
Factors Associated with Household Expenditure on Meat: Evidence from Malaysia

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Abstract - The objective of the present study is to examine sociodemographic and household factors associated with expenditure on meat among households in Malaysia. A seemingly unrelated regression (SUR) was utilised to analyse the associations between household expenditure on fresh and processed meat, and household heads' sociodemographic and household characteristics. Compared to households headed by younger individuals, households headed by older individuals spent more on fresh meat. Households with less-educated heads spent less on fresh and processed meats than households with well-educated heads. Larger households and households headed by employed individuals spent more on processed meat compared with smaller households and households headed by unemployed individuals. Urban households spent less on fresh meat but spent more on processed meat relative to rural households. Meat consumption expenditure varies significantly across sociodemographic and household factors. Findings of the present study are useful in formulation of policy to reduce meat consumption expenditure.

Keywords – consumption, demographics, expenditure, household, meat

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I. Introduction

Meat plays an important role in diet as it provides high quality protein for human. Protein is the building block of cells, thus it is essential for human growth and development. On average, an adult needs about 0.8 gram (g) of protein per kilogram (kg) of bodyweight per day (Lonnie et al., 2018). Meat protein is claimed to be

better than plant-based protein because it has complete essential amino acids profile (Hoffman & Falvo, 2004). Meat protein is also easier to be absorbed by human body compared with plant-based protein (Hoffman & Falvo, 2004). Thereby, people tend to incorporate more meat in their diet in an effort to boost their protein intake.

While meat is beneficial to health, excessive consumption of it, especially processed meat can lead to various chronic diseases (Sinha, Cross, Graubard, Leitzmann, & Schatzkin, 2009). As pointed out by Clonan, Wilson, Swift, Leibovici, & Michelle (2015), in order to maintain a healthy life, an individual should limit his/her meat intake to no more than 70 g per day. Consuming more than 70 g of meat per day can elevate the risks of developing various cancers and heart diseases. An empirical study conducted in the United Kingdom (UK) show that individuals who seldom consume meat are 3-12% less likely to acquire cardiovascular disease, diabetes and colorectal cancer relative to their counterparts who often consume meat (Aston, Smith, & Powles, 2012). According to the World Cancer Research Fund, an individual should not consume more than 500 g of red meat per week and should consume very little processed meat because consumption of red and processed meat is strongly associated with cardiovascular disease induced death (Pan et al., 2012; World Cancer Research Fund, 2018).

Owing to rapid economic growth, there is a trend towards increasing consumption of meat in Malaysia. Similar to Western countries, the Malaysians' preference for meat has been increasing. As the Department of Statistics Malaysia shows, the average monthly household expenditure on meat increased from Ringgit Malaysia (RM) 41 in 1994 to RM 109 in 2019 (Department of Statistics Malaysia, 1994, 2010, 2015, 2017, 2020) (Table 1). Moreover, the per capita meat consumption increased from 52.02 kg in 2007 to 65.86 kg in 2014 (Department of Veterinary Services, 2020). This upward trend of meat consumption may raise several issues. First, due to the low availability of domestic meat production, there could be a problem related to excess demand for meat in the local market (Sheng, Shamsudin, Mohamed, Abdullah, & Radam, 2010). Second, the prevalence of meat-induced diseases may increase over time.

Table 1. Average monthly household expenditure on meat (in RM), 1994 – 2019

	1994	1999	2005	2010	2014	2016	2019
Meat	41	50	54	64	101	104	109

Source: Malaysian Household Expenditure Survey 1994, 2010, 2014, 2016, & 2019

In light of the negative consequences of excessive meat consumption, there are enormous studies that examine sociodemographic factors associated with the decisions of people to consume meat. However, such research has seldom been the focus in developing countries. To the best of our knowledge, only two studies related to meat consumption have been conducted in Malaysia, but these studies examined meat consumption pattern at macro level and did not identify how sociodemographic factors influenced meat consumption behaviour (Baharumshah & Mohamed, 1993; Sheng et al., 2010). Therefore, questions related to which groups of people or households in Malaysia consume more or less meat remain unanswered. The objective of the present study is to narrow this research gap by examining factors associated with consumption expenditure on meat among households in Malaysia. We equate consumption of meat with expenditure on meat. Consumption is the quantity demanded, while expenditure is the product of quantity demanded and price. We assume that the price of meat is fixed because meat is price-controlled item in Malaysia. Hence, changes in expenditure on meat are expected to be caused by changes in quantity demanded of meat instead of price of meat.

