FOOD EXPENDITURE ON DIETS AND ITS RELATIONSHIP TO HEALTH RISK FACTORS AMONG NIGERIAN STUDENTS IN UNIVERSITI PUTRA MALAYSIA

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Abstract

Health risk factors have been highlighted among Nigerian students at Universiti Putra Malaysia, but the pattern of food expenditure on diets that are said to be a control measure for the prevalence of risk factors such as chronic diseases, obesity, diabetes, and hypertension has been poorly discussed. The purpose of this paper is to examine food expenditure on diets and its relationship to health risk factors among Nigerian students in Universiti Putra Malaysia. Cross-sectional research design was used and data for the study was obtained using structured questionnaire. A total of 236 Nigerian students' participants from Universiti Putra Malaysia aged 25-45 years consented to participate in this study and 233 were selected through systematic random sampling. Health conditions and personal risk factors were measured with the Institute for Public Health (2015) of National Health and Morbidity Survey (NHMS, 2011) questionnaire. The Center for Disease Control and Prevention (CDC); National Health and Nutrition Examination Survey (NHANES 2007-2008) of Flexible Consumer Behavior Survey (FCBS) on food expenditure questionnaire was used in measuring all food and beverages spending of respondents for the period of 30 days. The data collected was cleaned and entered into a database and analyzed using SPSS version 20. Descriptive analyses for continuous data were expressed in mean and standard deviation while categorical data were presented in percentage. Pearson correlation analyses were used to examine the relationship between food expenditure on diets and health risk factors. The findings of the study showed that 67% were males and 33% females. The association between health risk factors and food expenditure were positively weak, but significant $r = 0.14$, (231), $p < 0.05$. The findings suggested that an increase in food expenditure pattern on diets was significantly associated with a minimal increase in health risk factors. For an average student food expenditure on diets, this can lead to a real obstacle to healthy eating. The findings provided recommendations for food expenditure on diets and health risk factors interventions and policies aimed at University students.

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Keywords: Food expenditure patterns; Nutrition; Dietary Patterns; Cost of healthy diets; Health risk factors

Abstrak

Faktor risiko kesihatan telah disorotkan dalam kalangan pelajar Nigeria di Universiti Putra Malaysia, tetapi pola perbelanjaan makanan ke atas diet yang diperlihatkan sebagai ukuran kawalan bagi prevalens faktor risiko seperti penyakit kronik, obesiti, diabetes, dan hipertensi amat kurang diperbincangkan. Tujuan artikel ini adalah untuk meneliti perbelanjaan makanan ke atas diet dan hubungannya dengan faktor risiko kesihatan dalam kalangan pelajar Nigeria di Universiti Putra Malaysia. Reka bentuk keratan rentas telah digunakan dan data bagi kajian ini telah diperoleh menggunakan soal selidik berstruktur. Sebanyak 236 orang responden Nigeria dari Universiti Putra Malaysia berumur 25-45 tahun bersetuju untuk menyertai kajian ini dan 233 orang telah dipilih melalui persampelan rawak sistematik. Kondisi kesihatan dan faktor risiko personal telah diukur dengan soal selidik Tinjauan Morbiditi dan Kesihatan Kebangsaan (NHMS, 2011) Institut Kesihatan Awam (2015). Pusat Pencegahan dan Kawalan Penyakit (CDC); Tinjauan Peperiksaan Nutrisi dan Kesihatan Kebangsaan (NHANES 2007-2008) bagi Tinjauan Tingkah Laku Pengguna Fleksibel (FCBS) ke atas soal selidik perbelanjaan makanan telah digunakan bagi pengukuran semua makanan dan minuman yang dibelanjakan responden bagi tempoh 30 hari. Data yang dikumpul telah dibersih dan dimasukkan dalam pangkalan data dan dianalisis menggunakan SPSS versi 20. Analisis deskriptif bagi data berterusan telah diperlihatkan dalam min dan sisihan piawai manakala data kategorial telah diutarakan dalam peratusan. Analisis korelasi Pearson telah digunakan bagi meneliti hubungan antara perbelanjaan makanan ke atas diet dan faktor risiko kesihatan. Dapatan kajian menunjukkan bahawa 67% ialah lelaki dan 33% perempuan. Perkaitan antara faktor risiko kesihatan dengan perbelanjaan adalah positif lemah, tetapi signifikan $r = 0.14$, (231), $p < 0.05$. Dapatan kajian memperlihatkan bahawa peningkatan dalam pola perbelanjaan makanan ke atas diet secara signifikan berkaitan dengan peningkatan minimal dalam faktor risiko kesihatan. Bagi perbelanjaan makanan pelajar sederhana ke atas diet, hal tersebut mampu untuk membawa kepada halangan sebenar bagi sajian sihat. Dapatan memaparkan syor bagi perbelanjaan makanan ke atas diet dan intervensi dan polisi faktor risiko kesihatan yang ditujukan kepada pelajar universiti.

