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An Investigation of Fruits and Vegetables Consumption among University Students in Hong Kong

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ABSTRACT

Fruits and vegetables are important parts of healthy eating and they provide excellent sources of vitamins, minerals, and dietary fiber in our diet. According to the WHO, inadequate consumption of fruits and vegetables may contribute to as much as 14% of gastrointestinal cancer deaths and 11% of deaths resulted from ischemic heart disease worldwide. Higher risk of all-cause mortality is associated with insufficient fruits and vegetables consumption. Since 2011, Hong Kong has been promoting a “2 Plus 3 a day” diet campaign aiming to raise the public’s awareness on consuming a minimum of 2 portions of fruits and 3 portions of vegetables daily. Recent statistics showed that 81% of people aged 18 – 64 failed to meet this requirement. This finding suggested a strong demand to identify the underlying determinants that affect fruits and vegetables consumption behaviour that led to this result. This paper focuses on investigating these determinants among university students in Hong Kong. Surveys were conducted in 2015 with 600 participants randomly selected from universities across Hong Kong. The results indicated that 87% of students consuming fruits and vegetables regularly were due to the health benefits associated with fruits and vegetables, almost half of the students (47%) reported that taste of fruits and vegetables had led to their consumptions. Other factors such as gender, accessibility and parents’ consumption behaviour were also found to play a role as determinants. Meanwhile, taste, cooking

methods and texture of fruits and vegetables were found to play significant roles in preventing their consumptions.

KEYWORDS: Fruits, Vegetables, Nutrition, Consumption behavior, Health behavior, Determinants, University students, Hong Kong

1 INTRODUCTION

1.1 Background

Fruits and vegetables offer excellent sources of vitamins, minerals, as well as dietary fiber in our diet that are essential in maintaining a good health status (Department of Health, 2011). According to the World Health Organization (2004), inadequate consumption of fruits and vegetables may have contributed to as much as 14% of gastrointestinal cancer deaths, 11% of deaths resulted from ischemic heart disease and 9% of deaths from stroke. Higher risk of all-cause mortality is associated with insufficient intake of fruits and vegetables (Wang et al., 2014).

Since 2011, Hong Kong has been promoting a “2 Plus 3 a day” diet campaign aiming to raise the general public’s awareness on consuming a minimum of 2 portions of fruits and 3 portions of vegetables a day (Department of Health, 2011). However, according to a recent survey conducted by the Hong Kong government, it was reported that 81% of people aged 18 – 64 did not have adequate daily consumption for a total of 5 portions of fruits and vegetables (Centre for Health Protection, 2015).

It is evident to us that adequate consumption of fruits and vegetables bring along multiple health benefits. However, the underlying determinants that affect our fruits and vegetable consumptions are much less investigated. While researches have shown that healthy behaviours that began at a younger age are more likely to be maintained in the future. Therefore, this paper focuses on understanding the determinants of fruits and vegetables consumption behavior among university students in Hong Kong. Since university students share some common demographic characteristic and lifestyle. It is believed that by identifying the underlying determinants for their preference for fruits and vegetable consumptions, appropriate health interventions could be made by the Government and institutions to improve the rather low intakes of fruits and vegetables among the younger population.

1.2 Aims and Objectives

The aim of this study is to understand the consumption behavior of fruits and vegetables among university students in Hong Kong, the study focuses on investigating factors that might explain their preferences and their reasons for consumption, as well as their knowledge on fruits and vegetables. Based on the findings of the research, it was aimed at providing valuable insights to raise university students’ awareness and to provide recommendations in constructing effective health promotion programs that could benefit the general public as a whole.

2 LITERATURE REVIEW

Through reviewing literature that focused on understanding the determinants of fruits and vegetables consumption, the common determinants were divided into four main groups: *socio-demographic factors, personal factors, family-related factors and other factors.*

2.1 Socio-demographic Factors

Gender

A systemic review stated that females were more likely to consume fruits and vegetables than males in general (Rasmussen et al., 2006). Results of another study showed that females tended to ingest food and nutrient more frequently than males (Glynn, Emmett, & Rogers, 2005). It suggested that gender differences might play a role in fruits and vegetables consumption and would be investigated in this study.

Age

In the same study performed by Rasmussen et al., (2006), age was negatively related to fruits and vegetable consumption. Another study demonstrated that the decreasing frequency of fruits and vegetables consumption was accompanied with an increase in age. Older age groups were more likely to consume less fruits and vegetables than younger age groups among children and adolescents. Besides, development of fruits and vegetables eating habits at an early age could lead to sufficient consumption in adulthood (McAleese & Rankin, 2007). Based on this finding, university students would tend to ingest less fruits and vegetables than children do. The current study would investigate the fruits and vegetables consumption status among university students with an aim to propose potential health intervention programs if the intakes were found to be low.

Socioeconomic Position

Socioeconomic position was positively associated with consumption of fruits and vegetables (Rasmussen et al., 2006). People with lower socioeconomic position tended to ingest less fruits and vegetables. Combination of family income, parental occupation and parental education and constituted socioeconomic position were positively related to consumption of fruits and vegetables (Giskes, Turrell, Patterson & Newman, 2002).

2.2 Personal Factors

Preferences

Preferences including taste, texture and aesthetics of fruits and vegetables were found to be positively associated with adolescents' intake of fruits and vegetables (Blanchette & Brug, 2005; Rasmussen et al., 2006). A study carried out by Krolner et al., (2011) indicated that children preferred the sweet flavor of fruits and vegetables, while they did not prefer the bitter, sour and bland flavor of fruits and vegetables. Another important factor that affects children and adolescents' fruits and vegetables consumption was texture of fruits and vegetables. Children and adolescents tended to prefer the texture of crispy, crunchy and juiciness of fruits and vegetables. However, they did not prefer textures that are mushy, dry and hard. Food aesthetics was also considered a factor that influences fruits and vegetables consumption of children and adolescents. Diversity of colours encouraged people to consume more fruits and vegetables, however, appearance of fruits and vegetables were found to affect younger participants more than older participants (Krolner et al., 2011).

Knowledge

Nutritional knowledge was positively associated with fruits and vegetables consumption (Blanchette & Brug, 2005; Rasmussen et al., 2006). Krolner's studies (2011) demonstrated that children from higher socioeconomic position family whom participated in youth gardening programmes have more knowledge on fruits and vegetables, in turn these knowledge were believed to play a role in affecting their fruits and vegetables consumption. Hence, strengthening students' knowledge about fruits and vegetables might potentially increase their consumption as well.