In the present study, two main factors are explored: (1) sociodemographic profiles; and (2) household characteristics. We attempt to contribute to the literature in several ways. First, the country of interest of the present study is a rapid developing country, Malaysia, where the meat consumption pattern converges toward that of Western countries and lacks empirical studies on meat consumption. Second, nationally representative data with a large sample size are used. Therefore, important findings can be generated. Third, we use a rigorous statistical method, i.e., seemingly unrelated regressions (SUR), to provide precise estimates of household expenditure on fresh and processed meat. Given specific values of sociodemographic and household variables, the expenditure on fresh meat is anticipated to be different from the expenditure on processed meat.

II. Theoretical Framework

In the present study, the health capital theory developed by Grossman (2000) is used as a theoretical framework for household expenditure on meat. Grossman (2000) claims that utility is determined by both health status and consumption of commodities. Given that being healthy can enhance individuals' well-being, health poses as a commodity, which is consumed to elevate utility. This argument is true in the sense that being suffered from diseases can yield disutility.

In general, consumers utilise the resources that they possess in order to maximise their utility. Since health depreciates over time, it is treated as a capital good with a depreciation rate. Therefore, the consumers' current health stock could determine their future health condition. Consumers tend to invest in their health with the aim of increasing their health stock. This health investment includes use of medical care, being physically active, as well as engagement in healthy diets. As such, excessive consumption of meat is disinvestment in health, which is the topic of this study.

According to Grossman's (2000) argument, income, education and age are the factors affecting health disinvestment. First, health disinvestment could increase absenteeism and reduces productive time, thus higher income consumers are less likely to disinvest in their health compared with lower income consumers because they face a higher opportunity cost of being suffered from illnesses. As such, higher income households may spend less money on meat when compared with lower income households. However, if meat is a normal good, higher income households may spend more on it.

Second, health disinvestment can be lowered by education. Health awareness and understanding skills are better among more-educated consumers than less-educated consumers. Also, more-educated consumers had a lower rate of time preference compared with their less-educated counterparts, and thus are more future oriented. Households headed by more-educated individuals are, therefore, expected to spend less on meat than households with less-educated heads, assuming their income is identical.

Third, health reduces with age due to biological process of aging. As a result, older consumers tend to have better health awareness and be more concerned about their health when compared with younger consumers, and consequently are less likely to disinvest in their health. Given this argument, households with older heads are anticipated to spend less on meat than those headed by younger individuals.

III. Methods

Data

The present study is a cross-sectional, correlational study that used secondary data from the Malaysian Household Expenditure Survey (HES) 2014, which is a nationwide survey conducted by the Department of Statistics Malaysia in 2014 (Department of Statistics Malaysia, 2015). The survey period was from 1st January 2014 until 31st December 2014. The main objective of the survey is to acquire an in-depth understanding of the expenditure behaviour among households in Malaysia. Even though the HES 2014 is not the latest survey, it has a very large sample size ($n = 14838$) and accurate information about household heads' characteristics and household profiles. Hence, the survey is appropriate to use in the present study.

The sampling frame used in the survey was similar to the Household Sampling Frame designed for the Population and Housing Census. It comprised Enumeration Blocks (EBs), i.e., geographical contiguous areas of land. The EBs were categorised into urban and rural areas based on the number of populations in gazetted areas. In particular, each EB consisted of 80-120 Living Quarters (LQs). The survey adopted a two-stage stratified sampling method. In the first stage, EBs were selected using probability proportionate to size (PPS) approach. In the second stage, systematic approach was used to choose LQs from each of the selected EBs. In addition, an effort was made to ensure that each LQ had an identical probability to be chosen. A total of 6283 EBs and 50187 LQs were selected. Exclusion criteria were institutional households, i.e., those staying at hotels, welfare homes, hospitals, and prisons.

