

## Fruit consumption and associated determinants in a sample of young urban Malaysian adults

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### ABSTRACT

**Introduction:** Adequacy of fruit intake contributes to an individual's health including reducing the risk of non-communicable disease. This study aimed to assess consumption of fruits in various forms and to determine associated factors and barriers. **Methods:** In this cross-sectional study, a total of 300 adults aged 20-39 years were purposely recruited from several urban locations in the Klang Valley. Consumption of fruits in the past 12 months was assessed using a self-administered food frequency questionnaire (FFQ), assisted with pictures of serving size of fruits. Anthropometric measurements were taken and body mass index and waist circumference computed. **Results:** Fruit intake among young adults was lower ( $1.6 \pm 1.0$  servings/day) than the Malaysian Dietary Guideline 2010 of  $\geq 2$  servings/day. Only 32.3% consumed fruits as recommended, with women consuming significantly more fruits than men. Preferred fresh fruits were red apple, banana and papaya. Consumption of fruit juice was associated with increase in waist circumference ( $R^2=0.261$ ,  $p=0.027$ ) after adjustment for age, sex, ethnicity, education level and marital status. Fruit intake showed no significant association with other anthropometric measurements. Sensory appeal, perceived health benefit, easy to prepare and influence of family were the main determinants of fruit intake, whilst affordability and availability were the major barriers. **Conclusion:** Fruit consumption among young adults in this study was lower than the recommendation for daily fruit intake. Studies with larger sample size are suggested to verify the finding of significant association between fruit juice consumption and risk of abdominal obesity.

**Keywords:** Fruit, fruit juice, abdominal obesity, barriers, young adults

### INTRODUCTION

Low consumption of fruits is among the top five leading risk factors of global burden of diseases worldwide (Lim *et al.*, 2013). The Malaysian Dietary Guidelines 2010 recommended at least 2 servings of fruit (160g) daily (NCCFN,

2010). This practice reduces the risk of major non-communicable diseases (NCD) such as cardiovascular disease and certain types of cancer (WHO, 2014), and likely reduces body weight (Slavin & Lloyd 2012). Adequacy of fruit intake is associated with optimal

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intake of micronutrients, dietary fibre and phytochemicals which are vital for health. Despite these evidence of health benefits associated with regular fruit consumption, fruit intake among Malaysian adults has been reported to be low (IPH, 2015).

According to the National Health and Morbidity Survey (NHMS) 2015, 90.1% of Malaysian adults did not meet the recommendation of daily fruit intake, and the highest prevalence of inadequate intake was among men and young adults (IPH, 2015). Lifestyle habits of young adults during their transitional stage of life (including pattern of food intake) may have long term health implications (Spanos & Hankey, 2010). Adequate consumption of fruits may contribute toward reducing the risk of chronic diseases at a later stage of life.

Apart from fresh fruits, fruit juice, dried and preserved fruits are also included in guidelines for fruit intake. The French Dietary Guidelines 2008 and American Dietary Guidelines 2010 recommended that fruit juice should be consumed at no more than half of the total recommended daily fruit servings (Drewnowski & Rehn, 2015; USDA & HHS, 2010).

Socio-demographic factors such as age, sex, ethnicity, level of education and income are important predictors of fruit consumption (Yen & Tan, 2012). In Nepal, individuals from high socio-economic status were more engaged with healthy and nutritionally balanced diets than those from low socio-economic status (Nepal, Bohara & Gawande, 2011). Following education on the importance of fruit intake, subjects showed a modest increase in fruit intake (Wagner *et al.* 2016). However, other studies reported that health campaigns and interventions on increasing fruit intake were insufficient to bring about sustainable change in fruit consumption (Duthie *et al.*, 2017). Interactions of

factors influencing fruit consumption should be determined (Krølner *et al.*, 2011).

This study was aimed at assessing consumption of fruits in different forms, associated factors and barriers in a sample of Malaysian young adults.

## **MATERIALS AND METHODS**

This cross-sectional study was conducted with enrolment of subjects based on ethnicity of Malaysian population distribution 2016. Young Malaysian adults aged 20-39 years were invited to participate. Excluded from the study were pregnant women, ages outside 20-39 years, and individuals participating in intervention programmes that may alter their habitual diet. Recruitment made use of print advertising, social media engagement and professional networking. Six institutions, including private and government organisations, from several urban locations in the Klang Valley were randomly selected. The study was conducted from June 2016 to February 2017.

