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SOCIODEMOGRAPHIC FACTORS ASSOCIATED WITH CONSUMPTION AND EXPENDITURE ON VITAMIN SUPPLEMENTS AMONG YOUTH IN MALAYSIA

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ABSTRACT

Consumption of vitamins can lower the risks of various non-communicable diseases (NCDs). Nevertheless, only a small proportion of adults in Malaysia consume vitamin supplements, and this may contribute to the increase in the prevalence of NCDs across the country. Despite the high prevalence of NCDs and low consumption of vitamin supplements, there is insufficient research that assess individuals' use and expenditure on vitamin supplements. The objective of the present study is to examine the effects of sociodemographic factors on vitamin supplement spending among youth in Malaysia. The primary survey data were collected using convenient sampling (n = 482). In addition to one-way analysis of variance (ANOVA), a lognormal hurdle model was used to explore factors affecting consumption and amount decisions of vitamin supplements. Results of the present study showed that higher-income and less-educated individuals spent more on vitamin supplements compared to lower-income and well-educated individuals. Expenditure on vitamin supplements was higher among Chinese than Malays. Being male and married increased the likelihood of consuming vitamin supplements. In conclusion, sociodemographic factors play an important role in determining consumption and expenditure on vitamin supplements. With the present study's findings, policymakers could better understand which cohorts of the Malaysian population to be focused on. Therefore, a more effective policy directed towards promoting the use of vitamin supplements can be formulated.

Keywords: Consumption, expenditure, sociodemographic factors, supplement, vitamin.

INTRODUCTION

Non-communicable disease (NCD) mortality has been increasing across the globe. The current global death toll has reached 44 million (World Health Organisation [WHO], 2021). Of this number of deaths, 10.4 million are from Southeast Asia. Malaysia is one of the countries in Southeast Asia with high prevalence of NCDs. In 2016, NCDs accounted for 74 percent of total deaths in the country (WHO, 2018). Furthermore, a national health survey showed that 47.7 percent, 30.3 percent, and 17.5 percent of Malaysian adults were diagnosed with hypercholesterolemia, hypertension, and diabetes, respectively (Institute for Public Health, 2015). The rapid rise of NCDs in Malaysia has led to a large increase in economic costs, including productivity loss caused by absenteeism and premature deaths. According to the Ministry of Health Malaysia (2020), NCDs contribute to an economic cost of Ringgit Malaysia (RM) 8.91 billion annually.

One of the plausible factors contributing to the high prevalence of NCDs in Malaysia is the inadequate consumption of vitamins. As Moy and Bulgiba (2011) pointed out, insufficiency of vitamin D is highly associated with metabolic syndrome among Malaysian adults. In particular, adults with a low vitamin D level have 29 percent higher odds of developing metabolic syndrome than those with an adequate vitamin D level. In another study, vitamin D deficiency was found to be correlated with obesity (Shafinaz & Moy, 2016). More specifically, a one unit increase in body mass index reduces the serum

25-hydroxyvitamin D by 0.14 ng/ml. According to the Malaysian Adult Nutrition Survey, less than one-third (28.1%) of Malaysian adults consume vitamin supplements (Institute for Public Health, 2014). A vitamin supplement is a dietary product individuals consume to increase their vitamin intake. Vitamins are important for cell growth and general health. Overall, there are thirteen types of vitamins – vitamins A, C, D, E, K, and eight types of vitamin B. Some vitamins can help to fight infections and keep nerves healthy, while others can help the body to obtain energy from food and function properly. There is evidence suggesting that adequate intake of vitamins can lower the risk of NCDs, most notably, cardiovascular disease (CVD), diabetes, and mental illnesses. In an empirical study, thiamine (vitamin B1) deficiency is positively associated with the development of CVD (Eshak & Arafa, 2018). Moreover, folic acid and vitamin B12 have been found to be deficient in diabetic patients (Valdes-Ramos et al., 2015). Another study showed that vitamin supplements may reduce the risk of metabolic syndrome (Duc et al., 2021). Others found that vitamins can help to prevent NCDs. For example, B complex can lower the risk of stroke, vitamins C and D can reduce blood pressure, vitamins D and K1 can reduce the likelihood of developing diabetes, and vitamin E can prevent CVD (Bruins et al., 2019). There are also findings proving the negative associations between adequate intake of vitamins and the risks of asthma, chronic obstructive pulmonary disease, lung cancer, and other serious respiratory diseases (Whyand et al., 2018).

