Kertas Asli/*Original Article*s

Sociodemographic Factors as Determinants of Fruit and Vegetable Consumption in Malaysia
(Faktor Sociodemografi Sebagai Penentu Pengambilan Buah-Buahan dan Sayur-Sayuran Di Malaysia)

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ABSTRACT

The present study examines the factors affecting fruit and vegetable (FV) consumption in Malaysia. A nationally representative data that consists of a large sample size is used. Hence, the findings can provide inferential information. The present study uses secondary data from the Malaysian Household Expenditure Survey 2009/2010. The survey was carried out using a two-stage stratified sampling. The first stage was based on Enumeration Blocks, while the second stage was based on Living Quarters. A lognormal hurdle model is used to estimate the consumption decision and amount decision of FV across ethnic groups. The results suggest that household size, income, gender, marital status, age and education play significant roles in FV consumption. The probability of consuming FV and amount spent increase with household size (p<0.05). Higher income earners are more likely to consume FV than lower income earners (p<0.05). Being male (p<0.05) and unmarried (p<0.05) seem to reduce the consumption likelihood and amount spent. Compared to younger household heads, older household heads have a higher tendency to consume FV (p<0.05). In terms of policy implication, an intervention measure directed toward increasing FV consumption should focus particularly on those who are associated with low FV consumption. In conclusion, household heads' sociodemographic and household characteristics are important in determining consumption decision and amount decision of FV among Malaysian households.

Keywords: Age; demographic; fruit; household; income; vegetable

ABSTRAK

Kajian ini meneliti faktor-faktor yang mempengaruhi pengambilan buah-buahan dan sayur-sayuran (FV) di Malaysia. Data yang mewakili populasi negara yang terdiri daripada saiz sampel yang besar digunakan. Justeru, dapatan kajian boleh memberikan maklumat yang bersifat inferential. Kajian ini menggunakan data sekunder daripada Survei Perbelanjaan Isirumah Malaysia 2009/2010. Survei ini dilakukan dengan menggunakan persampelan berstrata dua-fasa. Fasa pertama adalah berdasarkan Blok Penyenaraian, manakala fasa kedua adalah berdasarkan Jenis Kediaman. Model lognormal hurdle digunakan untuk menganggarkan keputusan pengambilan dan keputusan amaun FV di kalangan kumpulan etnik. Dapatan kajian menyarankan bahawa saiz isirumah, pendapatan, jantina, status perkahwinan, umur dan pendidikan memainkan peranan yang penting dalam pengambilan FV. Kebarangkalian mengambil FV dan amaun yang dibelanjakan meningkat dengan saiz isirumah (p<0.05). Penerima-penerima pendapatan yang lebih tinggi adalah lebih cenderung untuk mengambil FV berbanding penerima-penerima pendapatan yang lebih rendah. Golongan lelaki (p<0.05) dan golongan bujang (p<0.05) lebih cenderung untuk mengurangkan kebarangkalian pengambilan dan amaun yang dibelanjakan. Berbanding ketua isirumah yang lebih muda, ketua isirumah yang lebih berumur memiliki kecenderungan untuk mengambil FV (p<0.05). Dari segi implikasi dasar, campur tangan yang ditujukan terhadap meningkatkan pengambilan FV seharsunya focus terhadap mereka yang dikaitkan dengan pengambilan FV yang rendah. Sebagai rumusan, sosiodemografi ketua isirumah dan ciri-ciri isirumah adalah penting dalam menentukan keputusan pengambilan dan amaun FV yang diambil di kalangan isirumah.

Katakunci: umur; demografi; buah-buahan; isirumah; pendapatan; sayur-sayuran.

INTRODUCTION

Fruit and vegetable (FV) are well known for their benefits to human body. Studies have shown that there is a negative relationship between FV consumption and the risk of all-cause mortality (Leenders et al. 2013; Wang et al. 2014). Each year, inadequate FV consumption is responsible for 16 million disability adjusted life years (DALYs) and 1.7

million mortalities worldwide (World Health Organization 2017). It also causes one in every seven cases of gastrointestinal cancer induced deaths. Furthermore, low FV consumption results in approximately 11% and 9% of deaths caused by ischaemic heart disease and stroke, respectively (World Health Organization 2017).

In Malaysia, one of the highest prevalence of lifestyle risk factors is low consumption of FV (72.8%) (Ghazali et al. 2015). In 2003, a large proportion (84.9%) of Malaysian adults failed to meet the FV intake recommendations (World Health Organization 2013). A national health survey shows that around 90.1% and 88.8% of Malaysian adults did not consume adequate amount of fruits and vegetables, respectively, in 2015 (Institute for Public Health 2015). Furthermore, Norimah et al. (2008) point out that fruit fails to enter the top ten daily consumed foods for Malaysian adults. These alarming facts and figures have raised concerns about population health in Malaysia.