The main language used in the questionnaire was Malay. It was translated to English, Chinese and Tamil languages. Face-to-face interview was conducted. All the interviewers had undergone proper training prior to conducting the interviews. In efforts to minimise data collection errors, the collected data were screened before they were used for analyses. More information about the HES 2014 was described elsewhere (Department of Statistics Malaysia, 2015).

Variables

The outcome variables used in the present study were monthly household expenditure on fresh meat and processed meat (in RM). The expenditure on these two types of meat was measured separately. Expenditure on meat is the product of quantity demanded of meat and price of meat. Since the market price of meat in Malaysia is controlled by government, changes in meat expenditure are mainly driven by changes in quantity demanded rather than changes in price. Expenditure on meat could thus be seen as a proxy for consumption of meat.

Because of the paucity of research related to expenditure on meat, the explanatory variables used in the present study were selected in light of previous studies on meat consumption. In particular, the explanatory variables consisted of household heads' sociodemographic characteristics (age, educational level, gender, marital status, employment status), and household profiles (household income, household size, household

location) (Fraser, Welch, Luben, Bingham, & Day, 2000; Schulze, Hoffmann, Kroke, & Boeing, 2001; Tseng & DeVellis, 2001; Park et al., 2005; Ricciuto, Tarasuk, & Yatchew, 2006; Olinto, Willett, Gigante, & Victora, 2010; Wang, Beydoun, Caballero, Gary, & Lawrence, 2010; Phuong, Cuong, & Mergenthaler, 2014; Clonan, Wilson, Swift, Leibovici, & Michelle, 2015; Clonan, Roberts, & Holdsworth, 2016; Schmid et al., 2017; Marques-Vidal, Waeber, Vollenweider, & Guessous, 2018). Since household heads played the main role in influencing consumption expenditure behaviour of household members, their sociodemographic characteristics were expected to be highly correlated with household expenditure pattern. Other studies have also used household heads' sociodemographic factors as explanatory variables (Bett, Musyoka, Peters, & Bokelmann, 2012; Phuong et al., 2014; Cheah, Abdul Adzis, Abu Bakar, & Applanaidu, 2019; Cheah, Abdul Adzis, Abu Bakar, & Applanaidu, 2020) (Table 2).

Table 2. Definition of variables (n = 14838)

Variables	Definition
<i>Dependent</i>	
Fresh meat	Monthly household expenditure on fresh meat (in RM)
Processed meat	Monthly household expenditure on processed meat (in RM)
<i>Independent</i>	
<i>Age</i>	
≤29 years	Household head aged ≤29 years
30-39 years	Household head aged 30-39 years
40-49 years	Household head aged 40-49 years
50-59 years	Household head aged 50-59 years
≥60 years	Household head aged ≥60 years
<i>Education</i>	
No formal	Household head has no formal education
Primary	Household head has primary-level education (<7 years of schooling)
Secondary	Household head has secondary-level education (7-11 years of schooling)
Tertiary	Household head has tertiary-level education (≥12 years of schooling)
<i>Income</i>	
≤RM 1499	Monthly household income is ≤RM 1499
RM 1500-2999	Monthly household income is RM 1500-2999
RM 3000-4499	Monthly household income is RM 3000-4499
RM 4500-5999	Monthly household income is RM 4500-5999
RM 6000-7499	Monthly household income is RM 6000-7499
≥RM 7500	Monthly household income is ≥RM 7500
<i>Gender</i>	
Male	Household head is male
Female	Household head is female
<i>Household size</i>	
Small	Household size is small (≤4 members)
Medium	Household size is medium (5-7 members)
Large	Household size is large (≥8 members)
<i>Marital status</i>	
Single	Household head is single
Married	Household head is married
Widow/divorce	Household head is widowed or divorced
<i>Employment status</i>	
Employed	Household head is employed
Unemployed	Household head is unemployed
<i>Household location</i>	
Urban	Urban household
Rural	Rural household

Source: Malaysian Household Expenditure Survey 2014

Household heads' age was categorised into five groups: ≤29, 30-39, 40-49, 50-59 and ≥60 years. Four categories of household heads' educational levels were formed: no formal education, primary-level (<7 years of schooling), secondary-level (7-11 years) and tertiary-level (≥12 years). Monthly household income was divided into six categories: ≤RM 1499, RM 1500-2999, RM 3000-4499, RM 4500-5999, RM 6000-7499 and ≥RM 7500. Household size was broken down into three categories: small (≤4 members), medium (5-7 members) and

large (≥ 8 members) (Mok, Maclean, & Dalziel, 2011). Household heads' marital status was categorised into single, married and widowed/divorced. Household heads' employment status comprised employed and unemployed, while household location consisted of urban and rural.