Despite the fact that vitamin supplements play an important role in preventing NCDs, there appears to be a lack of research examining the demand for vitamin supplements, especially in Malaysia, where NCDs are prevalent. Previous Malaysian studies often focused on factors associated with vitamin D deficiency (Moy & Bulgiba, 2011; Shafinaz & Moy, 2016; Al-Sadat et al., 2016; Quah et al., 2018; Isa et al., 2022), but no attention has been devoted to individuals' use and expenditure on vitamin supplements. To the best of the current authors' knowledge, the study by Mohd Zaki et al. (2018) is the only study that threw light on the relationships between sociodemographic factors and the use of vitamin supplements among adults in Malaysia. Nevertheless, it did not explore the magnitude of expenditure. The study only examined whether the consumers used vitamin supplements (yes vs. no) and left open the question related to how much consumers spent on vitamin supplements, which is important information to policymakers.

The present study aims to investigate factors affecting the consumption and amount decisions of vitamin supplements with a focus on youth in Malaysia. According to the Institute for Youth Research Malaysia, youth refer to individuals aged between 15 and 40 (Ponnusamy et al., 2021). Consumption implies the decision of consumers to use market goods and services (yes vs. no). In particular, this study attempts to answer two research questions: (i) What are the sociodemographic factors that affect the likelihood of consuming vitamin supplements? and (ii) How does the amount of money spent on vitamin supplements vary across sociodemographic factors? Comprehensive knowledge of sociodemographic variations in vitamin supplements consumption and expenditure is important to public health policymakers.

THEORETICAL BASIS

The theoretical underpinning for the demand for vitamin supplements is developed based on Grossman's demand for the health capital model (Grossman, 1972). According to Grossman (1972), health capital is a consumption and an investment product. Everyone is given a certain amount of health capital when he or she is born, but this amount will depreciate over time. Therefore, people need to consume and invest in health products, such as consumption of health supplements, in order to make up for the loss of health capital. Health benefits people in two ways: 1) increases in utility; and 2) increases in the time available for other activities, such as paid work and leisure.

According to Grossman (1972), health cannot be purchased directly. An individual must consume time and market commodities, including vitamin supplements, to produce good health. A person can determine his optimal stock of health capital at any age by equating the marginal efficiency of capital with the amount of investment in health capital. However, different people have different levels of health capital due to lifestyle, environmental, and genetic differences. Grossman (1972) claimed that the level of health is not exogenous but depends on the resources that individuals allocate to health production.

Based on Grossman's argument, older people tend to spend more money on health improvement than their younger peers because of ageing. For older people, the marginal cost of maintaining health is higher. Therefore, it is expected that older individuals spend more on vitamin supplements compared to younger individuals. In addition, people with higher education levels are expected to invest more in their health because education improves health knowledge. In other words, well-educated people are better health producers than less-educated people. More educated individuals are, therefore, hypothesised to have higher expenditure on vitamin supplements. Furthermore, assuming that vitamin supplement is a normal good, individuals with higher income have better financial means to purchase more vitamin supplements relative to those with lower income. Moreover, the health of higher-income people has a higher economic value than that of lower-income people because time available for work determines earnings.

INSIGHTS FROM THE LITERATURE

Numerous empirical studies found sociodemographic factors to be associated with the consumption of health supplements and other health-related products and services (Kim et al., 2010; Al-Naggar & Chen, 2011; Cheah, 2013; Pouchieu et al., 2013; Bailey et al., 2013; Cheah, 2014; Cheah, 2015; Gong et al., 2018; Mohd Zaki et al., 2018; Loo et al., 2020; Mohd Ashri et al., 2021). Findings from previous studies showed a positive relationship between age and demand for health supplements. In Malaysia, older people were found to be more likely to use dietary supplements than younger people (Mohd Zaki et al., 2018; Mohd Ashri et al., 2021). Similar findings were evidenced in South Korea (Kim et al., 2010). In France, Pouchieu et al. (2013) found that older people were more likely to use dietary supplements than their younger counterparts. Several studies conducted in the United States and China offered identical findings (Bailey et al., 2013; Gong et al., 2018).