2.3 Family-related Factors

Parental intake

Parental intake was found to be positively related to children and adolescents' fruits and vegetables consumption at home (Rasmussen et al., 2006). Parents acted as a role model at home, children and adolescents would learn behaviors from their parents. Therefore, parents' eating habits would affect adolescents' food choices. Parental support was an important determinant that influence adolescent's consumption behaviors as well, and it was positively related to amounts of overall food ingestion. Authoritative parenting style and monitoring were shown to increase children and adolescents' intakes of fruits and vegetables (Fisher, Mitchell, Smiciklas-Wright & Birch, 2002).

Home availability and accessibility

Studies illustrated that higher consumption level of fruits and vegetables was positively associated with higher availability of fruits and vegetables at home (Cullen, Baranowski, Owens, Marsh, Rittenberry & de Moor, 2003; Rasmussen et al., 2006). It was shown that home availability and accessibility were more likely to affect female's consumption of fruits and vegetables while there seemed to be less significant among male. On the other hand, accessibility to unhealthy foods at home and school were thought to prevent children and adolescent from ingesting sufficient fruits and vegetables.

2.4 Other Factors

Convenience and time costs

According to Krolner et al. (2011) and Drewnowski, & Darmon (2005), convenience of consuming fruits and vegetables was defined as handiness of acquiring, preparing, transporting and ingesting them. Comparing to snacks, preparing fruits and vegetables for consumption is relatively more time-consuming. Convenient snacks such as chips and candies were more preferable among students while they could save the time for preparing fruits and vegetables for other activities such as sleeping instead. Some students reported that they would be more likely to consume fruits and vegetables more frequently when they have more time during weekends. These studies suggested the convenience and time costs tended to play a role in determining the consumption of fruits and vegetables among the younger population.

Price and affordability

Krolner et al. (2011) reviewed ten studies and all of these studies showed that price of fruits and vegetables affected student's consumption behaviors in different countries. Affordability was positively related to fruits and vegetables consumptions (Zenk et al., 2005). It indicated that students also concerned about the quality, fullness and value of money when they purchase foods. Students reported that fruits and vegetables were too expensive for them and it could not satisfy their hunger, therefore, they would rather purchase more filling unhealthy food like chips and fast foods. For students with lower socioeconomic status, cost of fruits and vegetables were considered to be one of the major barriers for more fruits and vegetables consumption.

Media and TV influence

In media including television, newspaper and magazines, there often seems to be lacking advertisements that advocate the consumption fruits and vegetables. However, there were many advertisements that promote unhealthy foods and fast foods. TV and other media were the most common channels for adolescents to obtain food and nutrition information. Promoting unhealthy foods and fast foods on TV would reduce adolescents' consumption of fruits and vegetables (Krolner et al., 2011). Other studies have also shown that the amount of time spent on watching TV was negatively associated with the amounts of fruits and vegetables consumed by adolescents (Boynton-Jarrett et al., 2003; Rasmussen et al., 2006). Although it is important to understand how media and TV might play a role in affecting the consumption of fruits and vegetables among university students, due to limited time and resources, it was decided that these factors would not be included in the current investigation.

3 METHODOLOGY

As shown in the literature review above, many different determinants could affect one's consumption of fruits and vegetables. This study will focus on some of the determinants including gender, preferences, knowledge, parental intakes, home availability, time costs, and price owing to limited time and recourses. It was also believed that these factors would have more significant impact among university students.

3.1 Target Respondents

The target respondents included students aged 18 or above and who can speak Cantonese among different local Hong Kong universities.

3.2 Sampling and Data Collection

An anonymous cross sectional in-person survey was conducted from October 25 to November 20, 2015. Random samples were selected from universities including the Hong Kong Polytechnic University, the Open University of Hong Kong, the Chinese University of Hong Kong, the University of Hong Kong, the City University of Hong Kong and Lingnan University. In-person surveys were conducted from 12:00p.m to 3:00p.m (lunch hours) outside different faculty buildings in order to be able to interview students from different academic disciplines.

The purpose and the background of this study were briefed to students before each interview. Only students who were currently admitted into full-time programs would be selected for the survey. Verbal informed consent was obtained after the briefing and before the survey could begin. Anonymity and confidentiality of the survey were expected from all respondents.

In total, 600 university students had completed the questionnaire. The questionnaire took about 2 minutes on average to complete while the respondents were randomly selected from the abovementioned-designated locations. The response rate of the questionnaire was 95.5%, defined as the number of successful completed interviews divided by total numbers of all successful and unsuccessful cases.

3.3 Questionnaire Design

The questionnaire of this survey was designed bilingually (Chinese and English). The questionnaire consisted of 13 questions. The questionnaire covered four main areas: (i) Consumption behavior of fruits and vegetables, (ii) Likelihood of consuming fruits and vegetables, (iii) Knowledge of fruits and vegetables, and (iv) Tendency to gather more information in the future.

3.4 Categorization

The consumption behavior, likelihood, and knowledge about fruits and vegetables were tabulated with gender and faculties of the study. Due to a wide range of students from different disciplines had participated in this study, they were categorized into 3 broad categories of Sciences, Arts, and Commerce while it was assumed that disciplines within these category/faculty provided similar structure of knowledge to students (Beyer & Lodahl, 1976). Disciplines relating to Applied Science, Architecture, Engineering, Health Science, IT, Medicine, Science fell into the category of Sciences; Disciplines relating to Arts, Design, Education, Language, Culture and Communication, Law and Social Science fell into the categories of Arts; Business Administration, Hotel and Tourism Management fell into category of commerce.

3.5 Statistical Analysis

Chi-Square Tests were used to analyze nominal or ordinal variables with more than 2 x 2 chi square. It was used to identify the differences between perception and consumption behaviors in each demographic group. Independent samples t-tests were used to analyze the likelihood of fruits and vegetables consumption among male and female; and analysis of variance (ANOVA) were used to analyze the likelihood of fruits and vegetables among the three categories/faculties.

All statistical analyses were performed using SPSS for Windows version 23.0. P-value <0.05 was taken as statistically significant.

4 RESULTS

4.1 Demographic Characteristics

A total of 600 university students responded to the questionnaires with no exclusion of participants. Table 1 summarized the demographic data of participants in this study: 260 (43.3%) participants were males and 340 (56.7%) were females; for the three faculties, 226 (37.7%) participants were grouped into Sciences, 261 (43.5%) participants were Arts, and 113 (18.8%) were Commerce.