Statistical Analyses

Descriptive statistics of all the variables were computed. In addition, the average monthly household expenditures on fresh and processed meat across household heads' sociodemographic and household characteristics were assessed. We used non-parametric trend test to examine the trends in these expenditures (Cuzick, 1985). In terms of multiple regressions, we used a linear system of equations to analyse household expenditure on each type of meat. Specifically, we developed a SUR, i.e., a model with more than one linear equation, and estimated it using feasible generalized least squares (FGLS) (Wooldridge, 2010). Since the present study had two outcome variables, there were two equations in SUR, which could be expressed as:

$$\begin{aligned} y_1 &= \beta_{10} + \beta_{11}x_1 + \beta_{12}x_2 + \beta_{13}x_3 + \dots + \beta_{119}x_{119} + \varepsilon_1 \\ y_2 &= \beta_{20} + \beta_{21}x_1 + \beta_{22}x_2 + \beta_{23}x_3 + \dots + \beta_{219}x_{219} + \varepsilon_2 \end{aligned} \quad (1)$$

where y_1 is monthly household expenditure on fresh meat; y_2 is monthly household expenditure on processed meat; x_1 is age of 30-39; x_2 is age of 40-49; x_3 is age of 50-59; x_4 is age of ≥ 60 ; x_5 is no formal education, x_6 is primary-level education; x_7 is secondary-level education; x_8 is income of RM 1500-2999; x_9 is income of RM 3000-4499; x_{10} is income of RM 4500-5999; x_{11} is income of RM 6000-7499; x_{12} is income of \leq RM 7500; x_{13} is being male; x_{14} is medium family; x_{15} is large family; x_{16} is being married; x_{17} is being widowed/divorced; x_{18} is being employed; x_{19} is urban household.

Equation 1 could be rewritten as a matrix form:

$$\begin{aligned} y_1 &= \mathbf{x}_1\boldsymbol{\beta}_1 + \varepsilon_1 \\ y_2 &= \mathbf{x}_2\boldsymbol{\beta}_2 + \varepsilon_2 \end{aligned} \quad (2)$$

The SUR model of Equation 2 was expressed as:

$$y_i = \mathbf{X}_i\boldsymbol{\beta} + \varepsilon_i \quad (3)$$

where

$$y_i = \begin{pmatrix} y_{i1} \\ y_{i2} \end{pmatrix}, \mathbf{X}_i = \begin{pmatrix} x_{i1} & 0 \\ 0 & x_{i2} \end{pmatrix}, \boldsymbol{\beta} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix}, \varepsilon_i = \begin{pmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \end{pmatrix} \quad (4)$$

In addition, chi-squared test was conducted to examine the overall significance of the regression model. The 5% level of significance was selected. We used the Stata statistical software to perform all the statistical analyses because it can handle a large number of variables and observations (StataCorp, 2019).

IV. Results

On average, a Malaysian household spent about RM 77.76 and RM 14.69 on fresh and processed meat per month, respectively, indicating that Malaysians tended to spend more money in fresh meat than processed meat. This may be because fresh meat is more expensive than processed meat. For instance, a kg of fresh beef costs about RM 32.45, whereas a kg of processed beef costs around RM 15.21 only. Household heads' age breakdown consisted of 9.5% ≤ 29 years, 22.7% 30-39 years, 28% 40-49 years, 23.6% 50-59 years and 16.3% ≥ 60 years. The majority of household heads had secondary-level education, followed by those with tertiary-level, primary-level and no formal education. Approximately 21.5-23.6% of households had income of RM 1500-2999, RM 3000-4499 or \geq RM 7500, whilst only 7.7-9.5% had income of \leq RM 1499 or RM 6000-7499. The majority of households were headed by males, married individuals and the employed. In terms of household size, more than half of households were small, whilst only 35.6% and 6.6% were medium and large, respectively. A large proportion of households were located at urban areas (Table 3).