Previous studies identified a significant association between gender and demand for health supplements. In particular, females were more likely to use health supplements than males (Kim et al., 2010; Pouchieu et al., 2013; Gong et al., 2018; Mohd Zaki et al., 2018; Mohd Ashri et al., 2021). Males were also found to be less likely to consume health-promoting goods and services than females (Cheah, 2014; 2015). The given explanation is that females tend to pay more attention to their health than males, and consequently may have a higher incentive to use dietary supplements to improve their health. The relationship between marital status and demand for health supplements was found to be significant in previous studies. Married people were more likely to use dietary supplements than unmarried people (Mohd Ashri et al., 2021). Furthermore, being married was positively related to the use of preventive medical care and health-promoting goods and services (Cheah, 2013; 2014). This is simply because married people are more concerned about their health than their single counterparts as they take more responsibilities for taking care of their family members.

There appeared to be educational variations in the demand for health supplements. Specifically, well-educated people were more likely to use health supplements than less-educated people (Pouchieu et al., 2013; Gong et al., 2018; Mohd Zaki et al., 2018). In addition, a low education level was found to be associated with low consumption of preventive medical care and health-promoting goods and services (Cheah, 2013; 2014; 2015). This could be because more educated people have better health knowledge than their less-educated counterparts. Previous studies provided insights on employment status and health supplement use. According to Pouchieu et al. (2013), employed individuals were more likely to use dietary supplements when compared to the unemployed. Given that employed people have more work commitments than the unemployed, they may be more aware of their health. Furthermore, employed people are more capable of purchasing health-promoting goods and services. In past studies, income was found to be positively correlated with the demand for health supplements (Kim et al., 2010; Al-Naggar & Chen, 2011; Gong et al., 2018; Mohd Zaki et al., 2018; Loo et al., 2020; Mohd Ashri et al., 2021). Studies by Cheah (2013: 2014: 2015) suggested that lower-income individuals were less likely to consume preventive medical care, and health-promoting goods and services than higher-income individuals. Two reasons may explain these findings. First, higher-income earners have a better financial capability than lower-income earners. Second, if higher-income people have more time to work, they could make more money compared to their lower-income counterparts.

METHODOLOGY

Data

Primary survey data were used in the present study. The data were collected using convenience sampling because it is less expensive, more efficient, and easier to implement as compared to other sampling methods (Jager et al., 2017). Furthermore, convenience sampling can obtain information with the aim of generating tentative hypotheses, which can be tested thoroughly in future research (Galloway, 2005). Moreover, convenience sampling can simply increase the sample size without adopting any probability approaches (Galloway, 2005). The survey period was from 10th October 2021 to 24th February 2022. Since convenience sampling is a non-probability sampling method, it does not have a sampling frame. Online-structured questionnaires were created using Google Forms and distributed to respondents via email. Inclusion criteria were adults aged 18 years and above, Malaysian citizens, both genders, and all ethnic groups. The unit of analysis was individual consumer. One of the advantages of an online survey is that the respondents can answer the questions at any location. Geographical constraint is not an issue.

The questionnaires were prepared in three languages (English, Chinese, and Malay) so that respondents from various ethnic groups could have good understanding. The questionnaires consisted of two sections. In the first section, the respondents were asked to report the money that they spent on vitamin supplements in a month (in RM). The types of vitamins consisted of vitamins A, C, D, E, K, and eight types of vitamin B. In the second section, the respondents' sociodemographic characteristics, such as age, gender, ethnicity, educational level, and income, were recorded. In attempting to minimise non-sampling errors, a pilot test was conducted prior to the data collection. Respondents who did not give consent were not allowed to participate in the survey. A total of 482 respondents were surveyed in this study. According to Sekaran and Bougie (2016), a sample size of 384 is adequate for quantitative research. However, to be on the safe side, 482 observations were surveyed. If a sample size is too large ($n \geq 500$), type II errors may occur.

Selected Variables

The dependent variable of the present study, i.e., monthly expenditure on vitamin supplements, was formatted as a continuous variable (in RM). Considering the lack of studies related to the demand for health supplements in Malaysia, the independent variables used in the present study were selected based on economic theories, previous studies related to health supplements conducted elsewhere, and studies focusing on other health-related goods (Grossman, 1972; Kim et al., 2010; Bailey et al., 2013; Cheah, 2013; Pouchieu et al., 2013; Cheah, 2014; Gong et al., 2018; Mohd Zaki et al., 2018; Cheah et al., 2020; Mohd Ashri et al., 2021).