In response to the low consumption of FV, numerous studies on the factors affecting FV consumption have been conducted (Nayga 1995; Dubowitz et al. 2008; Azagba and Sharaf 2011; Dehghan et al. 2011; Landais et al. 2015). However, in Malaysia, only little attention has been devoted to this topic. Yen et al. (2011) and Yen and Tan (2012) are among the few researchers that investigate the sociodemographic determinants of FV consumption in Malaysia. Their analysis is based on single equation models of consumption decision of FV. Hence, the factors associated with amount decision of FV remains unidentified. Considering this gap, the present study attempts to extend the analysis of Yen et al. (2011) and Yen and Tan (2012) by using a two-part model to examine the determinants of consumption decision and amount decision of FV in separate mechanisms. In brief, the present study seeks to answer two questions: (1) should I consume FV?; and (2) how much should I spend on FV?

Overall, the present study offers four important contributions to the literature. First, the present study uses a rigorous econometric model (two-part model) to examine the sociodemographic differences across ethnic groups in FV consumption. This is to earn a holistic view of the factors affecting FV consumption in Malaysia. Second, a nationally representative data that consists of a large sample size is used. Hence, the estimated results can provide inferential information. Third, the focus is on a developing country, Malaysia, where FV consumption is low and only few studies have been conducted. Fourth, the findings can shed light on which groups of populations are unlikely to consume FV. Thus, a better intervention measure directed toward promoting consumption of FV can be developed by policy makers. The objective of the present study is to examine sociodemographic factors associated with consumption decision and amount decision of FV among households in Malaysia.

FV CONSUMPTION: AN ECONOMIC PERSPECTIVE

To date, there is no strong theoretical framework that explains the relationships between sociodemographic factors and FV consumption. As such, the health production model developed by Grossman (1972) is used. The model argues that a person is given a health capital endowment at birth, but the health capital will depreciate as the person grows older. This is because of biological process of aging (Grossman 1972). People can produce health via health production function. It is a function where people combine time and market goods and services to produce health (Grossman 1972). For example, people consume medication and participate in physical activity in order to stay healthy and prevent various illnesses.

FV consumption is an input into health production function. Aside from the utility derived from the taste of FV, FV produces health benefits to consumers due to its nutritious values. In other words, people need to consume FV in order to improve their health. The present study makes several hypotheses. First, older individuals tend to consume more FV than younger individuals because they are likely to have a poorer health condition. Second, level of education is positively associated with FV consumption. This is because education can improve health knowledge, thus raising the productive and allocative efficiencies of health production. Third, owing to the fact that FV consumption is subject to budget constraint, higher income individuals will consume more FV than lower income individuals. Furthermore, consumption of FV is a health investment, thus higher income individuals may find it more attractive than lower income individuals.

INSIGHTS FROM THE LITERATURE

Deshmukh-Taskar et al. (2007) used data from the Bogalusa Heart Study to study factors affecting consumption of FV in the United States (US). Analysis of covariance was conducted. The estimated results showed that well-educated adults and women consumed more FV than less-educated adults and men. In terms of ethnicity, Blacks consumed more FV compared to Whites. In another study, Dubowitz et al. (2008) used a three-level hierarchical linear model and Third National Health and Nutrition Examination Survey of the US to investigate the relationships between socioeconomic factors and FV consumption. Their results

show that FV consumption was positively associated with age, male, education level and household income. Interestingly, the authors also found that ethnicity played an important role in FV consumption.

In Canada, Azagba and Sharaf (2011) used Ordinary Least Square (OLS) and a nationwide health survey to examine FV consumption among adults. They found that income and education levels had positive impacts on FV consumption. In terms of gender, females were found to consume more FV than males. Interestingly, former and current smokers were found to consume less FV than non-smokers. A U-shape relationship between age and FV consumption was also evidenced. Considering the marital status, married individuals tended to consume more FV as compared to single individuals. Dehghan et al. (2011) conducted another study in Canada. By using a nationwide health survey data, they found that respondents who were older, female and well-educated were more likely to consume FV than others. They also found that individuals who were married were more likely to consume fruit than unmarried individuals. Drawing on a survey data of Morocco, Landais et al. (2015) found that women who were in a high economic status group ate more FV than their counterparts who were in a low economic group. They also found that older women tended to consume more types of FV than younger women.

