 2004). In addition, significant weight gain may occur when carbohydrates are consumed as liquids rather than as solids (DiMeglio and Mattes, 2000). DiMeglio have done a research in humans that demonstrated caloric compensation was less complete when liquid versus solid foods were consumed. The prevailing evidence suggests that weight gain arises because compensation at subsequent meals for energy consumed in the form of a liquid could be less complete than that for energy consumed in the form of a solid, most likely because of the low satiety of liquid foods. DiMeglio and Mattes showed that consumption of 1180 kJ soda/d resulted in significantly greater weight gain than did consumption of an isocaloric solid carbohydrate load.

This effect is supported by animal research that shows that consumption of foods low in viscosity is associated with greater caloric intake (less compensation) and greater weight gain than the consumption of high-viscosity foods (Davidson and Swithers, 2005). This study suggests that fluids stimulate weak appetitive and compensatory dietary responses compared with energy-matched semisolid or solid items. There is a strong orosensory effect because oral-liquid stimulation led to more rapid gastric-emptying and orocecal transit times, a smaller increase of satiety hormone release (GLP-1) and insulin, as well as a smaller reduction in ghrelin