Table 1

Descriptive Statistics of Variables (n = 430)

Variables	Mean / frequency	Std. dev. / percent
Dependent		
Vitamin supplements (RM)	117.37	151.15
Independent		
Age (year)		
18–24	323	75.12
25–39	107	24.88
Income (RM)		
≤1,000	294	68.37
1,001–2,000	46	10.70
2,001–3,000	38	8.84
3,001–4,000	25	5.81
≥4,001	27	6.28
Gender		
Male	92	21.40
Female	338	78.60
Ethnicity		
Malay	57	13.26
Chinese	360	83.72
Indian/Others	13	3.02
Marital status		
Married	74	17.21
Unmarried	356	82.79
Education		
Tertiary	366	85.12
Non-tertiary	64	14.88
Employment status		
Employed	98	22.79
Unemployed	332	77.21

Note: For the dependent variable, the values refer to mean and standard deviation. For independent variables, the values refer to frequency and percent.

The selected independent variables consisted of age, income, gender, ethnicity, marital status, educational level, and employment status. The respondents reported their age when asked: 'What is your age (in years)?' with one of the following: '18–24', '25–39', '40–54', and '≥55'. Since the present study focuses on youth in Malaysia, only '18–24' and '25–39' categories were used in the analyses.

Respondents were asked to report their monthly individual incomes (in RM). They answered with: '≤1,000', '1,001–2,000', '2,001–3,000' or '≥4,001'. The survey asked respondents about their ethnic profiles. The possible answers were 'Malay', 'Chinese', 'Indian', and 'Others'. 'Indian' and 'Others' were combined because of the small numbers of respondents in these two ethnic groups. Marital status consisted of two categories: 'married' and 'unmarried'. Respondents who were single, widowed, or divorced were categorised as 'unmarried'. Respondents were asked to state their highest education levels: 'What is your highest academic qualification?' The possible answers were 'primary', 'secondary', and 'tertiary'. Given that only a small proportion of respondents selected 'primary', both 'primary' and 'secondary' were grouped together to form a single category as 'non-tertiary'. Well-educated individuals referred to respondents with tertiary-level education. Employment status comprised two categories: 'employed' and 'unemployed'. The 'unemployed' category included students, housewives, and retirees.

Statistical Analyses

Since this study focuses on youth, respondents aged 40 years and above were removed from the data. As a result, only 430 respondents were used in the analyses. Descriptive statistics of all the variables were calculated and presented. Prior to performing multivariate analyses, a one-way analysis of variance (ANOVA) was applied to assess sociodemographic variations in the average monthly expenditure on vitamin supplements. The dependent variable had limited values as it contained many zeros. Several factors might cause these zeros. Firstly, the period of the survey might be too short. Some consumers might purchase vitamin supplements every three or four months. Secondly, some consumers did not prefer vitamin supplements because they had poor health awareness or did not understand the benefits of vitamin supplements. Thirdly, vitamin supplements were expensive, thus not every consumer could afford, especially those from a poor economic background. In dealing with these zeros, a two-part model must be used, instead of a linear regression. Therefore, the present study used a lognormal hurdle model to estimate the effects of sociodemographic factors on consumption decision and amount decision of vitamin supplements. The lognormal hurdle model is more flexible than the Tobit model because it allows separate mechanisms to estimate consumption and amount decisions. In the model, the effects of an independent variable on the probability of consumption and the amount spent can have different signs, assuming that the dependent variable has continuous distributions at positive values. Consumption decision refers to the decision of a consumer to consume vitamin supplements (yes vs. no). Amount decision signifies the amount of money which a consumer spends on vitamin supplements (magnitude of expenditure).

In the consumption equation, Probit regression was used to examine whether respondents consumed vitamin supplements. Marginal effects of independent variables were computed. The consumption equation can be expressed as:

$$E(y|\mathrm{x}, y > 0) = \exp(\mathrm{x}\beta + \frac{\sigma^2}{2}) \tag{1}$$

where y is the dependent variable (monthly expenditure on vitamin supplements), $\mathbf{x}$ refers to the independent variables (25–39 years, RM1,001–2,000, RM2,001–3,000, RM3,001–4,000, RM≥4,001, male gender, Chinese, Indian/Others, being married, tertiary-level education, and being employed), $\boldsymbol{\gamma}$ and $\boldsymbol{\beta}$ are estimates, and u and v are residuals. v is assumed to have a normal distribution, and it is independent of u.