Yen et al. (2011) applied a bivariate ordered probability model to examine the determinants of FV consumption in Malaysia. Data from the Malaysia Non-Communicable Disease Surveillance-1 (MyNCDS-1) was used. They found that respondents who were well-educated and older were more likely to consume FV than their less-educated and younger counterparts. Compared to individuals from other ethnic groups, Malays, Chinese and Indians tended to consume more fruits but less vegetables. Male were less likely to consume fruit than females. Smokers were less likely to consume FV than non-smokers. Surprisingly, the effect of income on FV consumption was ambiguous. Individuals who were in middle-low income and middle-high income groups were more likely to consume vegetables than their peers who were in high income group. However, individuals who were in high income group consumed more FV than individuals who were in the lowest income group. Another study on FV consumption in Malaysia was conducted by Yen and Tan (2012). They found that education level and income were positively associated with the odds of consuming fruit. In terms of ethnicity, Chinese and Indians were more likely to consume fruit than individuals who were from other ethnic groups. Compared to high income earners and females, low income earners and males were less likely to consume FV.

It appears that apart from price of FV, sociodemographic factors, most notably, age, income, gender and education level, play an important role in determining FV consumption. This may be because these factors could affect financial capability, health awareness and preference for FV. Other factors that may affect FV consumption include presence of chronic illnesses and hereditary diseases, but these factors were not well-examined in previous studies. If policy makers could acquire a better understanding of how all these factors affect FV consumption, a more effective intervention measure directed towards increasing FV intake among households could be implemented.

METHODS

SAMPLE

Data used in this study is derived from the Malaysian Household Expenditure Survey 2009/2010 (HES 09/10) (Department of Statistics Malaysia 2011). The survey is conducted by Department of Statistics every five years. Its main objective is to collect information on the pattern of goods and services consumption among Malaysian households. The survey is carried out in all the states, including federal territories. To ensure the survey is nationally representative, the sample is collected based on a two-stage stratified sampling. The first stage sampling unit is based on geographically contiguous areas of the country [i.e. Enumeration Blocks (EBs)]. The second stage sampling unit is based on Living Quarters (LQs). All the households within the selected LQs are surveyed. Only household heads are interviewed. The exclusion criteria are institutional households, such as those in prisons, hotels and welfare homes. The survey period is from April 2009 to March 2010. Overall, 6494 observations are used for analyses. Because the survey is conducted based on household level, the expenditures on goods and services are recorded in an aggregated manner.

QUESTIONNAIRE AND VARIABLES

The survey asks respondents to report their total household expenditure on FV (including preserved FV) in a month [in Ringgit Malaysia (RM)]. The information on income is obtained by asking household heads: 'How much is your monthly household income (in RM)?' Information on household size is obtained by asking respondents to list all the persons living in their households. The information on gender and marital status of household heads are recorded and used for analysis. Age of household head is calculated based on household head's date of birth. The ethnicity of respondents is also recorded. Respondents report their education level when asked: 'What is your highest level

of formal education?' They respond with one of the following: 'no formal education', 'primary', 'secondary' or 'tertiary'. Because there is only a small proportion of respondents who answer 'no formal education', this answer is proportion of combined with 'primary' to form a single category.

STATISTICAL ANALYSES

In order to maximise utilities, consumers need to consume goods and services subject to their budget constraint. However, not every good and service is consumed by all the consumers. In fact, some of the goods and services may yield disutility to the consumers. For instance, consumers who do not like the taste of FV will not consume FV. These consumers maximise their utilities based on a corner point solution. In other words, they allocate all their budgets for goods and services other than FV. As a result, there will be lots of zero in the data. Zero refers to those who do not consume FV. To deal with this kind of data, the present study uses a lognormal hurdle model (i.e. two-part model) to estimate the factors affecting consumption decision and amount decision of FV. Unlike tobit, this model allows the values of decision to consume FV and amount of FV expenditure to be determined by separate mechanisms.

The first step of the estimation is to use probit to analyse whether or not the consumers consume FV (consumption equation). In the second step, natural *log* is added to the dependent variable and OLS is utilised to analyse how much the consumers spend on FV per month (amount equation). Because the present study is unable to assure that the error terms in consumption and amount equations are bivariate normal and independent of each other, *log* transformation is necessary. Furthermore, *log* transformation can guarantee positive predictions of the value of the dependent variable. Hence, the model can effectively treat the corner solution responses. Since lognormal hurdle model does not require exclusion restriction for identification purposes, the independent variables included in both consumption and amount equations are identical, which consist of household size, household income, gender, marital status, age, ethnicity and education. See Wooldridge (2010) for further explanations on lognormal hurdle model.