Kata kunci: Corak perbelanjaan makanan; Pemakanan; Corak Diet; Kos diet sihat; Faktor risiko kesihatan

Introduction

Health risk factors have been highlighted among Nigerian students at Universiti Putra Malaysia, but the pattern of food expenditure on diets that are said to be a control measure for the prevalence of risk factors such as chronic diseases, obesity,

diabetes, and hypertension has been poorly discussed. University students being considered as a potential national builder represents a population of most viable in terms of educational programs particularly in the field of nutritional health and food expenditure on diets. The global disease research study 2013 rated unhealthful diets and high body weight as the first and third contributors to morbidity and mortality rate (Newton, Briggs, Murray, Dicker, Foreman, Wang, & Vos, 2015). These includes low intakes of whole grains, fruits and vegetables, low-fat milk, nuts, fiber, and seeds, and high intakes of red and processed meat, sugar and sodium (Bates, Lennox, Prentice, Bates, Page, Nicholson, & Swan, 2014). In many cases, foods spending on less nutritious diets were mostly observed among the students who eat at retail food stores like restaurants, fast-food stores particularly Nigerian students in Universiti Putra Malaysia. It is believed that some students have not yet realized the importance of food expenditure in their daily lives. Despite these considerable physiological facts, student's food expenditure on diets is not based on the perception of food accessibility, food availability rather on price (Giskes, Van Lenthe, Brug, Mackenbach, & Turrell, 2007). Food price and tasty foods appears to be the key determinants of their dietary behavior for students whose food budget is below average. As a result, cheaper food seems to be an option for students to meet their daily nutritional requirements and, as such, the impact of cheaper food is known. Any increase or decrease in food prices has a greater impact on food spending decisions; particularly among low-income students (Rosenheck, 2008), as students who spend more on food should enjoy better healthy nutrients (Drichoutis, Lazaridis, & Nayga Jr, 2009). Studies have found that higher-quality diets are known to be associated with higher food expenditure (Rao, Afshin, Singh, & Mozaffarian, 2013; Rehm, Monsivais & Drewnowski, 2015). Many other studies have shown that the least source of calories is often low-nutrition energy-dense food that is relatively cheap (Drewnowski, 2010; Jones, Conklin, Suhrcke, & Monsivais, 2014). Good-tasting fats and sweets have also been found to be easily consumed in excess (McCrory, Saltzman, Rolls & Roberts, 2006), and, as such, have led to an increase in chronic diseases such as obesity, diabetes mellitus, heart disease, stroke, and hypertension, among other adverse health consequences that are causing serious and growing concern to health governments and medical specialists (Larson, Chen, Wall, Winkler, Goldschmidt, & Neumark-Sztainer, 2018; Schnettler, Miranda, Miranda-Zapata, Lobos, Denegri, Lapo, & Hueche, 2018). Given this background, this study was conducted to examine food expenditure on diets and its relationship to health risk factors among Nigerian students in Universiti Putra Malaysia. Though very few studies on food expenditure and dietary quality were carried out in Japan (Andrieu, Darmon, & Drewnowski, 2006; Murakami, Sasaki, Takahashi, & Uenishi, 2009; Okubo, Murakami & Sasaki, 2016) but have been unexplored among Nigerian students population in Universiti Putra Malaysia.