Table 3. Descriptive statistics of variables (n = 14838)

Variables	Mean / Percent	Std. dev. / Frequency
<i>Continuous</i>		
Fresh meat	77.76	79.01
Processed meat	14.69	25.79
<i>Categorical</i>		
Age		
≤29 years	9.47	1405
30-39 years	22.66	3362
40-49 years	27.98	4151
50-59 years	23.61	3503
≥60 years	16.29	2417
Education		
No formal	4.42	656
Primary	17.58	2609
Secondary	56.69	8412
Tertiary	21.30	3161
Income		
≤RM 1499	7.65	1135
RM 1500-2999	23.58	3497
RM 3000-4499	21.48	3186
RM 4500-5999	14.39	2135
RM 6000-7499	9.54	1415
≥RM 7500	23.36	3465
Gender		
Male	84.78	12580
Female	15.22	2258
Household size		
Small	57.69	8560
Medium	35.56	5277
Large	6.75	1001
Marital status		
Single	12.08	1793
Married	79.09	11735
Widow/divorce	8.83	1310
Employment status		
Employed	92.51	13727
Unemployed	7.49	1111
Household location		
Urban	69.05	10246
Rural	30.95	4592

Note: For continuous variables, the values refer to mean and standard deviation. For categorical variables, the values refer to percent and frequency.

Source: Malaysian Household Expenditure Survey 2014

On average, households with heads aged 50-59 years spent the most on fresh meat, while households with heads aged 40-49 spent the most on processed meat. Household with secondary- or tertiary-educated heads spent more on fresh meat and processed meat compared with those having heads with no formal education. Households that were in the lowest income group spent the most on fresh meat. Household size was positively correlated with expenditure on processed meat. Having male, single and employed household heads were associated with an increase in expenditure on processed meat. Rural households spent more on processed meat than urban households (Table 4).

Table 4. Average monthly household expenditure on fresh and processed meat (n = 14838)

Variables	Fresh meat	Processed meat
Age		
≤29 years	74.20 (83.54)	15.58 (38.72)

30-39 years	76.75 (83.09)	16.01 (23.98)
40-49 years	78.50 (80.43)	16.23 (23.74)
50-59 years	79.06 (73.76)	14.76 (25.26)
≥60 years	78.10 (75.31)	9.56 (22.07)
<i>p</i> for trend	0.010	<0.001
Education		
No formal	73.87 (80.25)	8.46 (16.39)
Primary	77.20 (84.09)	9.96 (20.88)
Secondary	78.43 (79.86)	14.38 (25.90)
Tertiary	77.25 (71.84)	20.70 (29.30)
<i>p</i> for trend	0.005	<0.001
Income		
≤RM 1499	80.57 (74.97)	14.19 (22.27)
RM 1500-2999	77.57 (74.79)	14.43 (25.13)
RM 3000-4499	77.18 (72.63)	15.03 (24.06)
RM 4500-5999	81.10 (94.70)	15.14 (24.91)
RM 6000-7499	77.63 (74.89)	13.83 (22.19)
≥RM 7500	75.58 (81.09)	14.85 (30.51)
<i>p</i> for trend	0.006	0.607
Gender		
Male	77.65 (78.61)	14.91 (26.29)
Female	78.38 (81.27)	13.45 (22.79)
<i>p</i> for trend	0.732	0.006
Household size		
Small	77.36 (83.82)	13.22 (22.55)
Medium	78.21 (71.77)	16.47 (29.25)
Large	78.86 (72.90)	17.80 (30.93)
<i>p</i> for trend	0.138	<0.001
Marital status		
Single	75.81 (80.79)	15.27 (28.42)
Married	77.94 (76.73)	15.09 (25.89)
Widow/divorce	78.87 (95.09)	10.27 (20.09)
<i>p</i> for trend	0.337	<0.001
Employment status		
Employed	77.69 (78.55)	15.18 (26.28)

Unemployed	78.69 (84.57)	8.61 (17.59)
<i>p</i> for trend	0.547	<0.001
Household location		
Urban	76.96 (77.03)	10.41 (24.69)
Rural	79.55 (83.25)	16.60 (26.04)
<i>p</i> for trend	0.569	<0.001

Note: Standard deviations in parentheses. *p* for trend refers to probability value of non-parametric test for trend. The 5% level of significance is chosen.