Table 1 Demographic data and consumption behaviors of university students (n = 600) on daily consumption frequency and amount of fruits and vegetables

Demographic Perception Measurements	Gender		Faculty		
	Male	Female	Sciences	Arts	Commerce
n (% of Total)	260 (43.3)	340 (56.7)	226 (37.7)	261 (43.5)	113 (18.8)
Frequency^a					
< 1 time/day	9 (3.5)	6 (1.8)	6 (2.7)	9 (3.4)	0 (0)
1 time/day	124 (47.7)	165 (48.5)	103 (45.6)	129 (49.4)	57 (50.4)
2 times/day	79 (30.4)	129 (37.9)	80 (35.4)	87 (33.3)	41 (36.3)
3 times/day	23 (8.8)	30 (8.8)	16 (7.1)	24 (9.2)	13 (11.5)
4 times/day	10 (3.8)	3 (0.9)	5 (2.2)	8 (3.1)	0 (0)
≥ 5 times/day	15 (5.8)	7 (2.1)	16 (7.1)	4 (1.5)	2 (1.8)
Amount^b					
< 1 Portion/day	16 (6.2)	19 (5.6)	13 (5.8)	19 (7.3)	3 (2.7)
1-4 Portions/day	202 (77.7)	273 (80.3)	181 (80.1)	196 (75.1)	98 (86.7)
5-7 Portions/day	40 (15.4)	46 (13.5)	32 (14.2)	42 (10.6)	12 (10.6)
> 7 Portions/day	2 (0.8)	2 (0.6)	0 (0)	4 (1.5)	0 (0)
^a There are differences in between gender and frequency ($\chi^2 = 15.65, P < .01$), as well as faculty and frequency ($\chi^2 = 21.25, P < .05$)					
^b There are no differences in between gender and amount ($\chi^2 = 0.63, P > .05$), as well as faculty and amount ($\chi^2 = 11.13, P > .05$)					

4.2 Consumption Behavior

Table 1 also summarized the consumption behaviors of participants. Data analysis by 2 x 6 χ^2 related gender and frequency [$\chi^2 (5, N = 600) = 15.65, P < .01, C = .16$], 3 x 6 χ^2 related faculty and frequency [$\chi^2 (10, N = 600) = 21.25, P < .05, C = .19$]. Consumption frequency of vegetables and fruits for all variances in gender and faculty were mostly 1 time per day (more than 45%), followed by 2 times per day (more than 30%). Consumption amount of vegetables and fruits for all groups in gender and faculty were mostly less than 5 portions per day (more than 80%). In fact, observed frequencies in consumption amount has no meaning difference among genders [$\chi^2 (3, N = 600) = .633, P > .05, C = .03$] or faculties [$\chi^2 (6, N = 600) = 11.13, P > .05, C = .14$].

Table 2 Perceptions of university students (n = 600) on their sufficient consumption of fruits and vegetables, compared to actions on the consumption amount

Demographic Perception Measurements	Gender				Faculty						Total	
	Male ^b		Female ^c		Sciences ^d		Arts ^e		Commerce ^f		Yes	No
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
n ^a	135	125	148	192	105	121	133	128	45	68	283	317
(% of Total)	(51.9)	(48.1)	(43.5)	(56.5)	(46.5)	(53.5)	(51.0)	(49.0)	(39.8)	(60.2)	(47.2)	(52.8)
Amount												
< 1 Portion/day	4 (3.0)	12 (9.6)	2 (1.4)	17 (8.9)	3 (2.9)	10 (8.3)	3 (2.3)	16 (12.5)	0 (0)	3 (4.4)	6 (2.1)	29 (9.1)
1-4 Portions/day	99 (73.3)	103 (82.4)	101 (68.2)	172 (89.6)	77 (73.3)	104 (86)	88 (66.2)	108 (84.4)	35 (77.8)	63 (92.6)	200 (70.7)	275 (86.8)
5-7 Portions/day	32 (23.7)	8 (6.4)	4 (29.1)	3 (1.6)	25 (23.8)	7 (5.8)	40 (30.1)	2 (1.6)	10 (22.2)	2 (2.9)	75 (26.5)	11 (3.5)
> 7 Portions/day	0 (0)	2 (1.6)	2 (1.4)	0 (0)	0 (0)	0 (0)	2 (1.5)	2 (1.6)	0 (0)	0 (0)	2 (0.7)	2 (0.6)
^a There are differences in between perception and action ($\chi^2 = 72.89, P < .01$) in general ^b There are differences in between perception of males and consumption amount ($\chi^2 = 20.12, P < .01$) ^c There are differences in between perception of females and consumption amount ($\chi^2 = 62.44, P < .01$) ^d There are differences in between perception of students in Sciences and consumption amount ($\chi^2 = 16.87, P < .01$) ^e There are differences in between perception of students in Arts and consumption amount ($\chi^2 = 45.24, P < .01$) ^f There are differences in between perception of students in Commerce and consumption amount ($\chi^2 = 12.16, P < .01$)												

4.3 Perception and Action

According to an estimated consumption of fruits and vegetables provided by each participant, they gave perceptions on whether they had consumed enough fruits and vegetables (Table 2). In general, most of the participants perceived that they consumed enough amounts of fruits and vegetables [$\chi^2(3, N = 600) = .72.89, P < .01, C = .33$], only 6 (2.1%) participants with a consumption amount of less than 1 portion daily, 200 (70.7%) participants reported with 1 to 4 portions daily, 75 (26.5%) participants reported with 5 to 7 portions daily and 2 (0.7%) with more than 7 portions daily. Of participants answered that they perceived inadequate amount of fruits and vegetables, 29 (9.1%) participants reported consumption with amount less than 1 portion daily, 275 (86.8%) participants reported consumption with 1 to 4 portions daily, while 11 (3.5%) participants reported consumption with 5 to 7 portions daily, and 2 (0.6%) with more than 7 portions daily.