Methods

Study location and sampling

The study was conducted during the 2018-2019 academic session among Nigerian students studying in the Universiti Putra Malaysia, one of the best government tertiary Universities closed to the capital city, Kuala Lumpur, and next to the Malaysian administrative capital city Putrajaya. Cross-sectional research design was used and data for the study was obtained using structured questionnaire. A total of 236 Nigerian students aged 25-45 years consented to participate in the study and 233 participants were selected through systematic random sampling. Systematic sampling refers to a type of probability sampling in which every individual in the population list is selected for inclusion in the sample (Babbie, 2015). Data was selected on equal basis; beginning with a systematic random number from the population list.

Measurement instruments and data analysis

A questionnaire was designed to collect information from the respondents and comprises both open ended and closed ended questions. The questionnaire was structured into three (3) sections namely (a) Socio-demographic characteristic of the respondents (b) Health risk factors and (c) Food expenditure pattern. The researcher administered the structured questionnaire to the respondents. The permission to conduct the study was sought and obtained from the university ethnics, while informed consent was sought and obtained from all study participants.

Socio-demographic characteristic of the respondents

In the first section of the questionnaire, respondents were requested to tick in the box as much as relevant and the best options that describe their Socio-demographic background information. This includes (gender, age, marital status, education, employment status, monthly income, annual income, source of income, monthly expenditure, etc.).

General health risk assessment

The Institute for Public Health (2015) of National Health and Morbidity Survey (NHMS, 2011) questionnaire was adopted in measuring the overall health status and personal risk factors of the respondents. The (NHMS, 2011) survey was designed to examine adults, children's health, and nutritional conditions of Malaysians. Respondents were requested to fill in every of the lines and also tick in the box the best option that describe their general health status and personal risk factors in accordance to scale of measurement (Likert, 1932) ranging from; (a) Excellent = 4 (b)

Good = 3 (c) Poor = 2 (d) Undecided = 1 and other questions; (a) Undecided = 1 (b) No = 2 (c) Yes = 3 respectively.

Food expenditure assessments

The Center for Disease Control and Prevention (CDC); National Health and Nutrition Examination Survey (NHANES 2007-2008) of Flexible Consumer Behavior Survey (FCBS) module on food expenditure questionnaire was adopted for the assessment of all food and beverages spending of respondents for the period of 30 days. However, the consumer Behavior Survey (FCBS) module was added to the National Health and Nutrition Examination Survey (NHANES 2007-2008). The module was created in conjunction with the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) and provides information on food expenditure of respondents, as well as how much they spend on food away from home, ready to eat food, ready to cook food, beverages, fruits, and many others. The analysis methodology was selected and adopted based on the previous assessment of household food expenditure (Tang, Aggarwal, Liu, Acheson, Rehm, Moudon, & Drewnowski, 2016). Various festive seasons during the academic year and beginning of the school session have been taken into consideration. Respondents were requested to maintain and keep details of their household food expenditure for 30 days and record all the food spending on food items only.

Data Analysis

A bivariate analysis was conducted between food expenditure, health risk factors and socio-demographic variables to examine the differences between categories and the confounding potentials. Data collected were cleaned and entered into a database for analysis. The descriptive analysis for continuous data was expressed in mean and standard deviation while categorical data were presented in percentage. Pearson correlation analysis was used to examine the relationship between food expenditure and health risk factors. The SPSS IBM statistics version 20 software (IBM Corporation, Armonk, NY, USA) was used for statistical analysis.

Results and Discussion

Socio-demographic characteristic of the respondents

The results of the descriptive analysis showed that a total of 233 Nigerian students in Universiti Putra Malaysia were included in the study. More than half (67.0%) participants under this study were males and (33.0%) were females respectively (Table 1). The age of the participants falls between 25 to 45 years representing both graduate and postgraduate students with a mean average age of 2.1974 ± 0.7512. Most of the participants (64.0%) were married and (63.1%) were Master's degree

holders. Majority of the participants (63.9%) were working-class students and (30.9%) had only two people working in their family. The participant's summary monthly allowance was less than MYR 9000 and had a mean average of MYR1.571 ± 6402. On the other hand, the participant's annual savings was less than MYR 23000 with an average mean of MYR 1.180 ± 0.438. Also, (33.0%) source of income for participants under study were from businesses and (36.5%) were in the low middle class.