RESULTS

DESCRIPTIVE STATISTICS

The descriptive statistics are presented in Table 1. The average household size and income of Malays are four

members and RM3572.31, respectively. The majority (84.74%) of Malay household heads are male. Approximately 8.95%, 80.34% and 10.71% of Malay household heads are never married, married and widow/divorced, respectively. Most of the Malay household heads aged between 40 and 49 years (27.10%), followed by those aged between 30 and 39 years (23.39%), between 50 and 59 years (20.67%), 60 years or above (16.86%), and less than 30 years (11.98%). The education breakdown consists of 15.79%, 54.82% and 29.39% of Malays who have tertiary-, secondary- and tertiary-level education, respectively.

The average household size and income of Chinese respondents are four members and RM4874.60, respectively. Around 81.65% of Chinese household heads are male. A large proportion of Chinese household heads are married (74.53%), while only a small amount are never married (15.48%) and widow/divorced (9.99%). The majority of Chinese household heads aged between 40 and 49 years (28.28%), followed by those aged between 50 and 59 years (24.36%), 60 years or above (20.58%), between 30 and 39 years (19.53%), and less than 30 years (7.25%). Approximately, 18.75%, 54.15% and 27.11% of Chinese household heads have tertiary-, secondary- and primary-level education, respectively.

Indians/Others, on average, have household size of four members and household income of RM3213.13. The sample of Indian/Others consists of more males (83.50%) than females (16.50%). Approximately 74.42%, 16.50% and 9.08% of Indian/Others household heads are married, never married and widow/divorced, respectively. Indian/Others household heads are mostly in the age category of 40-49 years (28.52%), followed by 30-39 years (27.36%), <30 years (19.44%), 50-59 years (16.50%) and ≥60 years (8.18%). A large proportion of Indian/Others household heads have primary- (45.14%) and secondary-level education (43.35%), while only a small proportion have tertiary-level education (11.51%).

FACTORS ASSOCIATED WITH FV CONSUMPTION

Lognormal hurdle models are estimated across three ethnic groups (i.e. Malay, Chinese and Indian/Others). For each ethnic group, two separate regressions are estimated. One is for fruit consumption, while another one is for vegetable consumption. The variables used in all the regressions are identical. The overall significances of consumption equation and amount equation of FV are accessed by using likelihood ratio (LR) and F-statistics, respectively. The results show that all the independent variables are jointly significant in explaining FV consumption. It can, therefore,

TABLE 1. Summary statistics of independent variables

Variables	Malay		Chinese		Indian/Others	
	Mean / n	SD / %	Mean / n	SD / %	Mean / n	SD / %
Continuous						
Household	4.43	2.26	3.66	1.82	3.95	2.21
Income	3572.31	3460.84	4874.60	4582.33	3213.13	4336.21
Categorical						
Gender						
Male	3543	84.74	1250	81.65	653	83.50
Female	638	15.26	281	18.35	129	16.50
Marital status						
Never	374	8.95	237	15.48	129	16.50
Married	3359	80.34	1141	74.53	582	74.42
Divorced	448	10.71	153	9.99	71	9.08
Age						
<30	501	11.98	111	7.25	152	19.44
30-39	978	23.39	299	19.53	214	27.36
40-49	1133	27.10	433	28.28	223	28.52
50-59	864	20.67	373	24.36	129	16.50
≥60	705	16.86	315	20.58	64	8.18
Education						
Primary	1229	29.39	415	27.11	353	45.14
Secondary	2292	54.82	829	54.15	339	43.35
Tertiary	660	15.79	287	18.74	90	11.51
Observations	4181		1531		782	

Source: HES 09/10

Note: For continuous variables, the values refer to mean and standard deviation (SD). For categorical variables, the values refer to frequency (n) and percentage (%).

be concluded all the models are well specified. For consumption equation, the marginal effect of each independent variable is calculated because the estimates do not have direct interpretations. Hence, the results of consumption equation and amount equation are all interpreted based on percentage.

MALAY

The results of lognormal hurdle model for Malay sample are presented in Table 2. For fruits, the probability to consume (0.7%) and amount of expenditure (2.5%) are positively related to household size. An additional of RM100 in household income increases the probability of consuming fruits and amount of expenditure by 0.1% and 0.7%, respectively. Male-headed households have a lower likelihood of consuming fruits (7.6%) than female-headed households. Compared to households headed by widow/ divorced individuals, never married household heads are less likely to consume fruits (9.7%), whereas married household heads are more likely to consume fruits (12%).