A validated questionnaire consisting of socio-demographic data, medical history, fruit consumption pattern and food frequency questionnaire (FFQ) (107 items) for fruit intake was self-administered by the subjects. Measurement of fruit intake for the past 12 months, either as fresh, dried or juice using the FFQ was recorded according to the amount consumed and the average frequency of consumption, ranging from daily, weekly, monthly and annual consumption. Subjects were assisted with pictures of serving size of fruits. The original portion size of each fresh, juice and dried fruit was translated into recommended serving size according to the Malaysian Dietary Guidelines (NCCFN, 2010) and aided by the Atlas of Food Exchanges & Portion Sizes (Shahar *et al.*, 2009). The total amount

consumed per day was then calculated by multiplying the number of servings by the frequency of fruit intake.

Blood pressure, body weight and height for computation of body mass index (BMI), waist circumference (WC) and body fat percentage were determined by trained enumerators. Waist circumference was categorized according to World Health Organisation, WHO (2008). Body fat percentage was measured using Body Composition Analyzer (Tanita TBF 300, Germany) and categorized based on WHO (1995).

Data were analysed using IBM SPSS Statistics for Windows version 21.0 (IBM Corporation, New York, NY, USA). Descriptive statistics, independent sample t-test, one-way ANOVA and multiple linear regressions were used for data analysis. Significant value was set at  $p<0.05$ .

This study was approved by the Universiti Kebangsaan Malaysia Research Ethics committee (NN-2016-032). Informed consent was obtained from all subjects before commencement of the study.

## RESULTS

Majority of subjects were female (62.7%), with a mean age of  $26\pm5$  years. The subjects were predominantly Malay (68.0%) followed by Chinese (23.4%), Indian (7.3%) and others (1.3%). Most of them were single (72.3%). Their highest education level was SPM/A-level/foundation (pre-university) with mean monthly income of  $\leq$  RM1,000 (Table 1). More than half reported monthly earnings of  $\leq$  RM2,000.

Mean fruit intake was  $1.6\pm1.0$  serving per day, with 32.3% consuming fruits  $\geq 2$  servings/day. Female subjects consumed significantly more fruits ( $1.7\pm1.0$  serving/day) than men ( $1.5\pm1.0$  serving/day). Among the ethnic groups, highest mean intake of fruits was among

Malay subjects ( $1.6\pm1.0$  serving/day). In general, the subjects preferred to consume fresh fruits ( $1.3\pm0.8$  serving/day) compared to fruit juices ( $0.2\pm0.3$  serving/day) and dried fruits ( $0.1\pm0.3$  serving/day). Frequently consumed fresh fruits were red apple, banana and papaya, whilst the most preferred dried fruits were dates, raisin and mango. Orange, mango and watermelon juices were preferred by the subjects.

Body mass index, WC and body fat percentage showed no significant associations with mean daily intake of fruits (Table 2). However, consumption of fruit juice had a significant association with WC, wherein an increase of one unit of fruit juice consumption significantly increased 0.126 unit of WC. No significant association was found between consumption of fruit juice with BMI and percentage of body fat (Table 3).

Most subjects liked to eat fruits due to the sensory appeal (taste) (97.3%), for health benefits (96.3%), and to keep a healthy bowel movement (90.0%). Apart from that, more than half of the subjects (61.0%) reported avoiding consuming certain fruits. Common barriers for consuming fruits include costs (expensive) (57.9%), limited choices available (48.1%) and storage problems (45.9%). However, none of the barriers mentioned were found to have a significant influence on fruit intake (Table 4).

## DISCUSSION

National surveys have reported a reduction in fruit consumption among Malaysian adults, decreasing from 14.6% in 2011 to 9.9% in 2015 (IPH, 2015). This study found the mean intake of fruits among young adults was lower than the recommendation of  $\geq 2$  servings/day by Malaysian Dietary Guidelines 2010 (NCCFN, 2010). About 67.7% of the subjects failed to meet the

**Table 1.** Consumption pattern of fruits (fresh, dried and juice) according to demographic profile of participants

<i>Demographic factor</i>	<i>Number of subjects, n(%)</i>	<i>Total fruit intake (servings/day), Mean±SD</i>
Age (mean=26±5 years)		1.6±1.0
Sex		
Male	112(37.3)	1.5±1.0*
Female	188(62.7)	1.7±1.0
Ethnicity		
Malay	204(68.0)	1.6±1.0 <sup>a</sup>
Chinese	70(23.4)	1.5±0.9
Indian	22(7.3)	1.8±1.2
Others	4(1.3)	1.2±0.2 <sup>b</sup>
Marital status		
Single	217(72.3)	1.6±1.0
Married	80(26.7)	1.7±1.0
Widowed/Divorced	3(1.0)	2.0±1.1
Education level		
Secondary school	21(7.0)	1.8±1.3
STPM/A-level/Foundation	112(37.3)	1.5±0.9
Diploma	49(16.3)	1.7±1.1
Degree	101(33.7)	1.6±1.0
Postgraduate	17(5.7)	1.9±0.9
Working status		
Worker	144(48.0)	1.7±1.1
Student	117(39.0)	1.5±1.0
Not working	10(3.3)	1.9±1.0
Income <sup>†</sup>		
<RM1000	131(43.7)	1.5±1.0
RM1001-2000	38(12.7)	1.7±0.2
RM2001-3000	55(18.3)	1.8±1.2
RM3001-4000	40(13.3)	1.5±0.9
>RM4000	36(12.0)	1.6±1.0

