PREDICTIVE FACTORS OF FRUITS AND VEGETABLES INTAKE AMONG MALAYSIAN ADULTS: FINDINGS FROM MALAYSIAN ADULTS NUTRITION SURVEY 2014

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Abstract. Based on Malaysian Dietary Guidelines, five servings of fruits and vegetables should be taken every day to meet nutrient requirement. This study aim to determine the prevalence of fruits and vegetables intake and its predictive socio-demography factors among adults aged 18 years and above in Malaysia based on the findings from the Malaysian Adults Nutrition Survey (MANS) 2014. This study was a cross-sectional population-based household survey using multi-stage stratified cluster sampling. A total of 2,820 respondents comprising of 1,302 males and 1,518 females were interviewed to obtain socio-demographic information and data on food intake. Overall prevalence of fruits and vegetables intake that met food pyramid recommendation was 22.9% [95% confidence interval (CI): 20.6-25.3%]. Prevalence of those not meeting the required fruits and vegetables intake was higher [77.6% (95% CI: 74.2-80.7%)] among males compared to females. Adults of 40-49 years of age, those with a tertiary educational level and a household income level of more than RM 3,500 (USD862.06) have a higher prevalence [24.7% (95% CI: 20.9-28.9%)], 25.8% (95% CI: 21.8-30.4%) and 27.6% (95% CI, 23.2-32.5), respectively] of meeting the recommended daily fruits and vegetables intake. Knowledge on the health benefits of eating fruits and vegetables is an important factor to encourage Malaysian to meet this daily food requirement. Thus, promotion and education on eating fruits and vegetables should be given to Malaysians of all ages.

Keywords: fruit, vegetable, predictive factor, Malaysia

INTRODUCTION

Good nutritional habits play an important role in maintaining healthy body function and prevention of diseases stemming from inadequate nutritional intake. Fruits and vegetables are part of the important components of a healthy diet, and insufficient consumption of these may increase risk of critical chronic diseases, such as cardiovascular diseases, hypertension, diabetes, and cancer (American Diabetes Association, 2002; He *et al*, 2007).

According to World Health Report (WHO, 2003), insufficient intake of fruits and vegetables was estimated to cause about 31% of ischemic heart disease and 11% of stroke worldwide. Many epidemiological studies have shown a strong

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association between eating fruits and vegetables and their protective effects against cancer and there is a possible decreased risk of certain types of cancer through eating fruits and vegetables (World Cancer Research Fund/American Institute for Cancer Research, 2007). In addition, an association between increased consumption of vegetables and lower incidence of obesity, a risk for diabetes, has been reported (Wang *et al*, 2016). A significant inverse association between fruits and vegetables consumption and weight gain was reported in Mediterranean men from a multipurpose cohort study (Bes-Rastrollo *et al*, 2006), and an analysis of food consumption from a Nurses' Health Study of women in United State showed increasing intake of fruits and vegetables may reduce long-term risk of obesity and weight gain (He *et al*, 2004).

Fruits and vegetables consumption also varies with socio-demography characteristics. Females have a higher prevalence of meeting fruits and vegetable intake compared to males (Darfour-Oduro *et al*, 2018). In general, this prevalence is higher among persons with higher educational level and those greater than 40 years of age. Individuals with normal body mass index (BMI) (18.5-24.9 kg/m^2) are also more likely to meet the fruits and vegetables daily intake recommendation compared to those with BMI values outside the normal range (OECD, 2015).

Based on these findings, many countries have developed their own dietary recommendations. World Health Organization (2003) suggests a minimum of 400 g of fruits and vegetables per day for the prevention of chronic diseases as well as for the prevention and alleviation of several micronutrient deficiencies, especially in less developed countries. USA Dietary Guidelines and Food Guide Pyramid recommends five or more servings of fruits and vegetables per day (US Department of Agriculthere, 2010). In Malaysia, individuals are advised to consume at least five portions or servings of fruits and vegetables a day, which amount to at least 400 g of a variety of non-starchy vegetables and fruits (Malaysian Dietary Guidelines, 2010).

Apart from meeting the recommendations, a limited number of studies on factors influencing the consumption of fruits and vegetables intake have been carried out. In Malaysia, there is an absence of this type of research, and, thus, this cross-sectional study was designed to examine predictive socio-demographic factors for intake of fruits and vegetables among adults in Malaysia using data from Malaysian Adults Nutrition Survey (MANS) (Institute of Public Health, 2014).