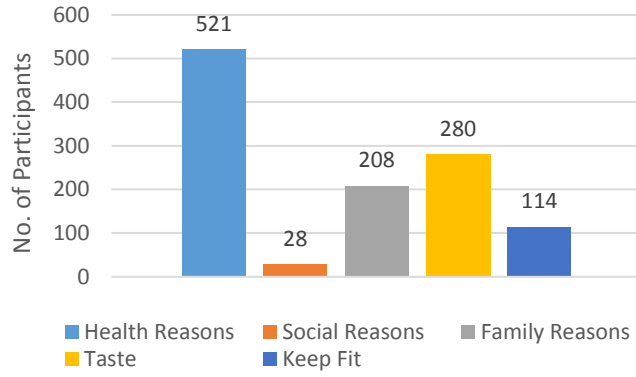


Figure 1: Reasons of consumption in general

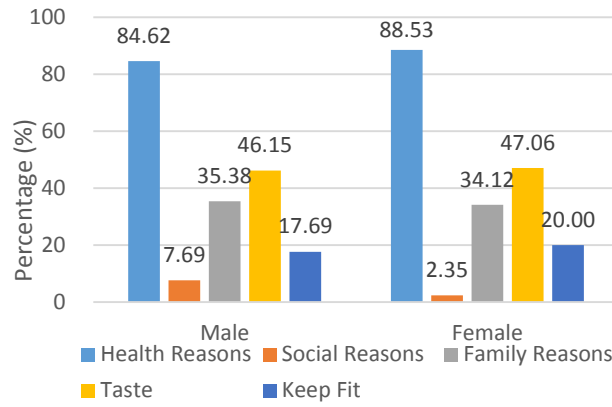


Figure 2: Reasons of consumption by gender

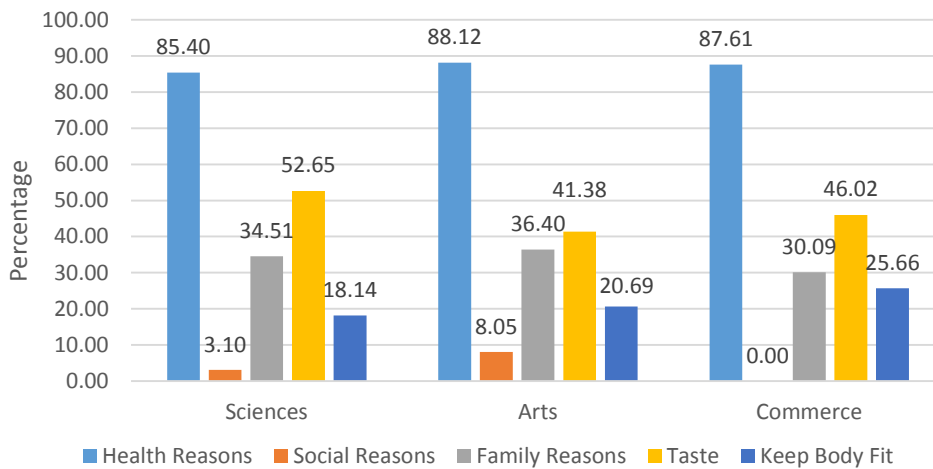


Figure 3: Reasons of consumption by faculty

4.4 Likelihood of Consumption

There seemed to be a general trend for reasons of fruits and vegetables consumption. The main determinant for university students in Hong Kong to consume fruits and vegetables was related to health beliefs associated with fruits and vegetables, followed by taste, family reasons, keeping fit and social reason (Figure 1, 2 and 3).

For all participants, more than 80% of the intake of fruits and vegetables was for health reasons, over 41% participants consumed fruits and vegetables for the reason of taste, more than 30% of the consumption was affected by family reasons, and over 17% of the participants reported the consumption was meant for keeping the body fit, and not many participants (less than 8%) reported social reason was a determinant for fruits and vegetable consumption.

Preference degree of fruits and vegetables were measured by using a 5-point Likert Scale (Table 3). The preference degree of fruits and vegetables for male and female were analyzed by using an independent-samples t-test. Genders related to the score on the preference of fruits [$t(600) = -2.93, p = .004, \text{Cohen's } d = .24$] and vegetables [$t(600) = -3.66, p = .00, \text{Cohen's } d = .30$]. Female participants had higher scores on fruits and vegetables than male participants. The preference degree of fruits and vegetables for faculty of Sciences, Arts and Commerce were analyzed by using one-way, between groups ANOVA. Tukey's post hoc comparisons examined differences between groups ($p > .05$). No group means differed ($p > .05$). However, it could be observed that the preference scores on fruits were always higher than vegetables.

Table 3 Preference degree on fruits and vegetables by gender and faculty

Demography	Gender		Faculty		
	Male	Female	Sciences	Arts	Commerce
Measurements	Mean \pm SE ^a	Mean \pm SE	Mean \pm SD	Mean \pm SD	Mean \pm SD
Preference on Fruits	3.88 \pm .06*	4.10 \pm .05*	3.96 \pm .93	3.99 \pm .85	4.12 \pm .96
Preference on Vegetables	3.63 \pm .06**	3.91 \pm .05**	3.73 \pm .92	3.78 \pm .96	3.93 \pm .94

^a Mean \pm Standard Error of the Mean, measured on a 5-point Likert scale (1 = Dislike, 5 = Like).
* $P < .05$, ** $P < .01$ indicate significant difference according to independent-samples t tests