\*Mean difference using independent t-test significant at  $p<0.05$

<sup>a,b</sup>Different alphabets within the same column for the same factor indicate significant difference (one-way ANOVA) at  $p<0.05$

<sup>†</sup>RM1.00 = USD4.10

Abbreviation: STPM, *Sijil Tinggi Pelajaran Malaysia*

daily recommendation of fruit intake. This result is consistent with the finding of the NHMS 2015, whereby 90.1% of adults daily consumed inadequate amounts of fruits (IPH, 2015).

Consistent with the findings by Yen & Tan (2012), female subjects in this study consumed more fruits than the males. This might be due to social and cultural norms, in which most women have a greater interest in healthy diet as

compared to men (Othman *et al.*, 2012).

Studies have reported that an increase in fruit consumption was associated with a reduction in adiposity among obese adults after 8 weeks of consumption of blueberries (Basu *et al.*, 2010). Weerts & Amoran (2011) reported significant weight loss within 3 months among overweight adults after increasing fruit consumption. While this study found no association between total fruit intake

**Table 2.** Consumption of fruits (fresh, dried and juice) based on anthropometric indicators

<i>Anthropometric indicators</i>	<i>Mean total of fruit intake (servings/day), Mean±SD</i>	<i>p-value<sup>†</sup></i>
Body Mass Index (BMI), kg/m <sup>2</sup>		
Underweight	1.5±0.7	0.808
Normal	1.6±1.0	
Overweight	1.6±1.1	
Obese	1.5±1.0	
Waist circumference (WC) <sup>‡</sup> , cm		
Normal	1.6±1.0	0.497
Abdominal obesity	1.5±1.0	
Percentage of body fat <sup>§</sup> , %		
Normal	1.6±1.0	0.862
Obese	1.6±1.0	

<sup>†</sup>Mean difference was calculated using one-way ANOVA and Games-Howell post hoc analysis for BMI and independent sample *t*-test for WC and percentage of body fat

<sup>‡</sup>Waist circumference cut-offs: ≥90 cm in men, ≥80 cm in women

<sup>§</sup>Body fat percentage cut offs: ≥ 25% in men, ≥ 35% in women

**Table 3.** Association between consumption of fruit juice and adiposity

<i>Indicators</i>	<i>Adjusted b (95%CI)<sup>†</sup></i>	<i>t</i>	<i>p</i>	<i>R<sup>2</sup></i>
Body mass index (BMI), kg/m <sup>2</sup>	0.103 (-0.284, 3.733)	1.691	0.092	0.107
Waist circumference (WC), cm	0.126 (0.625, 10.201)	2.226	0.027*	0.261
Percentage of body fat, %	0.077 (-1.010, 6.047)	1.405	0.161	0.295

\*Significant at *p*<0.05, multiple linear regression

<sup>†</sup>Adjusted for age, sex, ethnicity, education level, marital status

and BMI, WC and percentage of body fat, however, a significant association between fruit juice consumption and WC was shown, indicating that higher fruit juice consumption was related to greater WC. A similar finding was reported by Clemens *et al.* (2015). Naturally present sugar in fruit juice is absorbed and converted into fat, which builds up in the abdominal area (Walker, Dumke & Goran, 2014; Tappy *et al.*, 2010).

Both USDA & HHS (2010) and Malaysian Dietary Guidelines 2010 (NCCFN, 2010) advised that fruit juice consumption should be limited to one serving per day. Fresh fruits have been recommended as the best choice as it contains more nutritional value compared to fruit juice (Clemens *et al.*, 2015) and dried fruits (Holzwarth *et al.*,

2012), as their nutritional value may be degraded due to processing or thawing procedure.

Various factors including sensory appeal influence food choices (Saba *et al.*, 2010). Sensory appeal is a source of pleasure and also an important determinant of a person's food choices (Stewart-Knox *et al.*, 2015). In this study, individuals who enjoy eating fruits believe fruits help "keep a healthy bowel". Subjects who face less time constraints were more likely to eat more fruits. Time constraint among young adults with a busy lifestyle poses a barrier, and hence fresh fruit especially cut fruits was preferred by the subjects, as less preparation time is needed. Familiarity with the type of fruit tend to favour fruit consumption. Influence