MATERIALS AND METHODS

Study population

This cross-sectional study, carried out in 2014, constituted respondents 18-59 years of age who were not on a specific diet due to illness at the time of the interview. Sample size was calculated using a formula appropriate for survey and involved 2,820 respondents comprising 1,302 males and 1,518 females (not pregnant or breastfeeding). The design was a multi-stage stratified cluster sampling of living quarters (LQs) covering Peninsular Malaysia, Sabah and Sarawak (Institute for Public Health, 2014).

Ethical approval was obtained from the Medical Research Ethical Council (MREC), National Institute of Health (NIH) of Malaysia. Prior written informed consent was obtained from each participant.

Data collection and tools

A structured questionnaire was used to collect data via face-to-face interviews. One respondent from each household was selected to be interviewed. The questionnaire covered socio-demographic parameters and details of food intake. Vegetables and fruits consumption data comprised of frequency per week and serving size to evaluate pattern of consumption. Interviews on food were conducted by professional nutritionists and on anthropometric data by trained research assistants.

Weight (kg) was measured using Tanita Personal Scale HD319 (Tokyo, Japan) and height (m) using Seca Stadiometer 217 (Hamburg, Germany), and BMI (weight/height^2) was calculated to determine nutritional status: underweight, <18.5 kg/m^2; normal, 18.5-24.9 kg/m^2; overweight, 25.0-29.9 kg/m^2); and obese, 30.0-39.9 kg/m^2 (WHO, 1998).

Statistical analysis

Statistical analysis was performed using Statistical Package for the Social Science (SPSS) version 21 (IBM, Armonk, NY). Descriptive analysis was used to determine prevalence of intake fruits and vegetables based on the Malaysian Food Pyramid recommendation of 5 servings per day, categorized into two groups, namely, met recommendation (5 servings or more per day) and not met recommendation (<5 servings per day). Simple logistic analysis was used for each independent variable (IV) with a p-value <0.25. Multiple logistic regression was carried out, with forward LR and backward LR analyses based on four variables selected in the preliminary main effect model to identify socio-demographic factors associated with fruits and vegetable intake based on Malaysian Food Pyramid Recommendation (Malaysian Dietary Guidelines, 2010).

RESULTS

Among Malaysian adults, overall prevalence of fruits and vegetables intake that met the Malaysian Food Pyramid Recommendation (Malaysian Dietary Guidelines, 2010) was only 22.9% (Table 1). Based on socio-demography, there is no significant difference between adults in urban and rural areas who did not meet the recommended fruits and vegetables intake, or between males and females. Adults aged 20-29 years old showed the highest prevalence of not meeting the recommended fruits and vegetables intake. Malaysians of Indian ethnicity had the highest prevalence of meeting the recommended fruits and vegetable intake, followed by Malay and Chinese.

Univariate analysis revealed only household income level and BMI were significant variables, while education level and other variables are not significant (Table 2). Strata (location) and education level with p-value <0.25 were included for model building. Based on household income level, those having a higher income [(>RM 3,500, USD862.06) per month] were 7.9 times more likely to meet the recommended fruits and vegetables intake compared to those who have low income (<RM 1,500) [crude odds ratio (OR) = 1.38; 95% confidence interval (CI): 1.10-1.72, p = 0.005; without adjusting for other confounders]. Malaysians who were underweight were 6.3 times more likely in meeting the recommended fruits and vegetables intake compared to those of normal weight (crude OR = 6.34; 95% CI: 0.33-0.87; p = 0.12; without adjusting for other variables). Education level is not statistically significant among the stratified BMI groups (p = 0.59).

However, using a multivariate analysis, those who were underweight were

Table 1
Prevalence of fruit and vegetable intake among Malaysian adults based on Malaysia Food Pyramid Recommendation.