In the amount equation, natural log was added to the dependent variable. Ordinary Least Square (OLS) was utilised to assess how much respondents spent on vitamin supplements per month. Only the respondents who consumed vitamin supplements, i.e., those reporting non-zero values, were used in the amount equation. The amount equation can be written as:

$$y = 1[\mathbf{x}\boldsymbol{\gamma} + v > 0]\exp(\mathbf{x}\boldsymbol{\beta} + u) \tag{2}$$

where σ^2 is the variance. The conditional expectation of y is assumed to have a lognormal distribution. The details of the lognormal hurdle model were described elsewhere (Wooldridge, 2010). In terms of a diagnostic test, variance inflation factor (VIF) was used to detect potential multicollinearity problem. The significance level of $p < 0.05$ was selected. All the analyses were performed using Stata statistical software (StataCorp, 2019).

RESULTS AND DISCUSSION

Descriptive statistics of all the variables are presented in Table 1. Of the total 430 respondents, only 295 (68.6%) consumed vitamin supplements. The majority of respondents were 18–24 years (75.1%), followed by those of 25–39 years (24.9%). More than half of the respondents had an income of ≤RM1,000 (68.4%), while only a small percentage had RM3,001–4,000 (5.8%). Most of the respondents were females (78.6%). The ethnic breakdown consisted of 13.3 percent Malay, 83.7 percent Chinese, and 3 percent Indian/Others. A large proportion of respondents were unmarried (82.8%), well-educated (85.1%), and unemployed (77.2%).

Sociodemographic variations in the average monthly expenditure on vitamin supplements are shown in Table 2. Respondents aged 25–39 years spent around RM173 on vitamin supplements, whereas those aged 18–24 years spent only RM99. Of all the income groups, respondents in the RM3,001–4,000 group had the highest expenditure on vitamin supplements (RM226), while those in the ≤RM1,000 group had the lowest expenditure (RM85).

The average monthly expenditure on vitamin supplements among females was around RM129, compared to RM73 among males. Expenditure on vitamin supplements among Chinese was the highest (RM130), followed by Malay (RM50), and Indian/Others (RM48). On average, married and unmarried respondents spent around RM212 and RM98 on vitamin supplements, respectively. Expenditure on vitamin supplements was higher among respondents without tertiary-level education (RM183) and employed respondents (RM194) than those with tertiary-level education (RM106) and the unemployed (RM95). These significant sociodemographic differences in the average monthly expenditure on vitamin supplements provided support for the use of multiple regressions.

Table 2

Average Monthly Expenditure on Vitamin Supplements (RM) (N = 430)

Variables	Mean	Std. dev.	F-statistics#
Age (year)			
18–24	98.88	144.79	20.29*
25–39	173.18	156.85	
Income (RM)			
≤1,000	85.04	121.25	13.43*
1,001–2,000	146.46	148.51	
2,001–3,000	205.79	214.91	
3,001–4,000	225.60	191.77	
≥4,001	195.19	176.53	
Gender			
Male	73.08	110.03	10.27*
Female	129.43	158.54	
Ethnicity			
Malay	49.53	58.25	8.79*
Chinese	130.61	159.87	
Indian/Others	48.31	63.41	
Marital status			
Married	212.30	154.74	38.32*
Unmarried	97.64	142.89	
Education			
Tertiary	105.93	143.50	14.54*
Non-tertiary	182.81	176.56	
Employment status			
Employed	193.98	197.22	35.20*
Unemployed	94.76	126.35	

Note: *Significance at the 5% level ($p < 0.05$). #test of equality of mean.

Results related to factors associated with consumption and amount decisions of vitamin supplements are illustrated in Table 3. The likelihood ratio and f-statistics of the lognormal hurdle model were highly significant, implying that all the selected independent variables were jointly significant in affecting the dependent variable.