Table 1: Socio-demographic Characteristic of the Respondents

Variable	Frequency (%)
Gender	
Male	156 (67.0%)
Female	77 (33.0%)
Age (*Mean* age)	**2.197 ± 0.751 years (*SD*)**
25 – 31	47 (20.2%)
32 – 38	93 (39.9%)
39 – 40	93 (39.9%)
Marital Status	
Single	64 (27.9)
Widowed	4 (1.7%)
Divorced	8 (3.4%)
Separated	7 (3.0%)
Married	150 (64.0%)
Program of study	
Diploma	3 (1.3%)
Bachelor	80 (3.4%)
Master's	147 (63.1%)
PhD	3 (3.0%)
Source of Income	
Business	77 (33.0%)
Scholarship	12 (5.2%)
Salary	103 (44.2%)
Family Sponsor	40 (17.2%)
None Applicable	1 (4.0%)
Household Workforce	
One	64 (27.7%)
Two	72 (30.9%)
Three	35 (15.0%)
More than four	43 (18.2%)
None applicable	19 (8.2%)

Table 1 (continues)

Variable	Frequency (%)
Working Status	
No	84 (36.1%)
Yes	149 (63.9%)
Students' Income (*Mean*)	**MYR 1.571 ± 6402 (SD)**
< 3,000	119 (51.1%)
3,001 – 6,001	95 (40.8%)
6,002 – 9,000	19 (8.2%)
Yearly Savings (Mean)	**MYR1.180 ± 0.438 (SD)**
< 7,667	196 (84.1%)
7,668 – 15,335	32 (13.7%)
15,336 – 23,000	5 (2.7%)
Income Evaluation	
Poor	18 (7.7%)
Low Middle Income level	85 (36.5%)
Middle Income level	128 (52.8%)
High Middle Income level	5 (2.1%)
None Applicable	2 (0.9%)

General health risk assessments of the respondents

The general health risk factors of the respondents was assessed and summarized in Table 2. The descriptive findings of the study suggested 57.5% participants were in good health and 67.8% had good daily study performance during the past one (1) month. Most of the participants (52.4%) had good health screening and prevention measures for the past one (1) month. This suggested that majority of the respondents are health conscious and as well undergo periodic medical tests and health screening exercise to ascertain their health status. The findings observed 53.6% participants had good average sleep and 60.5% had good physical activity in the past one (1) month. Almost 82.4% participants were not on any special diet and probably may have good knowledge of food expenditure and dietary plan. Majority of the participant (79.8%) have not been advised by any physician or medical officer to lose weight and 49.4% participants do not follow healthy weight recommendations. Surprisingly, the findings suggested the need for health officers, dieticians, and other institutions to play a more active role in educating students especially Nigerian students in Universiti Putra Malaysia on the need to maintain a good healthy lifestyle and follow recommended weight maintenance. Though, the effect of poor weight maintenance and over weight is known. About 74.2% participants had no health-related problems and 58.4% have not taken any medicine in the past two (2) weeks (Table 2).

The present study in summary indicated that students were more health-conscious as studies reported that healthy behavior of students often follows them to their adulthood (Higgs and Thomas, 2016). Thus, the high percentage of student's health awareness could be attributed to a good knowledge of healthy life (Wardle, Haase, & Steptoe, 2006), nutrition (Krešić, Kenđel, Pavičić, Cvijanović, & Ivezić, 2009) and healthy diet (Yahia, Wang, Rapley, & Dey, 2016). However, Lee & Molassiotis (2002) proposed that nutrition knowledge is one of the driving factors for adherence to a healthy life. This assumption has been further reported between 18 and 24 years old adults, a significant number of university students shows long-term health effect and the health of their future families by developing healthy life habits, including dietary behavior (DeBate, Topping, & Sargent, 2001). Most university students reported that risk factors such as non-communicable chronic diseases are strongly correlated with lifestyle, predominantly dietary and physical inactivity (Katzmarzyk & Janssen, 2004; Geleijnse, Grobbee, & Kok, 2005; Popkin, Kim, Rusev, Du, & Zizza, 2006).