Source: Malaysian Household Expenditure Survey 2014

Chi-squared statistics was highly significant, indicating that all the independent variables were jointly significant in explaining the dependent variable. Compared to households headed by individuals aged ≤ 29 years, households with heads aged 50-59 years spent more on fresh meat. Households having heads with no formal education spent less on fresh and processed meat relative to households having heads with tertiary-level education. Households with heads who had primary- and secondary-level education spent less on processed meat compared with their counterparts which were headed by individuals who had tertiary-level education. Households having income of \geq RM 7500 spent less on fresh meat than households with income of \leq RM 1499. In terms of household size, medium and large households spent more on processed meat compared with small households. Households with employed heads spent more on processed meat than households with unemployed heads. Although urban households spent less on fresh meat than rural households, they spent more on processed meat (Table 5).

Table 5. An estimated SUR model for monthly household expenditure on fresh and processed meat (n = 14838)

Variables	Fresh meat	Processed meat
Constant	80.53* (4.77)	11.86* (1.53)
Age		
≤ 29 years	Ref.	Ref.
30-39 years	2.39 (2.62)	-0.17 (0.84)
40-49 years	3.99 (2.66)	0.62 (0.85)
50-59 years	4.98* (2.74)	0.57 (0.88)
≥ 60 years	4.81 (3.16)	-1.32 (1.01)
Education		
No formal	-6.83* (3.65)	-8.47* (1.17)
Primary	-2.84 (2.32)	-8.36* (0.75)
Secondary	0.16 (1.69)	-5.77* (0.54)
Tertiary	Ref.	Ref.
Income		
\leq RM 1499	Ref.	Ref.
RM 1500-2999	-2.82 (2.69)	0.20 (0.86)
RM 3000-4499	-3.24 (2.73)	0.80 (0.87)
RM 4500-5999	0.78 (2.90)	0.93 (0.93)
RM 6000-7499	-2.82 (3.14)	-0.41 (1.01)

≥RM 7500	-4.75* (2.70)	0.57 (0.87)
Gender		
Male	-1.26 (2.17)	-0.64 (0.70)
Female	Ref.	Ref.
Household size		
Small	Ref.	Ref.
Medium	0.50 (1.46)	2.67* (0.47)
Large	0.95 (2.69)	5.31* (0.86)
Marital status		
Single	Ref.	Ref.
Married	0.54 (2.30)	0.82 (0.74)
Widow/divorce	0.91 (3.25)	-1.22 (1.04)
Employment status		
Employed	-0.61 (2.84)	3.11* (0.91)
Unemployed	Ref.	Ref.
Household location		
Urban	-3.13* (1.48)	4.73* (0.47)
Rural	Ref.	Ref.
Chi-squared statistics [#]		550.38*

Note: Ref. refers to reference category. [#]Chi-squared test for the overall significance of the model. Standard errors in parentheses. * $p < 0.05$.

Source: Malaysian Household Expenditure Survey 2014

V. Discussion

The present study is the first to our knowledge to offer insight into the associations between sociodemographic and household factors, and expenditure on meat among Malaysian households using large nationwide survey data. SUR was adopted to estimate household expenditure on fresh and processed meat. According to non-parametric trend test, there were significant differences in the mean of household expenditure on meat across age, educational levels, income, gender, household size, marital status, employment status, and household location. These significant trends provided support for the use of regression, which could offer more precise results.

In the regression, we found that household heads' age, educational levels and employment status, as well as household income, household size and household location were independently associated with household expenditure on meat. However, the relationships between marital status and gender, and household expenditure on meat were insignificant in the regression. It can, thus, be concluded that household expenditure behaviour of meat is not influenced by household heads' marital status and gender, independently of other sociodemographic factors. We recognize that price of meat in Malaysia is likely to be the same throughout the country. Hence, changes in expenditure mostly result from changes in amount consumed instead of changes in price. This indicates that expenditure on meat is a proxy for consumption of meat.