Likewise, households headed by married individuals tend to spend more on fruits (21.2%) than their widow/divorced counterparts. Households with younger household heads (<30 years) are 5.4% less likely to consume fruits than households with older household heads (≥60 years). Similarly, amount spent on fruits is lower among younger household heads [<30 years (-31.3%); 30-39 years (-22.4%); 40-49 years (-18.4%)]. Households headed by individuals who have only primary-level education spend 24.9% less on fruits than households headed by individuals who have tertiary-level education.

In terms of vegetable consumption, the probability to consume (0.5%), as well as the amount spent (8.0%) are positively related to household size. A RM100 increase in household income raises the expenditure on vegetable by 0.2%. Although household income is statistically significant in lowering the probability to consume, the effect is quite negligible (-0.1%). Households headed by male are 0.5 less likely to consume vegetables and also spend 8.8% less than households headed by female.

TABLE 2. Factors affecting FV consumption among Malays

Variables	Fruit			Vegetable		
	Participation		Amount	Participation		Amount
	Estimates	ME	Estimates	Estimates	ME	Estimates
Constant	0.626***	–	2.276***	1.013***	–	2.838***
	(0.119)		(0.100)	(0.229)		(0.060)
Household	0.025**	0.007**	0.025***	0.395***	0.005***	0.080***
	(0.011)	(0.003)	(0.009)	(0.042)	(0.001)	(0.006)
Income / 100	0.005***	0.001***	0.007***	-0.004***	-0.001**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gender						
Male	-0.290***	-0.076***	-0.006	-0.639***	-0.005***	-0.088**
	(0.083)	(0.020)	(0.750)	(0.139)	(0.001)	(0.044)
Female	–	–	–	–	–	–
Marital status						
Never	-0.309***	-0.097**	0.077	-0.254	-0.004	-0.186***
	(0.112)	(0.038)	(0.108)	(0.193)	(0.004)	(0.063)
Married	0.384***	0.120***	0.212**	0.706***	0.017**	0.242***
	(0.097)	(0.033)	(0.089)	(0.188)	(0.008)	(0.052)
Divorced	–	–	–	–	–	–
Age						
<30	-0.180*	-0.054*	-0.313***	-0.592***	-0.014*	-0.291***
	(0.100)	(0.032)	(0.086)	(0.205)	(0.008)	(0.052)
30-39	-0.104	-0.031	-0.224***	-0.330	-0.005	-0.150***
	(0.084)	(0.025)	(0.069)	(0.203)	(0.004)	(0.042)
40-49	-0.128	-0.038	-0.184***	-0.134	-0.002	-0.095**
	(0.080)	(0.024)	(0.066)	(0.205)	(0.003)	(0.040)
50-59	0.016	0.005	0.004	0.283	0.003	0.049
	(0.079)	(0.022)	(0.063)	(0.220)	(0.002)	(0.039)
≥60	–	–	–	–	–	–
Education						
Primary	-0.088	-0.026	-0.249***	0.216	0.002	0.181***
	(0.091)	(0.027)	(0.074)	(0.192)	(0.002)	(0.045)
Secondary	-0.052	-0.015	-0.035	0.105	0.001	0.147***
	(0.722)	(0.021)	(0.058)	(0.121)	(0.002)	(0.036)
Tertiary	–	–	–	–	–	–
LR	188.090	–	477.190	–		
F-statistics	–	–	27.270	–	–	63.120
Observations			4181			

Source: HES 09/10

Note: Asymptotic standard errors in parentheses. *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. ME refers to marginal effect. LR refers to likelihood ratio.

Households headed by never married individuals spend 18.6% less on vegetables than households headed by widow/divorced individuals. However, households headed by married individuals are associated with a greater likelihood of consumption (1.7%) and amount spent (24.2%) than households headed by widow/divorced individuals. Households with younger household heads (<30 years) are 1.4% less likely to consume vegetables compared with their older counterparts (≥60 years). Likewise, there is a negative relationship between young age and amount of expenditure [<30 years (-29.1%); 30-39 years (-15%); 40-49 years (-9.5%)]. In terms of education, household heads who have primary- (18.1%) and secondary-level education (14.7%) spend more on vegetables than household heads who have tertiary-level education.

CHINESE

The results of lognormal hurdle model for Chinese sample are presented in Table 3. Household size is positively associated with the probability to consume (1.4%) and amount spent (6.6%) on fruits. Each RM100 increase in household income elevates the probability to consume and amount spent on fruits by 0.1% and 0.4%, respectively. Setting household heads aged ≥60 years as the reference group, the likelihood of fruit consumption seems to be lower among individuals aged <30 years (17.3%), 30-39 years (10.3%) and 40-49 years (5.5%). The amount equation shows similar results [<30 years (48.9%); 30-39 years (33.5%); 40-49 years (29.9%)].