Table 3

Consumption and Amount Decisions of Vitamin Supplements (n = 430)

Variables	Consumption Coefficients	Marginal effects	Amount Coefficients
Constant	0.230 (0.308)	–	4.243 (0.178)*
Age (years)			
18–24	Ref.	Ref.	Ref.
25–39	-0.086 (0.253)	-0.060 (0.092)	-0.012 (0.147)
Income (RM)			
≤1,000	Ref.	Ref.	Ref.
1,001–2,000	0.231 (0.263)	0.106 (0.077)	0.360 (0.134)*
2,001–3,000	-0.026 (0.357)	0.032 (0.121)	0.607 (0.237)*
3,001–4,000	0.188 (0.423)	0.079 (0.129)	0.650 (0.217)*
≥4,001	0.147 (0.404)	0.118 (0.115)	0.388 (0.243)
Gender			
Male	-0.467 (0.161)*	-0.201 (0.061)	-0.111 (0.132)
Female	Ref.	Ref.	Ref.
Ethnicity			
Malay	Ref.	Ref.	Ref.
Chinese	-0.043 (0.202)	0.007 (0.069)	0.533 (0.123)*
Indian/Others	-0.426 (0.401)	-0.182 (0.155)	0.337 (0.215)
Marital status			
Married	0.808 (0.317)*	0.241 (0.070)	0.317 (0.166)
Unmarried	Ref.	Ref.	Ref.
Education			
Tertiary	0.378 (0.228)	0.139 (0.089)	-0.289 (0.131)*
Non-tertiary	Ref.	Ref.	Ref.
Employment status			
Employed	0.132 (0.311)	0.084 (0.102)	0.143 (0.165)
Unemployed	Ref.	Ref.	Ref.
Likelihood ratio	39.574	–	–
p-value	<0.001	–	–
F-statistics	–	–	15.650
p-value	–	–	<0.001
Maximum VIF	3.470	–	–

Note: Ref. refers to reference group. *Significance at the 5% level ($p < 0.05$). Robust standard errors in parentheses.

Furthermore, the maximum VIF was less than ten, indicating that multicollinearity was not an issue (Wooldridge, 2013). The constant was insignificant in the consumption equation but was significant in the amount equation. This finding showed that there could be unobservable variables possibly affecting the amount decision of vitamin supplements. These variables include genetics and health.

Individuals with incomes of RM1,001–2,000, RM2,001–3,000, and RM3,001–4,000 spent 36 percent, 60.7 percent, and 65 percent more on vitamin supplements, respectively, compared to those with an income of ≤RM1,000. These results indicated that expenditure on vitamin supplements was positively correlated with income. Similar findings were evidenced in previous studies, which focused on consumption of health supplements, preventive medical care, and health-promoting goods and services (Kim et al., 2010; Al-Naggar & Chen, 2011; Cheah, 2013; 2014; 2015; Gong et al., 2018; Mohd Zaki et al., 2018; Loo et al., 2020; Mohd Ashri et al., 2021). A plausible explanation for this outcome is straightforward. Since vitamin supplement is expensive, low-income earners tend to find it unaffordable. They would rather spend on necessities, such as foods, housing, and clothing, than dietary supplements. Another reason is that higher-income people can earn more money than lower-income people if they are healthy (Grossman, 1972). As such, higher-income people have a higher incentive to invest in their health by spending more on vitamin supplements. With the availability of data, a future study can estimate the income elasticity of demand for vitamin supplements. Therefore, one can better understand whether vitamin supplement is a normal good and sensitive to income change.

Gender was significantly correlated with the consumption decision of vitamin supplements. More specifically, males were 20.1 percent less likely to consume vitamin supplements than females. This finding was consistent with those of previous studies suggesting that being female was associated with increased consumption of health-related goods (Kim et al., 2010; Pouchieu et al., 2013; Cheah, 2014; 2015; Gong et al., 2018; Mohd Zaki et al., 2018; Mohd Ashri et al., 2021). Generally, females are more concerned about their health than males and consequently tend to spend more on vitamin supplements (Mohd Ashri et al., 2021).

There were ethnic differences in expenditure on vitamin supplements. Compared to Malays, Chinese spent 53.3 percent more on vitamin supplements. Of all the ethnic groups, Chinese spent the most on vitamin supplements in a month. A previous study conducted in Malaysia also found a significant relationship between ethnicity and consumption of health-promoting goods and services (Cheah, 2014). Nonetheless, the study found higher odds of consuming health-promoting goods and services in the Malay ethnic group than Indian and other ethnicities. One can therefore conclude that there could be cultural and religious variations in the preference for vitamin supplements. This conclusion needs to be further supported by empirical evidence. Exploring culture or religion as a mediator of the relationship between ethnicity and demand for vitamin supplements could be a direction for future research as this could offer more information about the role of ethnicity in vitamin supplements consumption.