Table 2: General Health Risk Assessment of the Respondents

Category	Undecided %	Poor %	Good %	Excellent %
How would you rate your health?	0.4	9.0	57.5	33.0
In the past one(1) month, how would you rate your study daily performance.	1.3	9.0	67.8	21.9
In the past one (1)month, how would you describe your health screening and disease prevention.	12.9	17.9	52.4	17.6
In the past one (1) month, how would you rate your sleeping pattern.	4.7	21.0	53.6	20.6
How would you rate your physical exercise activities.	3.9	20.6	60.5	15.0
Category	**Undecided** %		**No** %	**Yes** %
Are you on any special diet?	3.4		82.4	14.2
Have you been advised by a doctor or assistant medical officer to lose weight	4.3		79.8	15.9
Do you maintain a healthy weight within the recommendation specified by health care.	10.7		49.4	39.9
Do you have any health problems?	6.4		74.2	19.3
Have you taken any medicine in the past two (2) weeks	9.4		58.4	32.2

Food expenditure assessments

Many researchers have noted some methodological constraints that hampered the analysis of food expenditure and risk factors. A group of Economist researchers who conducted a study on the household expenditure survey lack details on individual intake and food expenditure on nutritional composition (Maillot, Darmon, Darmon, Lafay, & Drewnowski, 2007). The combination of average mean price of food intake surveys (and the association between the average mean of nutritional composition) has enabled researchers to resolve this methodological problem and however estimate food expenditure for each diet daily (Maillot *et al.,* 2007; Drewnowski & Specter, 2004). This methodology appears to be useful in this present study.

The descriptive assessment for food expenditure was conducted and the total scores were computed according to food item groups, the mean and standard derivation values were derived respectively. The findings observed that the average monthly food expenditure for the participants MYR 1,297 ± 702 was based on the 12 Malaysian food categories items (Table 3). The food expenditure on food at home, eat out / ready to eat food and ready to cook food were among the highest food expenditure with average monthly food expenditure MYR 287 ± 137, MYR 177 ± 86 and MYR 145 ± 78 respectively. Others were Beverages (MYR 99 ± 59), Seafood (MYR 85 ± 38), Chicken (MYR 79 ± 40), Snacks (MYR 68 ± 38), Cereals (MYR 76 ± 40) and Dairy (MYR 72 ± 39) respectively. These six (6) food categories were known to be high in protein and energy although the food expenditure on the six (6) food categories did not account for high food spending compared to the amount spend on food at home, ready to eat food and ready to cook food respectively. The food expenditure on Fruits (MYR 82 ± 41) and Vegetables (MYR 94 ± 48) were low. These food categories were deemed healthy but considered expensive and unaffordable by the participants. The high cost of food in the market environment seems to be a burden to this population under study and therefore lower priced foods become an option for students to meet daily food needs as the effect of an unhealthy diet is known. Thus unhealthy dietary intake is known to have adverse effect on health (Alamgir, Sami & Salahuddin, 2018). The results also noted that alcoholic drinks (MYR33 ±58) were the least in the monthly food expenditure items (Table 3). Previous studies suggested reasons for low food expenditure on alcoholic drinks as it associated with a known factor particularly for increasing cardiovascular diseases (CVD) risk (Rehm, Room, Monteiro, Gmel, Graham, Rehn, Sempos & Jernigan, 2003). Other significant risk factors for CVD include high blood glucose, physical inactivity, obesity and increase level of cholesterol which is all related to smoking (Wong, 2014). Although there are needs for specific recommendations for alcohol intake among adult's student that will assist them to maintain a better healthy life throughout their life process (Tyrovolas, Panaretos, Daskalopoulou, Gine-Vazquez, Niubo, Olaya, Bobak, Prince, Prina, Ayuso-Mateos, & Caballero, 2020).