	Malaysia Fruits And Vegetables Intake Recommendation[a]					
	Not met recommendation			Met recommendation		
	Number	Prevalence (%)	95% CI	Number	Prevalence (%)	95% CI
Total	2,196	77.1	74.7-79.4	624	22.9	20.6-25.3
Location						
Urban	1,158	76.4	73.2-79.4	353	23.6	20.6-26.8
Rural	1,038	78.9	75.4-81.9	271	21.1	18.1-24.6
Age in years						
18 – 19	98	78.6	65.6-87.6	26	21.4	12.4-34.4
20 – 29	519	79.1	74.6-82.9	142	20.9	17.1-25.4
30 – 39	606	76.3	71.6-80.5	166	23.7	19.5-28.4
40 – 49	550	75.3	71.1-79.1	165	24.7	20.9-28.9
50 – 59	423	77.3	72.3-81.6	125	22.7	18.4-27.7
Gender						
Male	1,020	77.6	74.2-80.7	282	22.4	19.3-25.8
Female	1,176	76.7	73.7-79.4	342	23.3	20.6-26.3
Ethnicity						
Malay	1,065	77.4	74.0-80.5	307	22.6	19.5-26.0
Chinese	389	78.1	72.7-82.7	100	21.9	17.3-27.3
Indian	96	74.1	64.4-82.0	26	25.9	18.0-35.6
Others	646	76.5	72.0-80.4	191	23.5	19.6-28.0
Marital status						
Never married	549	78.3	73.6-82.5	153	21.7	17.5-26.4
Married	1,507	76.9	74.2-79.4	429	23.1	20.6-25.8
Others	139	74.0	64.0-82.1	41	26.0	17.9-36.0
Education level						
No formal education	104	82.9	73.4-89.4	23	17.1	10.6-26.6
Primary school	471	80.1	75.7-83.9	113	19.9	16.1-24.3
Secondary school	1,080	77.4	74.1-80.4	296	22.6	19.6-25.9
Tertiary school	523	74.2	69.6-78.2	184	25.8	21.8-30.4
Others	11	77.4	49.5-92.2	5	22.6	7.8-50.5
Household income per capita						
<RM 1,500	1,056	79.3	75.6-82.5	269	20.7	17.5-24.4
RM 1,500-3,500	649	77.7	74.0-81	188	22.3	19.0-26.0
>RM 3,500	468	72.4	67.5-76.8	164	27.6	23.2-32.5
Employment status						
Government/semi-government employee	262	77.4	71.6-82.2	82	22.6	17.8-28.4

Table 1 (Continued)

	Malaysia Fruits And Vegetables Intake Recommendation[a]					
	Not met recommendation			Met recommendation		
	Number	Prevalence (%)	95% CI	Number	Prevalence (%)	95% CI
Private employee	808	77.8	73.8-81.3	220	22.2	18.7-26.2
Self employed	603	74.8	70.5-78.6	184	25.2	21.4-29.5
Unpaid worker/not working/student	479	78.4	73.9-82.3	127	21.6	17.7-26.1
Retired	22	88.7	67.5-96.8	4	11.3	3.2-32.5
Body mass index (BMI)						
Normal[b]	904	76.3	72.8-79.4	275	23.7	20.6-27.2
Underweight[c]	128	82.0	70.9-89.5	21	18.0	10.5-29.1
Overweight/ obese[d]	1,099	77.1	74.0-80.0	313	22.9	20.0-26.0

[a]WHO, 1998. [b]18.5-24.9 kg/m^2. [c]<18.5 kg/m^2. [d]25.0-39.9 kg/m^2. RM 1 = USD 0.25.

44% less likely in meeting the Malaysian Food Pyramid Recommendation for fruits and vegetables intake compared to those who were normal weight (adjusted OR = 0.56; 95% CI: 0.35-0.91, p = 0.12; after adjusting for confounder income) (Table 3). Those with higher income (>RM 3,500 per month) were 1.3 times more likely to meet the recommended fruits and vegetables intake (adjusted OR = 1.34; 95% CI: 1.07-1.68; p = 0.011; after adjusting for confounders).

DISCUSSION

Overall, less than 50% of adults in Malaysia consumed the recommended amounts of fruits and vegetables based on the Malaysian Food Pyramid (Malaysian Dietary Guidelines, 2010). Fruits and vegetables consumption depended on socio-economic status, with prevalence of meeting the recommended intake higher among populations residing in urban area, who were married and having a household income of more than RM 3,500.

The same situation was reported from US NHANES, which reveals only a small number of the US population meets the recommended intake in My Pyramid nutrient-rich food groups (Casangrade *et al*, 2007). Previous studies reported individuals who were married, with higher education and income are more likely to consume more fruits and vegetables and are concerned with their health compared to those in other categories (Hulshof *et al*, 2003; Blisard *et al*, 2004; Krebs-Smith *et al*, 2010; Safdar *et al*, 2013; Al-Otaibi, 2014). Fruits and vegetables availability tend to be higher among family where household heads have a higher level of education (Blisard *et al*, 2004). Highly educated individuals tend to meet the national and international recommendations regarding dietary guidelines (Safdar *et al*, 2013), consume more fruits and vegetables and have a lower intake of fat and meat (Casangrade *et al*, 2007). However, different results observed from studies in Spain and Greece, where people with lower education consume fruits more often than those with higher educated (Bates *et al*, 2008).

Table 2
Socio-demographic factors associated with fruits and vegetable intake among Malaysian adults based on simple logistic regression analysis.