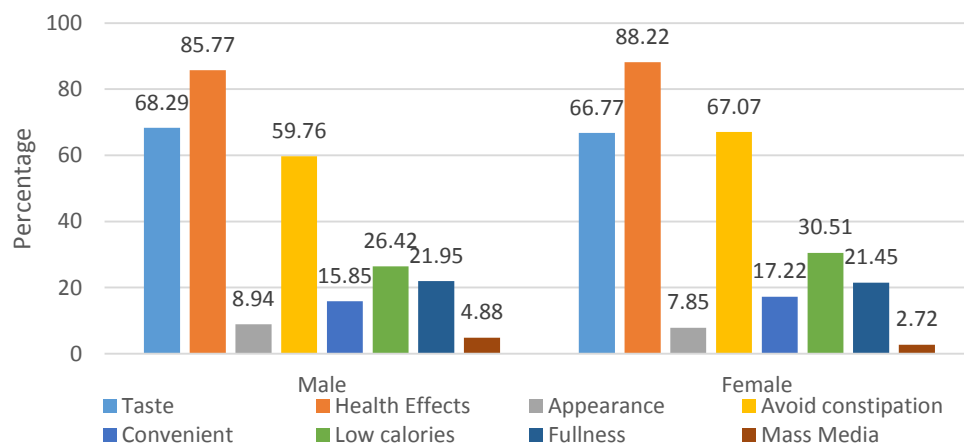


Figure 4: Reasons of preference on fruits and vegetables by gender

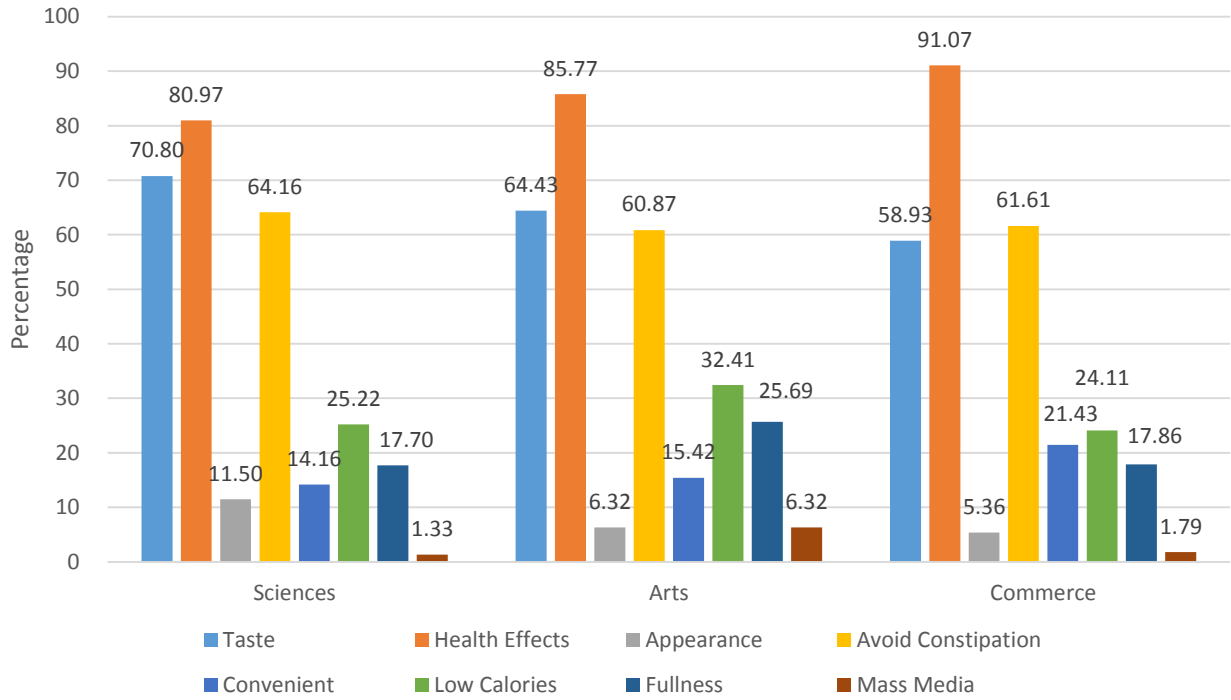


Figure 5: Reasons of preference on fruits and vegetables by faculty

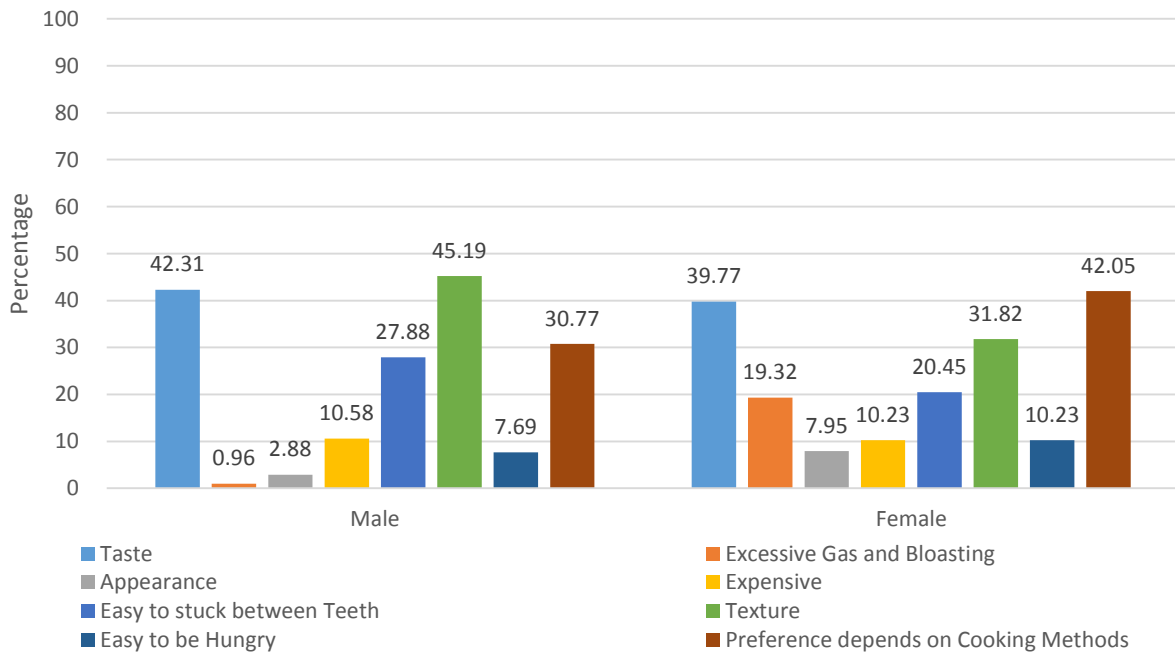


Figure 6: Reasons of less preference on fruits and vegetables by gender

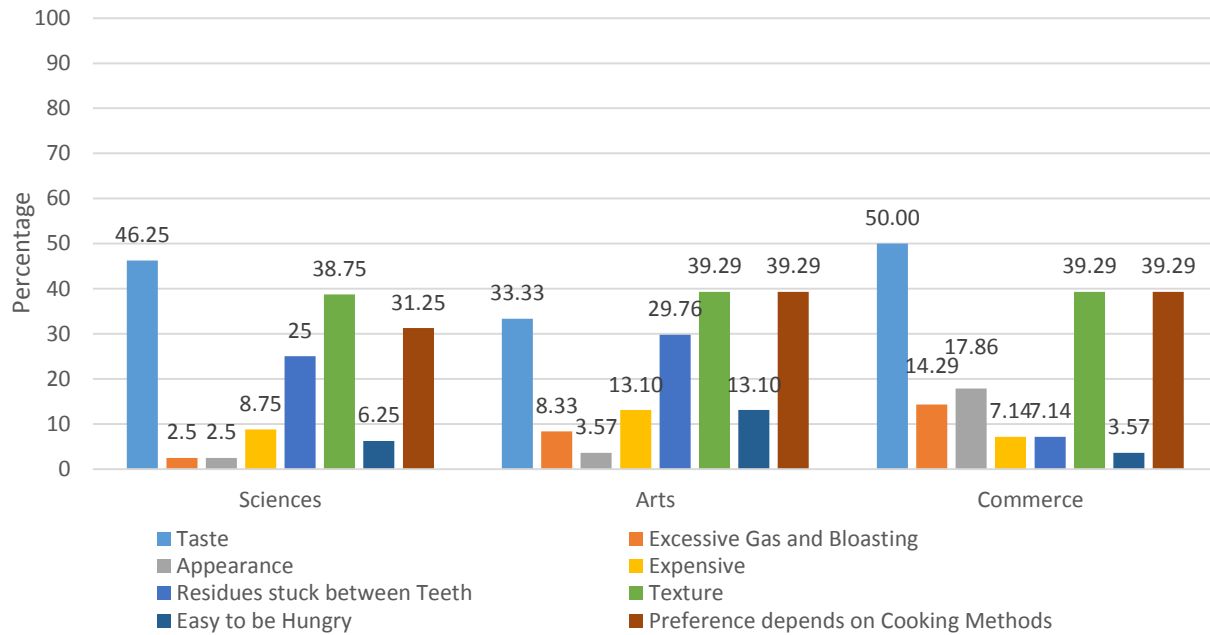


Figure 7: Reasons of less preference on fruits and vegetables by faculty

4.5 Reasons of Preference on Fruits and Vegetables

Most of the participants (over 80%) were likely to consume fruits and vegetables because they knew the health benefits associated with the consumption of fruits and vegetables, which was also the major reason observed in the categories of gender and academic disciplines. The second factor for males' consumption was taste (68.29%), for female avoiding constipation (67.07%) thought to play a role in determining the consumption status. The third determinant for male was also to avoid constipation (59.76%), while for female was taste. The remaining factors were in the same order for both male and female, followed by low calories, fullness after consumption, convenient, appearance of fruits and vegetables and mass media (Figure 4).

The second factor for students in faculty of Sciences and Arts was taste (70.80% & 64.43%), factor for students in faculty of Commerce was to avoid constipation (61.61%). The third factor for students in faculty of Sciences and Arts was to avoid constipation (64.16% & 60.87%), for students in faculty of Commerce is taste (58.93%). The remaining factors were in the same order for all academic faculties and gender, except for students in commerce who believed that convenience were more important than the feeling of satiety (Figure 5).

The major determinants that led participants to prefer less consumption of fruits and vegetables were taste, texture and cooking method. These were the top three reasons, which were observed in gender and different faculties (Figure 6 and 7).

Table 4 Comparison between the knowledge on the minimum consumption and action consumption of fruits and vegetables by gender

Demographic Knowledge Measurements	Gender								Total (M/F)
	Male ^a				Female ^b				
	1-4	5-7	8-10	>10	1-4	5-7	8-10	>10	
n (% of total)	95	152 (58.5)	11	2	142	186 (54.7)	10	2	260/340 (100/100)
Actual Consumption									
< 1 portion	7 (7.4)	8 (5.3)	1 (9.1)	0 (0)	13 (9.2)	6 (3.2)	0 (0)	0 (0)	16/19 (6.2/5.6)
1-4 portions	85 (89.5)	109 (71.7)	7 (63.6)	1 (50)	123 (86.6)	143 (76.9)	5 (50)	2 (100)	202/273 (77.7/80.3)
5-7 portions	3 (3.2)	35 (23.0)	1 (9.1)	1 (50)	6 (4.2)	35 (18.8)	5 (50)	0 (0)	40/46 (15.4/13.5)
7 portions	0 (0)	0 (0)	2 (18.2)	0 (0)	0 (0)	2 (1.1)	0 (0)	0(0)	2/2 (0.8/0.6)