Owing to the lack of studies on household expenditure on meat, we interpret our measured results, in light of previous findings on consumption of meat. Age was found to be associated with expenditure on meat. In particular, compared to households with heads aged ≤ 29 years, those headed by individuals aged 50-59 years spent more on fresh meat. These households also had the highest expenditure on fresh meat. However, the differences in other age groups were insignificant. On one hand, our findings were consistent with a study by Hielkema & Lund (2021), which found older consumers to be less likely to reduce meat intake than younger consumers. Our findings, on the other hand, contradicted those of other studies. For instance, Park et al. (2005) using the Hawaiian data found that older people were less probable to consume meat than their younger counterparts, Ricciuto et al. (2006) found likewise that proportion of people aged ≥ 65 years was negatively

associated with consumption of high fat meat in Canada, and Tseng & DeVellis (2001), who made use of the health and nutrition survey in the United States (US), found that age was related to a decreased intake of red meat. Based on our findings, we conclude that older people may not necessarily have a lower preference for meat than their younger counterparts, even though they have poorer health condition. Because of data limitation, the actual reason that explains the association between age and meat expenditure remain unclear. Further examinations of this association should, therefore, be planned for a qualitative study.

Households headed by well-educated individuals spent more on meat, especially processed meat compared with households headed by less-educated individuals. The money spent on processed meat seemed to increase with educational levels. This evidence was consistent with Oluwatusin et al. (2019), who found that household heads' educational levels increased with household expenditure on meat in Nigeria. Our findings were, however, in contrast to those of previous studies in the US (Tseng & DeVellis, 2001; Park et al., 2005; Wang et al., 2010), Germany (Schulze et al., 2001), Canada (Ricciuto et al., 2006), England (Fraser et al., 2000), and China (Zhang, Wang, & Martin, 2018). For example, Wang et al. (2010) found that well-educated individuals were less likely to consume meat than less-educated individuals, Schulze et al. (2001) found that educational level was negatively associated with consumption of processed meat, Fraser et al. (2000) observed that individuals with higher educational attainment consumed less meat than those having lower educational attainment, and Zhang et al. (2018) found no significant relationship between education and meat expenditure. A likely explanation for our findings is that well-educated individuals tend live a more stressful and hectic lifestyle compared with less-educated individuals (Koopman, Wanat, & Whitsell, 2003). Hence, they may opt for pleasurable foods, such as processed meat (Yau & Potenza, 2013). Also, they may have a better financial capability to purchase fresh meat. Our findings lead to a conclusion that while well-educated people have better health awareness than less-educated people, they may spend more on processed and fresh meat. As such, a nationwide policy directed towards reducing expenditure on processed and fresh meat among households headed by well-educated people could be given consideration.

There appeared to be household income differences in expenditure on meat. In particular, we found that higher income households (\geq RM 7500) spent less on fresh meat than lower income households (\leq RM 1499). Households of the highest income group also had the lowest expenditure on fresh meat. Previous studies that were conducted elsewhere suggested otherwise. In Vietnam, Phuong et al. (2014) using a household survey found that meat consumption increased with household income. Similarly, Olinto et al. (2010) reported that higher income Brazilians had a higher likelihood of consuming meat than their lower income counterparts. Ricciuto et al. (2006) shared similar findings in Canada. Using data from various countries across the globe, Milford, Mouel, Bodirsky, & Rolinski (2019) also found that income per capita was positively associated with meat consumption per capita. A conclusion drawn from our finding is that although meat is more affordable for high income earners than low income earners, high income earners may be more aware of their health. Additionally, we argue that expenditure on meat in Malaysia does not depend heavily on income because not all the income groups are independently associated with meat expenditure. We suggest policy makers to pay special attention to low income households with the aim of reducing fresh meat expenditure. However, if the focus of policy is lowering expenditure on processed meat, income factor should not be given too serious consideration because it is insignificant.