For vegetables, the probability to consume (1.8%) and amount spent (15.8%) are positively associated with household size. Male household heads are 1.3% less likely to consume vegetables and spend 12.3% less than female

TABLE 3. Factors affecting FV consumption among Chinese

Variables	Fruit			Vegetable		
	Participation		Amount	Participation		Amount
	Estimates	ME	Estimates	Estimates	ME	Estimates
Constant	0.747***	–	2.881***	0.529*	–	2.761***
	(0.204)		(0.134)	(0.276)		(0.106)
Household	0.073**	0.014***	0.066***	0.622***	0.018***	0.158***
	(0.029)	(0.006)	(0.017)	(0.068)	(0.004)	(0.014)
Income / 100	0.005***	0.001***	0.004***	-0.001	-0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Gender						
Male	-0.084	-0.016	0.020	-0.710***	-0.013***	-0.123*
	(0.124)	(0.022)	(0.087)	(0.177)	(0.004)	(0.068)
Female	–	–	–	–	–	–
Marital status						
Never	0.168	0.030	0.110	0.286	0.007	0.247**
	(0.182)	(0.030)	(0.131)	(0.240)	(0.005)	(0.103)
Married	0.286*	0.060	0.035	0.469**	0.018	0.351***
	(0.163)	(0.037)	(0.115)	(0.222)	(0.012)	(0.091)
Divorced	–	–	–	–	–	–
Age						
<30	-0.666***	-0.173***	-0.489***	-0.972***	-0.072*	-0.397***
	(0.200)	(0.065)	(0.146)	(0.264)	(0.038)	(0.115)
30-39	-0.457***	-0.103***	-0.335***	-0.611***	-0.028*	-0.208***
	(0.154)	(0.040)	(0.101)	(0.225)	(0.015)	(0.078)
40-49	-0.266*	-0.055*	-0.299***	-0.429*	-0.015	-0.090
	(0.144)	(0.032)	(0.089)	(0.221)	(0.010)	(0.069)
50-59	-0.174	-0.035	-0.130	0.214	0.005	0.054
	(0.141)	(0.300)	(0.085)	(0.242)	(0.005)	(0.066)
≥60	–	–	–	–	–	–
Education						
Primary	-0.024	-0.005	-0.036	0.123	0.003	0.175**
	(0.158)	(0.031)	(0.100)	(0.235)	(0.006)	(0.079)
Secondary	0.026	0.005	0.055	-0.092	-0.003	0.147**
	(0.126)	(0.024)	(0.080)	(0.165)	(0.005)	(0.064)
Tertiary	–	–	–	–	–	–
LR	66.970		–	250.930		–
F-statistics	–	–	7.760	–	–	23.640
Observations			1531			

Source: HES 09/10

Note: Asymptotic standard errors in parentheses. *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. ME refers to marginal effect. LR refers to likelihood ratio.

household heads. Compared with household heads who are widow/divorced, those who are never married (24.7%) and married (35.1%) spend more on vegetables. The probability to consume [<30 years (-7.2%); 30-39 years (-2.8%)] and amount spent [<30 years (-39.7%); 30-39 years (-20.8%)] on vegetables are lower among younger household heads than older household heads. In terms of education, household heads with primary- and secondary-

level education spend 17.5% and 14.7% more on vegetables, respectively, than their counterparts with tertiary-level education.

INDIAN/OTHERS

The results of lognormal hurdle model for Indian/Others sample are presented in Table 4. An additional of RM100