^a There are meaningful differences in between knowledge of male and consumption amount ($\chi^2 = 65.69$ P < .01)									
^b There are meaningful differences in between knowledge of female and consumption amount ($\chi^2 = 32.66$, P < .01)									

Table 5 Comparison between the knowledge on the minimum consumption and action consumption of fruits and vegetables by faculty

Demographic Knowledge Measurement	Faculty												Total (S/A/C)
	Sciences ^a				Arts ^b				Commerce ^c				
	1-4	5-7	8-10	>10	1-4	5-7	8-10	>10	1-4	5-7	8-10	>10	
n (% of total)	82	138	5	1	102	146	10	3	53	54	6	0	226/261/113 (100/100/100)
Actual Consumption													
< 1 portion	7 (8.5)	6 (4.3)	0 (0)	0 (0)	10 (9.8)	8 (5.5)	1 (10)	0 (0)	3 (5.7)	0 (0)	0 (0)	0 (0)	13/19/3 (8.5/7.3/ 2.7)
1-4 portions	70 (85.3)	108 (78.3)	2 (40)	1 (100)	90 (88.2)	98 (67.1)	6 (60)	2 (66.7)	48 (90.6)	46 (85.2)	4 (66.7)	0 (0)	181/196/98 (80.1//75.1/ 86.7)
5-7 portions	5 (6.1)	24 (17.4)	3 (60)	0 (0)	2 (2)	38 (26.0)	1 (10)	1 (33.3)	2 (3.8)	8 (14.8)	2 (33.3)	0 (0)	32/42/12 (14.2/16.1/ 10.6)
7 portions	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1.4)	2 (20)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0/4/0 (0/1.5/0)
^a There are meaningful differences in between knowledge of sciences students and consumption amount ($\chi^2 = 15.66$ P < .05)													
^b There are meaningful differences in between knowledge of arts students and consumption amount ($\chi^2 = 52.06$, P < .01)													
^c There are meaningful differences in between knowledge of commerce students and consumption amount ($\chi^2 = 9.928$, P < .05)													

4.6 Knowledge of Fruits and Vegetables

Knowledge on minimum consumption related to the actual consumption by gender or faculty was shown in Table 4 & 5. For male who reported the minimum consumption amount was 5 to 7 portions per day, approximately 72% of them only consumed 1 to 4 portions per day [$\chi^2(9, N=600) = 65.69, p < .01, C=.45$]. For female who reported the minimum consumption amount was 5 to 7 portions per day, approximately 77% of them only consumed 1 to 4 portions per day, [$\chi^2(9, N=600) = 32.67, p < .01, C=.30$].

For students in categories of science, arts and commerce who reported the minimum consumption amount was 5 to 7 portions per day, approximately 78% [$\chi^2(6, N=600) = 15.66, p < .05, C=.26$], 67% [$\chi^2(9, N=600) = 50.61, p < .01, C=.41$], and 85% [$\chi^2(4, N=600) = 9.93, p < .05, C=.28$] of them only consumed 1 to 4 portions per day respectively. For students who reported the minimum consumption amount was 1 to 4 portions per day, more than 86% of all these students consumed equally 1 to 4 portions per day. These findings suggested that students who reported a higher consumption of fruits and vegetables, tended to overestimate their actual consumption.