**Table 4.** Determinants and barriers of fruit intake (fresh, dried and juice) among young adults

Factors	Score <sup>†</sup>	Number of subjects, n(%)	Mean fruit intake (serving/day)	p-value
Determinants:				
Sensory appeal (taste)	1	3(1.0)	0.2±0.2 <sup>a</sup>	0.049*
	2	5(1.7)	1.7±1.1	
	3	291(97.3)	1.6±1.0 <sup>b</sup>	
Health benefits	1	3(1.0)	0.5±0.4	0.062
	2	8(2.7)	1.2±0.9	
	3	288(96.3)	1.6±1.0	
To keep a healthy bowel	1	8(2.7)	0.7±0.5 <sup>a</sup>	0.009*
	2	22(7.3)	1.3±1.0	
	3	269(90.0)	1.7±1.0 <sup>b</sup>	
Less preparation effort	1	22(7.4)	1.1±0.9 <sup>a</sup>	0.019*
	2	32(10.7)	1.5±1.0	
	3	245(81.9)	1.7±1.0 <sup>b</sup>	
Availability	1	36(12.0)	1.3±0.9	0.075
	2	35(11.7)	1.5±0.9	
	3	228(76.3)	1.7±1.0	
Influence of family	1	48(16.1)	1.3±1.0 <sup>a</sup>	0.007*
	2	43(14.4)	1.4±0.8	
	3	207(69.5)	1.7±1.0 <sup>b</sup>	
Cost (cheaper price)	1	81(27.1)	1.6±0.9	0.422
	2	70(23.4)	1.5±0.9	
	3	148(49.5)	1.6±1.1	
Health promotion campaign	1	104(34.8)	1.5±0.9	0.231
	2	91(30.4)	1.5±0.9	
	3	104(34.8)	1.7±1.1	
Barriers:				
Cost (expensive price)	1	50(27.3)	1.3±0.9	0.407
	2	27(14.8)	1.4±0.9	
	3	106(57.9)	1.6±1.0	
Storage	1	75(41.0)	1.6±1.0	0.538
	2	24(13.1)	1.5±1.1	
	3	84(45.9)	1.4±0.9	
Limited choice	1	68(37.2)	1.5±1.0	0.535
	2	27(14.8)	1.6±1.0	
	3	88(48.1)	1.4±0.1	
Eating outside	1	83(45.4)	1.6±1.0	0.161
	2	25(13.6)	1.5±0.8	
	3	75(41.0)	1.3±0.9	
Sensory appeal (taste)	1	93(50.8)	1.5±1.0	0.711
	2	24(13.1)	1.3±0.8	
	3	66(36.1)	1.5±0.9	
Not commonly consume by family	1	105(57.4)	1.5±0.9	0.523
	2	21(11.5)	1.5±0.9	
	3	57(31.1)	1.4±1.0	
Bloating	1	119(65.0)	1.6±0.9	0.056
	2	31(17.0)	1.1±0.8	
	3	33(18.0)	1.5±1.0	
Feeling cold	1	112(61.2)	1.5±1.0	0.441
	2	48(26.2)	1.3±0.9	
	3	23(12.6)	1.6±1.1	

<sup>†</sup>Score: 1= Disagree, 2= Neither agree nor disagree, 3= Agree

a,b Different alphabet denotes significant difference ( $p<0.05$ ) using one-way ANOVA and Games-Howell post hoc analysis

\* $p<0.05$

of family for food habits may lead a person to develop preferences or dislikes for foods including fruits (Giacalone & Jaeger, 2016). Factors such as attitude, habit, social influences and availability of fruits are factors that significantly affect the intention of individuals to consume fruits (Othman *et al.*, 2012). Recognising existing barriers of fruit consumption, such as affordability and availability, is key to enabling strategies and policies in encouraging fruit intake. An increase in fruit intake can also be achieved by a variety of approaches such as social marketing, approaches based on behavioural economics, and technology-based behaviour change models (Thomson & Ravia, 2011).

### Limitations of study

Estimation of fruit intake was based on self-reported intake which depends on memory recall leading to bias and inaccuracies (Yaroch *et al.*, 2012). The nature of this cross-sectional study does not permit inference of causation. A strength of this present study is the inclusion of different forms of fruit, such as fresh fruit, fruit juice and dried fruit, all of which contribute toward daily servings of fruit intake.

### CONCLUSION

Fruit consumption among young urban Malaysian adults was unsatisfactory, being lower than the recommended guidelines. Research should be undertaken to verify this study's finding of a significant association between fruit juice consumption and risk of abdominal obesity. It is also suggested that future studies include determining the link between fruit intake and associated blood biomarkers.

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### Authors' contributions

All the authors involved in conceptualised and designed the study; BNAH, principal investigator, led the data collection in Klang Valley, analysing the data and prepared the draft of the manuscript and reviewed the manuscript; HMY, SS & ZAM assisted in drafting and reviewed the manuscript.

### Conflict of interest

The authors do not have any conflict of interest to declare.

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