The finding on marital status was noteworthy. Although the amount decision of vitamin supplements was not affected by marriage, married respondents were 24.1 percent more likely to consume vitamin supplements compared to their unmarried counterparts. This finding lent support to the evidence from previous studies related to consumption of health-related goods (Cheah, 2013; 2014; Mohd Ashri et al., 2021). A plausible explanation for this finding is that married people tend to put more efforts into improving their health than unmarried people as they carry more responsibilities for taking care of their family members (Cheah, 2013). In other words, household commitment encourages health-enhancing behaviour.

In terms of education, individuals with tertiary-level education spent 28.9 percent less on vitamin supplements when compared to those without tertiary-level education. This finding indicated that although education improves health awareness, a higher educational level is associated with lowered expenditure on vitamin supplements. This contrasted with the findings from previous studies, which showed more educated consumers to be more likely to use dietary supplements, preventive medical care, and health-enhancing goods and services than less-educated consumers (Pouchieu et al., 2013; Cheah, 2013; 2014; Gong et al., 2018; Mohd Zaki et al., 2018). A likely explanation for the present study’s finding is that well-educated individuals may prefer to use other methods to improve their health, such as participation in physical activity and adopting a healthy diet, rather than vitamin supplements. This explanation should be verified in future qualitative and quantitative studies when more data related to education and consumption of vitamin supplements are available.

The bivariate analysis results showed significant age and employment status differences in expenditure on vitamin supplements. Nevertheless, after controlling other sociodemographic factors, these variables were not correlated with both consumption and amount decisions of vitamin supplements, indicating that age and employment status factors did not have independent effects on vitamin supplement spending. These findings suggest that being older and employed do not necessarily lead to an increased consumption of vitamin supplements, even though these factors may be correlated with health awareness. Older and employed individuals may use other methods to improve their health.

CONCLUSIONS AND RECOMMENDATIONS

In view of the important role of vitamins in disease prevention, the present study used a rigorous statistical approach to examine the influences of sociodemographic factors on expenditure on vitamin supplements with a focus on youth in Malaysia. Drawing from primary survey data, the present study found that income, gender, ethnicity, marital status, and education were associated with expenditure on vitamin supplements. Particularly, youth were more likely to consume or spend more on vitamin supplements if they were higher-income earners, female, Chinese, married, and less educated. Several policies directed towards promoting the use of vitamin supplements are suggested in light of the findings from the present study. First, given that males were less likely to spend on vitamin supplements than females, it is worthwhile for the government to introduce various health awareness programmes with the aim of providing the male population with information on the benefits of vitamin supplements. Details about how vitamin supplements can help to improve men's health could be highlighted in the programmes.

Second, the influence of marital status should not be ignored if the goal of increasing the use of vitamin supplements among the Malaysian population is to be achieved. A specific intervention measure could be aimed at improving health knowledge among individuals who are single, widowed, or divorced. The purpose is to ensure that these individuals would be more aware of the benefits of vitamins.

Third, there is an urgent need to promote the consumption of vitamin supplements in the low-income segment of the population. One of the demotivating factors for consuming vitamin supplements is the high price. Low-income earners may have a higher tendency to allocate their income to necessities rather than health supplements. The government may want to consider providing low-income earners with health supplement subsidies or vouchers. This could be seen as an incentive for low-income earners to purchase vitamin supplements.

Fourth, a recent nationwide health awareness programme carried out by the Ministry of Health Malaysia, *Komuniti Sihat Perkasa Negara* (KOSPEN), could take into consideration the findings from the present study. This programme is a part of the National Strategic Planning initiative. Its main objective is to lower the prevalence of NCDs and risk factors and promote healthy behaviours, such as adopting a physically active lifestyle and practising healthy eating behaviour, among the community members. With the findings of the present study, this programme could focus specifically on promoting the use of vitamin supplements in the cohorts of the population, which have low consumption expenditure on vitamin supplements. As a suggestion, health professionals and agents in this programme could make an extra effort to educate the targeted population about the advantages of vitamin supplements as well as on how to consume them. Providing the targeted population with free samples of vitamin supplements is also worthy of consideration. Although the present study has important contributions to the literature and policy, it is not without limitations. First, due to the small sample size and non-probability sampling, the data used in the present study may not be representative. Second, all the information is self-reported by respondents, thus minor reporting errors may exist. Third, owing to data limitations, some health and lifestyle variables that may affect the consumption and amount decisions of vitamin supplements could not be included in the analyses. A future study could use panel data to explore the causal effects of health and lifestyle variables on the intake of vitamin supplements.

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