Socio-demoprahic factors	Regression coefficient	Crude OR (95 % CI)	*p*-value[a]
Location			
Urban	0	1	
Rural	-0.15	0.86 (0.72-1.02)	0.090
Age in years			
18 - 19	0	1	
20 - 29	0.03	1.03 (0.64-1.65)	0.898
30 - 39	0.03	1.03 (0.65-1.64)	0.893
40 - 49	0.12	1.13 (0.71-1.80)	0.605
50 - 59	0.11	1.11 (0.69-1.79)	0.657
Gender			
Male	0	1	
Female	0.05	1.05 (0.88-1.26)	0.579
Ethnicity			
Malay	0	1	
Chinese	-0.11	0.89 (0.69-1.15)	0.376
Indian	-0.06	0.94 (0.60-1.48)	0.787
Others	0.03	1.03 (0.84-1.27)	0.809
Marital status			
Never married	0	1	
Married	0.02	1.02 (0.83-1.26)	0.842
Others	0.06	1.06 (0.72-1.57)	0.776
Education level			
No formal education	0	1	
Primary school	0.08	1.08 (0.66-1.78)	0.748
Secondary school	0.21	1.24 (0.78-1.98)	0.371
Tertiary school	0.46	1.59 (0.98-2.58)	0.059
Others	0.72	2.06 (0.65-6.49)	0.219
Household income per capita			
<RM 1,500	0	1	
RM 1,500-3,500	0.13	1.14 (0.92-1.40)	0.231
>RM 3,500	0.32	1.38 (1.10-1.72)	0.005
Employment status			
Government/semi- government employee	0	1	
Private employee	-0.14	0.87 (0.65-1.16)	0.345
Self employed	-0.03	0.98 (0.72-1.31)	0.868
Unpaid worker/not working/student	-0.17	0.85 (0.62-1.16)	0.303
Retired	-0.54	0.58 (0.20-1.73)	0.330
Body mass index			
Normal[b]	0	1	
Underweight[c]	-0.62	0.54 (0.33-0.87)	0.012
Overweight/obese[d]	-0.07	0.94 (0.78-1.13)	0.484

[a]Significance at $p<0.05$; [b]18.5-24.9 kg/m^2; [c]<18.5 kg/m^2; [d]25.0-39.9 kg/m^2; OR, odds ratio; CI, confidence interval; RM 1 = USD 0.25.

Table 3
Socio-demographic factors associated with fruits and vegetable intake among Malaysian adult based on multiple logistic regression (multivariable) analysis.

Socio-demoprahic factors	Regression coefficient[a]	Adjusted OR (95 % CI)	*p*-value[b]
House hold income per capita			
<RM 1,500	0	1	
RM 1,500-3,500	0.12	1.13 (0.91-1.40)	0.257
>RM 3,500	0.29	1.34 (1.07-1.68)	0.011
Body mass index			
Normal[c]	0	1	
Underweight[d]	-0.58	0.56 (0.35-0.91)	0.019
Overweight/obese[e]	-0.06	0.94 (0.78-1.13)	0.500

[a]Backward LR Multiple Logistic regression was applied; multicollinearity and interaction were not found; Hosmer-Lemeshow test showed $p = 0.577$; classification table (overall correctly classified = 77.7% and ROC curve = 54.5%) was accepted to check model fitness. [b]Significance at $p<0.05$. [c]18.5-24.9 kg/m^2. [d]<18.5 kg/m^2. [e]25.0-39.9 kg/m^2. OR, odds ratio; CI, confidence interval. RM 1 = USD 0.25.

Our study identifying that people with higher income meet the fruits and vegetables recommendation is similar to a report from Tanzania that those with higher earning occupations, such as small or large business owners and professionals (OR = 0.83, 0.50 and 0.66, respectively) are less likely to have inadequate fruits and vegetables intake compared to farmers (Msambichaka *et al*, 2018). Its might be due to affordability of high prices of fruits and vegetables in this country.

That underweight adults were significantly less likely to meet the recommended fruits and vegetables intake suggests dietary intervention is needed to address a poor dietary habit present in Malaysia. Similarly, Australian and Canadian cohort studies indicated an inverse correlation between fruits and vegetables consumption with body mass index, with a person in the underweight category having a lower intake of fruits and vegetables compared than other body mass index categories (Drapeau *et al*, 2004; Charlton *et al*, 2014). In addition, the current study showed females having a higher prevalence of meeting the recommended fruits and vegetables intake. Other studies have shown similar findings (Bates *et al*, 2008).

The present study has a number of limitations. Firstly, the cross-sectional design did not allow the establishment of causal relationship, and, secondly, fruits and vegetables intake was assessed only in two short separate questionnaires that might have results in an under- or over-estimation of intake data.

In conclusion, knowledge regarding the health benefits of eating fruits and vegetables is an important factor to encourage Malaysians to daily consume more of such food items. Education of the health benefits of fruits and vegetables should be promoted to Malaysians of all ages.

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