Household size was positively associated with household expenditure on meat. Specifically, large and medium households spent more on processed meat compared with small households. This is simply because a large household size is linked to a large consumption of food. Sheng et al. (2010) showed likewise that household size was positively associated with demand for meat. Similar findings were evidenced by Schmid et al. (2017) and Ricciuto et al. (2006), who found that quantity of meat consumed increased with the number of household member. However, no significant relationship between household size and expenditure on meat was evidenced by Zhang et al. (2018) and Oluwatusin et al. (2019). An important policy implication of our finding is that an intervention strategy aimed at lowering processed meat expenditure among large and medium households could be worthy of consideration.

The relationship between employment status and consumption of meat was examined in a previous study by Tseng & DeVellis (2001). The authors found that being employed was associated with an increase in the intake of meat. Consistent with this, the present study showed that households with employed heads spent more on processed meat relative to households headed by unemployed individuals. More particularly, on average, households with employed heads spent about RM 15.18 on processed meat per month, whereas households headed by unemployed heads spent around RM 8.61 only. This could be due to the fact that employed individuals tend to live a more hectic lifestyle than the unemployed (Cheah & Goh, 2017), and thus are more likely to opt for easily prepared processed meat. In terms of policy implication, we suggest policy makers to make a concerted effort to reduce expenditure on processed meat among households headed by employed individuals.

Household location is another factor which has seldom been examined in the past. The present study is the first of its kind to provide insights into household location differences in expenditure on meat. Interestingly, we found that urban households spent more on processed meat but spent less on fresh meat compared with rural households. On average, if households located in urban areas instead of rural areas, their expenditure on processed meat increased by RM 4.73, whilst their expenditure on fresh meat reduced by RM 3.13. Our findings were comparable those of Hielkema & Lund (2021), which showed consumers living in urban areas to be more likely to reduce meat intake than those living in rural areas. We could relate our finding to hectic lifestyle rather than price factor because price of meat is likely to be the same in urban and rural areas in Malaysia. Family members in urban households usually adopt a busier lifestyle than those in rural households (Cheah & Poh, 2014). Thereby, they may prefer processed meat over fresh meat. As pointed out by Tan (2010), who examined household consumption of food-away-from-home (FAFH), urban households usually consumed more FAFH relative to rural households. Since FAFH is comprised of more processed meat, it is not surprising that urban households spend more on processed meat than rural households. Our findings appear to have important implications for policy. In order to reduce expenditure on processed meat, concentration could be given to urban households, but if lowering expenditure on fresh meat is the centre of interest, policy makers could pay special attention to rural households instead.

There seem to be several limitations. Longitudinal data was not used in the present study. Therefore, the causal relationships between sociodemographic and household variables, and expenditure on meat could not be well-identified. Furthermore, given that the data used in the present study are household data, it could not provide a very clear picture of individual consumption behaviour of meat. Moreover, although efforts had been made to improve the quality of the data, some minor reporting errors could not be avoided due to self-reports of information by respondents. Another limitation is that because the data do not have information on price of meat, we were unable to identify the exact quantity of meat purchased by households. Despite these limitations, the present study used nationally representative data and a rigorous statistical method to acquire extensive knowledge of how sociodemographic and household factors influence household expenditure on meat.

VI. Conclusion

Although the negative consequences of excessive consumption of meat are well-documented, it is still unclear about what factors that can explain the consumption expenditure of meat among households in Malaysia. This study throws new light on the relationships between household expenditure on meat and household heads' sociodemographic, and household characteristics. Using nationally representative data, the present study provides the evidence that household expenditure on meat is varied significantly by household heads' age, educational levels, employment status, as well as household income, household size and household location. These findings are important to support the development of policies related to meat consumption expenditure among households in Malaysia, especially in view of the fact that Malaysians often adopt an unhealthy eating lifestyle (Febian & Syed Anuar, 2020). While the government needs to ensure that domestic food processing industry is efficient and has consistent supply of meat (Mohd Salleh, 2017), this effort has to be taken carefully because it may also elevate the prevalence of meat-induced diseases. Therefore, the Ministry of Agriculture and Food Industries is suggested to work closely with the Ministry of Health in order to formulate effective and safe policies. In future studies pertaining to determinants of demand for meat, factors which have been examined in the present study should be taken into account as explanatory variables.

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