Knowledge on highest fiber-containing food was neither related to gender or faculties, participants had similar responses as shown in Figure 8. The highest fiber containing food was actually Peas rather than carrots, cucumber, celery and lettuce. However, 232 (38.7%) participants answered celery was the vegetable that contained most fiber, followed by “I do not know” (20.8%), carrots (17.5%), lettuce (10.7%), Peas (8.7%) and cucumber (3.7%). Only about 9% of the respondents had answered correctly.

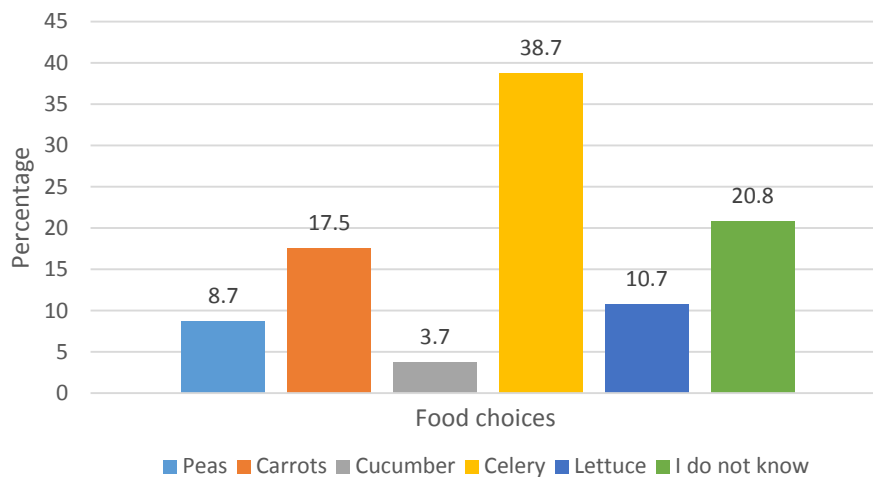


Figure 8: Knowledge of participants on highest fiber-containing vegetables

4.7 Health Promotion Effects after Completing the Questionnaire

Tendency of gathering more information about fruits and vegetables after completion of the questionnaire was measured by using 5-point Likert Scale (Table 6) and analyzed by using an independent-samples t-test for genders.

Genders of participants were related to the score on the tendency of gathering more information about fruits and vegetables after completing the questionnaire [$t(600) = -2.63$, $p = .016$, Cohen's $d = .22$]. Female participants' mean was higher than male participants' mean. In other words, female participants had a higher tendency on gathering more information about fruits and vegetables than male participants after completing the questionnaire.

The tendency of gathering more information about fruits and vegetables after completing the questionnaire for faculty of Sciences, Arts and Commerce were analyzed by using one-way, between groups ANOVA. Tukey's post hoc comparisons examined differences between groups ($p > .05$). No group means differed ($p > .05$). The sequence of mean from high to low was in the order of Commerce, Sciences and Arts. In other words, Commerce students had a slightly higher tendency for gathering more information about fruits and vegetables than students in Sciences and Arts. In general, the tendency mean of gathering more information in the future was 3.5. Tendency mode was 4. More than 50% of total participants in this study selected '4' which suggested they were likely to gather more information related to fruits and vegetables in the future after completing the questionnaire.

Table 6 Tendency of gathering more information about fruits and vegetables.

Demography		Gender*		Faculty			Total M/F, S/A/C Mean±SD
		Male Mean±SE	Female Mean±SE	Sciences Mean±SD	Arts Mean±SD	Commerce Mean±SD	
n (% of Total)	600(100)						
Likelihood^a							
1 Not likely at all	19(3.2)						
2 Not likely	29(4.8)	3.40 ± .05	3.58 ± .04	3.50 ± .75	3.48 ± .82	3.56 ± .87	3.50 ± .80
3 Same as before	215(35.8)						
4 Likely	306(51.0)						
5 Very likely	31(5.8)						
^a Mean ± Standard Error of the Mean, measured on a 5-point Likert scale (1 = Not likely at all, 5 = Very likely).							
* P < .05, ** P < .01 indicate significant difference according to independent-samples t tests							

5 DISCUSSION

5.1 Consumption Behavior

From the above findings, it can be observed that most participants (85%) did not reach the minimum consumption of 5 portions of fruits and vegetables per day. It seemed that the “2 Plus 3 a day” intervention programs had not been effective. Most of the participants did not consume fruits or vegetables for every meal during the day. Half of the participants consumed fruits or vegetables 1 time per day while 35% consumed for 2 times per day. Only about 15% of participants consumed more than 3 times of fruits and vegetables per day. There was significant difference in the frequency of consumption between genders (female had a higher frequency for consumption of fruits and vegetables than male). Instead of promoting an increase in consumption amount only, university or government agencies could suggest everyone to also increase the frequency of consumption during every meal, which in return will increase the overall consumption. Meanwhile, more efforts can be focused on encouraging male to consume fruits and vegetables during each meal.

It was astonishing to find out that most participants perceived of having an inadequate consumption of fruits and vegetables, but approximately 96% of them still consumed less than 5 portions of fruits and vegetables per day. They knew that they were consuming an insufficient amount of fruits and vegetables, but they did not do anything to change that. They seemed to understand the general health benefits associated with the consumption of fruits and vegetables, while it was also the main determinant that affected their consumption status, but it was not a strong enough factor that could motivate others with a lower consumption status to consume. Advices from family factors became the second reasons for their change in consumption; while convenience and time costs seemed to play a large role as well on consumption status. Future health promotions could focus efforts in promoting family unit to have a higher availability of fruits and vegetables at home, which might increase the consumption of family members as a result.

Barriers of consumption were found to include taste, texture, cooking methods, high price and potential residues of fruits and vegetables stuck between teeth. Cooking methods could alter the taste and texture of vegetables and further affect participants’ preferences. Consuming other types of fruits and vegetables that are easier to chew and less expensive could solve the issues of residues of fruits and vegetables stuck between teeth, and high price respectively. Meanwhile, increasing the diversity of fruits and vegetables choices, as well as cooking method in normal diet could potentially increase the appetite of people.

5.2 Likelihood of Consumption

This study found out that likelihood of consumption was related to the degree of preference and reasons of preference, which was consistent with other literatures (Brug, Tak, te Velde, Bere & De Bourdeaudhuij, 2008). Taste preference was the most positively related to the likelihood of consumption, followed by the availability and accessibility at home. Taste preference is an innate predisposition for sweet, salty, as well as energy-dense foods (Birch, 1999). Public has much more acceptance to fruits than vegetables because of the flavor. It is suggested that it would be better to have habitual changes in earlier life for less developed taste preference (William, Ball & Crawford, 2010), in order to increase the consumption of both fruits and vegetables later in life.