TABLE 4. Factors affecting FV consumption among Indian/Others

Variables	Fruit			Vegetable		
	Participation		Amount	Participation		Amount
	Estimates	ME	Estimates	Estimates	ME	Estimates
Constant	1.226***	–	2.592***	1.599***	–	2.902***
	(0.309)		(0.258)	(0.582)		(0.172)
Household	0.040	0.013	0.013	0.408***	0.008***	0.093***
	(0.023)	(0.008)	(0.022)	(0.079)	(0.003)	(0.014)
Income / 100	-0.001	-0.001	0.009***	-0.005*	-0.001*	0.003***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Gender						
Male	-0.133	-0.044	0.005	-1.033***	-0.011**	-0.009
	(0.152)	(0.050)	(0.143)	(0.379)	(0.005)	(0.089)
Female	–	–	–	–	–	–
Marital status						
Never	0.014	0.005	-0.232	-0.496	-0.016	0.038
	(0.235)	(0.080)	(0.219)	(0.486)	(0.023)	(0.140)
Married	0.127	0.044	-0.147	0.258	0.006	0.034
	(0.206)	(0.073)	(0.190)	(0.445)	(0.013)	(0.120)
Divorced	–	–	–	–	–	–
Age						
<30	-0.820***	-0.305***	-0.283	-0.080	-0.002	-0.318**
	(0.248)	(0.094)	(0.197)	(0.451)	(0.011)	(0.131)
30-39	-0.595***	-0.215**	-0.257	-0.247	-0.006	-0.311***
	(0.228)	(0.085)	(0.170)	(0.417)	(0.012)	(0.116)
40-49	-0.650***	-0.235***	-0.331**	0.034	0.001	-0.262**
	(0.226)	(0.084)	(0.168)	(0.442)	(0.009)	(0.114)
50-59	-0.532**	-0.197**	-0.245	0.201	0.004	-0.025
	(0.235)	(0.090)	(0.178)	(0.503)	(0.008)	(0.121)
≥60	–	–	–	–	–	–
Education						
Primary	-0.356*	-0.123*	-0.291*	0.048	0.001	0.196*
	(0.185)	(0.064)	(0.172)	(0.310)	(0.006)	(0.113)
Secondary	-0.115	-0.040	-0.182	0.330	0.007	0.417***
	(0.181)	(0.063)	(0.162)	(0.324)	(0.007)	(0.108)
Tertiary	–	–	–	–	–	–
LR	28.180		-	89.750		-
F-statistics	–	–	8.430	–	–	10.990
Observations			782			

Source: HES 09/10

Note: Asymptotic standard errors in parentheses. *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level. ME refers to marginal effect. LR refers to likelihood ratio.

in household income increase the amount spent on fruits by 0.9%. Compared to older household heads, younger household heads have a lower likelihood of consuming fruits [<30 years (-30.5%); 30-39 years (-21.5%); 40-49 years (-23.5%); 50-59 years (-19.7%)]. However, only household heads aged 40-49 years spend less on fruits (33.1%) than their counterparts aged ≥60 years. Considering the education variable, households headed by individuals with only primary-level education are 12.3% less likely to consume fruits and also spend 29.1% less than households headed by individuals with tertiary-level education.

The probability of consumption (0.8%) and amount spent on vegetables (9.3%) are positively associated with household size. There is a negative relationship between household income and the likelihood of consuming vegetables (-0.1%). However, an increase of RM 100 in household income increases the amount spent on vegetables by 0.3%. Households headed by males are 1.1% less likely to consume vegetables than households headed by females. Household heads aged <30 years, 30-39 years and 40-49 years spend 31.8%, 31.1% and 26.2% less on vegetables, respectively, than their counterparts aged ≥60 years. Households heads with only primary- (19.6%) and secondary-level education (41.7%) spend more on vegetables than household heads with tertiary-level education.

DISCUSSION

The present study finds that household size is positively associated with the likelihood of consuming FV as well as the amount spent among all the ethnic groups. This finding is in line with those of previous studies (Nayga 1995; Asmuni et al. 2016). The explanation is quite straightforward. Since FV is a part of the normal diet among Malaysians, the demand for FV increases when there is an additional household member. Another contributing factor for this outcome is related to externality. When individuals consume FV, the benefits of being healthy can be shared with their family members. This positive externality is greater among individuals with a larger household size than individuals with a smaller household size because more individuals can reap the benefits.

Consistent with our anticipation and the findings of Nayga (1995) and Yen and Tan (2012), income is found to be positively associated with FV consumption. All ethnic groups exhibit an increase in the probability of consuming FV and amount spent when there is an increase in household income. This finding implies that budget constraint plays a significant role in FV consumption. When household income increases, household purchasing power increases as well, and this enables households to consume more FV.

As pointed out by Yen and Tan (2012), compared to higher income individuals, lower income individuals tend to allocate more of their income for necessity goods, such as rice, clothing and housing rather than FV. Another reason is that higher income earners will reap a higher return of health investment than lower income earners. Since FV consumption is a health investment, individuals with higher income are more devoted to consume FV than their lower income counterparts. Based on this finding, it can be concluded that FV is a normal good rather than a necessity good. In order to further confirm this conclusion, income elasticity should be calculated in future studies when information are available.

The finding on gender is noteworthy. Male-headed households are less likely to consume FV and also spend less compared with households headed by female, which is in agreement with the findings of Yen and Tan (2012) and Asmuni et al. (2016). Similar findings are also evidenced by Azagba and Sharaf (2011), Dehghan et al. (2011) and Yen et al. (2011). Three plausible reasons are cited to explain this outcome. Firstly, women have the natural family caretaker characteristic, thus they tend to have a better health awareness than men (Cheah 2014). Secondly, men seldom play a major role in family decision making and consequently are less concerned about nutritious diet than women (Yen & Tan 2012). Thirdly, men much prefer meat, that is, the food with high protein value, to FV. This is because they want to demonstrate masculinity (Yen & Tan 2012).

Being married seems to increase the likelihood of consumption and amount spent among Malays and Chinese. This finding confirms the arguments of Donkin et al. (1998) and Roos et al. (1998) that marital status can influence food consumption behaviour. Specifically, Roos et al. (1998) claim that marriage can promote healthy diet among men and women. This is likely attributable to household commitment. Married individuals tend to bear more responsibilities in taking care of their family members than their unmarried counterparts, and consequently spend more on FV, especially given the fact that FV can improve health. The influence of household commitment on FV should be further tested by estimating a model that includes presence of children in a household as an explanatory variable.

In terms of age, the results of the present study show that households headed by older individuals are more likely to consume FV and consume more than households headed by younger individuals, which are consistent with our hypothesis. Similar findings are shared by Yen et al. (2011) and Yen and Tan (2012). This is simply because older individuals are more aware of their health than their younger counterparts and thus are more likely to improve their health (Yen et al. 2011). Quite the opposite, younger

individuals tend to take their health for granted and are less devoted to make health investment.

It is surprising to find that the effect of education on FV consumption is mixed. On one hand, level of education increases fruit consumption. On the other hand, it reduces vegetable consumption. Our hypothesis and the argument that education improves allocative efficiency and productive efficiency in health production is not strongly supported by these findings (Grossman 1972). Perhaps, this is because well-educated individuals may substitute other types of health inputs for physical activity. Therefore, an in-depth qualitative study should be conducted to offer a better understanding of the relationship between education and FV consumption.

POLICY IMPLICATION

Few policies are suggested based on the findings of the present study. First, households with a small household size should be the focus of policy makers. Hence, health awareness campaigns that can improve health concerned among households with a small number of family members are worthwhile. It is however that policy makers should take into consideration of the negative effects of large family if the intervention strategy directed towards increasing household size is to be implemented. Second, given the finding that income plays an important role in promoting FV consumption, an intervention measure targeted towards increasing household income may yield promising results. Government should make a concerted effort to increase the level of subsidy on FV or provide the needy with food vouchers. As a result, low income households are able to allocate a higher proportion of their income for FV. However, this financial support policy should be implemented carefully to ensure that the benefits are not reaped by high income households.

Third, the finding on gender has important implications for developing a policy aimed at increasing the prevalence of FV consumption. The main focus of the policy must be on households headed by males than those headed by females. In particular, consideration should be given to the strategy that educates men about the benefits of consuming FV. How FV can improve men's health should be emphasised. Fourth, the policy implication of the finding on marital status is somewhat interesting. It appears that an intervention strategy that pays special attention to encouraging marriage can help to promote FV consumption. Although this strategy seems to be effective, it can cause the problem of early marriage. Hence, policy makers should take note of this. Last, the finding on age has provided government with useful information on policy development. It implies that policy maker's attention should be devoted to youngsters, instead of the elderly because FV consumption tends to increase with age. Education programme that focuses primarily on improving health awareness among young adults is worthy of consideration.

CONCLUSION

In view of the importance of FV consumption, the present study offers an in-depth analysis of the factors affecting FV consumption among households in Malaysia. Data from a nationally representative survey is used. A lognormal hurdle model is applied to examine the consumption decision and amount decision of FV across ethnic groups. Evidence of the present study shows that sociodemographic factors, such as household size, income, gender, marital status, age and education are significantly associated with FV consumption. Intervention measures directed toward promoting FV consumption among large households, low income earners, males, unmarried individuals and the elderly appear to be promising, as these groups of populations are likely to have low consumption of FV.

While the present study has thrown new light on the determinants of FV consumption, it has several limitations. First, the data only has the information on households. It would be better if the analysis can be conducted at the individual level, which can provide government with more information on policy development. Second, all the information provided by the data are self-reported. Hence, reporting errors may occur. Third, some important variables are not considered in the regression analysis. These include number of children in a family, presence of illnesses and lifestyle factors. Despite these limitations, the present study has made significant contributions to literature and policy formulation. Future studies are suggested to use a panel data to examine how pattern of FV consumption changes over time.

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