According to a survey conducted by Centre for Health Promotion (2010), over half of the respondents were eating outside for every meal. Eating outside frequently is significantly associated with insufficient consumption of fruit and vegetables. The availability and accessibility are general lower in outside settings. Restaurants, as well as cafeterias in universities, are encouraged to provide more options of fruits and vegetables to students. University students are also encouraged to carry fruits in bags for accessible consumption everywhere, especially for fruits that would not require much preparation, such as apples or bananas.

5.3 Knowledge related to the Servings' size and Nutrients

Only half of the respondents (56.3%) answered correctly on the daily minimum consumption of 5 to 7 portions of fruits and vegetables. 39.5% of participants answered correctly on the daily minimum consumption with 1 to 4 portions. This suggested that the awareness of the "2 Plus 3 a day" campaign among university students were rather low. Promotional health talks or events could be hosted at different universities on a regular basis in order raise the awareness of consuming sufficient fruits and vegetables among university students

On the other hand, in the question that asked participants to identify the highest fiber-containing food, 38.7% of participants answered celery as the highest fiber-containing food. Most of the participants answered incorrectly, while only 52 (8.7%) participants had answered correctly. This suggested that participants might not have a clear concept on the amount fiber content within fruits and vegetables.

Supplemental Nutrition Assistance Program Education and Evaluation Study (Wave II) conducted by Long et al., (2013) found that the nutrition education program could increase fruits and vegetables consumption. Efforts on nutritional education could help individuals to make healthier food choices, while correct knowledge on nutrition value of foods would contribute to proper eating and nutrition, which was directly associated with people's health. Hence, universities could incorporate appropriate concepts on consuming fruits and vegetables into their existing curricula in order to improve students' understanding in this aspect, which would have an overall beneficial effect on students' health status.

5.4 Health Promotion Effect of Conducting Questionnaire

The tendency mean of gathering more information in the future was 3.5 while mode was 4. 51% of the participants in this study reported that they were likely to gather more information related to fruits and vegetables in the future after completing the survey. And 5.2% of participants indicated that they are very likely to gather information (e.g health benefits) related to fruits and vegetables in the future. More than half of the participants reported that they would gather more information about fruits and vegetables after completing the survey. It could be suggested that health promotion effects could be observed during the processes of conducting these health researches, assuming the response bias is minimum. Conducting questionnaire could potentially raise participants' awareness on adequate amount of fruits and vegetables consumption. Delivering questionnaires could elicit or enhance people' perception of fruits and vegetables intakes. Therefore, health promotion campaigns could be promoted along with scientific health researches. For example, researchers could distribute health promotion leaflets after conducting in-person survey.

5.5 Limitations

The self-reporting nature of fruits and vegetables intake was one of the main limitations in this studying. Measurement error and recall bias could cause collecting inaccurate findings (Moore, & Thompson, 2015). Overestimation and underestimation might occur in analysis and reporting data. Participants might not report or answer the questionnaire genuinely due to response bias or social desirability bias (Van de Mortel, 2008). Participants did not want to perceive as unhealthy and reported a higher than actual amount of fruits and vegetables consumption. Therefore, the results may be exaggerated.

Besides, gender was one of the variables that might have significant impact on the results. In this study, there were imbalanced proportions of male and female among the participants in the three faculties. To reduce the error, stratified random sampling with grouping for male and female could be used, though with limitation of time and resources, it would be difficult.

6 CONCLUSION AND RECOMMENDATIONS

Inadequate consumption of fruits and vegetables were reported among university students. University students' basic knowledge towards fruits and vegetables were thought to be sufficient; for example, they understood that they should consume at least 5 portions per day and they also knew that there was certain health effects associated with fruits and vegetables consumption. Although they had the basic knowledge, the results demonstrated that most of them were still not consuming enough amounts of fruits and vegetables according to the standards. The study also revealed that there were barriers on consuming more fruits and vegetables, including factors such as taste, texture, accessibility and availability. Recommendations were provided in the following section to increase university students' engagement in sufficient intake of fruits and vegetables.

6.1 Extending Student Health Service to University Students

Government could extend student health services to university students in Hong Kong. Providing annual body check or health services for university students can raise their awareness on health, and advices could be provided for improving their lifestyles. Health services of Student Health Service Center and Special Assessment Center includes physical examination, screening for growth problems such as nutrition, vision, hearing, spine and blood pressure (Department of Health, 2014). Psychological and behavioral health services are also included. The Student Health Service Center provides individual health counseling and health education. After the basic health checks, students will be referred to special assessment center for an in-depth assessment and follow-up. University students' awareness towards fruits and vegetables might be enhanced after the assessment of nutrition and health education. Health education and nutrition leaflets could be provided to university students and motivate them to take actions.

Blanchette & Brug (2005) claimed that nutritional knowledge was positively associated with fruits and vegetables consumption. Therefore, prolonging student health service towards university students could provide opportunities for them to gain more health knowledge and reflect their health status and lifestyles and thereby increase their consumption of fruits and vegetables.

6.2 Increasing the Availability and Accessibility of fruits and vegetables on Campus

Fruits and vegetables could be sold in universities' cafeteria and snack bars in order to increase the availability and accessibility for students. As indicated in studies including the present one, higher availability and accessibility of fruits and vegetables was positively associated with higher consumption level of fruits and vegetables (Cullen et al., 2003; Rasmussen et al., 2006). Besides, offering unhealthy foods and snacks in canteens might prevent students from consuming enough fruits and vegetables. Therefore, offering fruits and vegetables on campus could provide university students with more alternatives on food choices. Increasing the availability and accessibility on campus would likely increase university students' likelihood in consuming more fruits and vegetables.

6.3 Promoting Usage of Fruits and Vegetables Containers

Promoting usage of fruits and vegetables containers such as bananas container (as shown in Appendix I) can avoid crushing or bruising of fruits and vegetables during transportation. According to Krolner et al. (2011) and Drewnowski & Darmon (2005), fruits and vegetables are categorized into inconvenient snack foods in terms of acquiring, preparing, transporting and ingesting. It is hard to transport fruits due to the soft texture. Promoting usage of fruits and vegetables containers among students would make bringing fruits and vegetables to campus easier and therefore reduce a barrier for consumption.

APPENDIX I Figure of Banana Box



Source:

Banerjee, S. [online] <http://bengalicuisine.net/2013/magickart-review/> (Accessed 5 December 2015)

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