The fact remains that students identified in this present study who intended to practice high food expenditure will incur greater food expenditures (Table 3). Hence, adequate nutritional foods are possible to attend but are more costly (Verly Jr, Darmon, Sichieri, & Sarti, 2020). Previous studies have suggested that food expenditure on eating out and ready to cook food were significantly associated with risk factors (Jaworowska, Blackham, Long, Taylor, Ashton, Stevenson, & Davies, 2014; Alkerwi, Crichton, & Hébert, 2015). Similar studies have also demonstrated that food expenditure on food at home were significantly associated with good quality diets and reduced risk factors (Mills, Brown, Wrieden, White, & Adams, 2017). Food expenditure budget on sweetened beverages intake have been previously found to be significantly associated with hyperuricemia (Zhang, Bian, Gu, Meng, Zhang, Liu, Wu, Zhang, Wang, Wang, & Cao, 2020), fruit and vegetables (Aune, Giovannucci, Boffetta, Fadnes, Keum, Norat, Greenwood, Riboli, Vatten, & Tonstad, 2017; Miller, Mente, Dehghan, Rangarajan, Zhang, Swaminathan, Dagenais, Gupta, Mohan, Lear, & Bangdiwala, 2017), seafood (Berger, Taylor, Harriss, Campbell, Thompson, Jones, & McDermott, 2020), chicken (English, MacInnis, Hodge, Hopper, Haydon, & Giles, 2004), snack (Nicklas, O'Neil, & Fulgoni 2014), cereals (Barrett, Amoutzopoulos, Batterham, Ray, & Beck, 2020), and diary (Godos, Tieri, Ghelfi, Titta, Marventano, Lafranconi, & Ray, 2020) reduced the risk of chronic diseases such as of type 2 diabetes, hypertension, depression, obesity, cardiovascular disease and many others. The results supported public health interventions aimed at unhealthy diets that will encourage food producers to produce cheap nutritional food at affordable cost in order to promote healthy lifestyle among the University students.

Table 3: Food Expenditure Assessments for the Period of 30 Days

Food items	Mean (MYR)	Standard deviation
Food at home	297	137
Eat out / ready to eat	177	86
Ready to cook food	145	78
Alcohol	33	58
Beverages	99	59
Vegetables	94	48
Fruits	82	41
Seafood	85	38
Chicken	79	40
Snacks	68	38
Cereals	76	40

Table 3 (continues)

Food items	Mean (MYR)	Standard deviation
Dairy	72	39
Total	**MYR 1,297**	**702**

Note: MYR = Malaysian Ringgit

Association between food expenditure and health risk factors

The relationship between food expenditure on diets and health risk factors of participants was examined using Pearson product –moment correlation coefficient as summarized in the Table 4. The findings found a weakly positive significant relationship between health risk factors and food expenditure on diets, $r = 0.14$, (231), $p < 0.05$. The result is based on Cohen (1988) which reported that a correlation coefficient of 0.1 indicates small correlation, 0.3 indicates moderate correlation; and 0.5 indicates large correlation. The findings suggested that an increase in food expenditure on diets were significantly associated with a minimal increase in health risk factors. Therefore, each 1% increase in food expenditure on diets was significantly associated with a minimal increase in health risk factors. For an average University student food expenditure budget, this can lead to a real obstacle to healthy eating and as such, the students may opt for cheaper diets with much health implication in order to satisfy hunger. The fact remains that the students can attain high food expenditure in other to avert health risk factors but choose not to (Townsend, Aaron, Monsivais, Keim & Drewnowski, 2009; Reed, Frazao, & Itskowitz, 2004). These findings are consistent with previous studies of university students which founds a positive association between food expenditure on low-energy foods and weight gain over five years in Spain (Lopez, Martinez-Gonzalez, Sanchez-Villegas, Alonso, Pimenta, & Bes-Rastrollo, 2009). Although the strength of the association was positively weak which could be attributed to student's choice of food spending which seems to be based on taste, cost, and convenience and to a minor degree in health and variety (Glanz, Rimer, & Viswanath, 2008). Thus, positive attitudes towards healthy diets may result from a greater nutritional knowledge, awareness of diet–disease relationships and food spending. Findings from previous studies have shown that diets tend to be nutrient-poor and energy-rich when food expenditure is the primary key factor in dietary selection (Darmon, Ferguson, & Briend, 2006). By contrast, a study in the Greek cohort founds no significant association between food expenditure and cardiovascular disease (CVD) incidences over 5 years (Vlismas, Panagiotakos, Pitsavos, Chrysohoou, Skoumas, Sitara, & Stefanadis, 2010). One of the surveys in Japan reported very different results that higher food expenditure was correlated with increased cholesterol and total saturated fats intake (Murakami *et al*., 2009). The results were concluded on the basis that the traditional food consumed in Japan differed from those consumed in other countries

including the present population under study. Many studies have shown that intake of high quality and very likely more expensive diets were associated with decreasing Body Mass Index (BMI) values (Schroder, Marrugat, Vila, Covas, & Elosua, 2004), improved health outcomes (Sacks, Svetkey, Vollmer, Appel, Bray, Harsha, & Karanja, 2001; Juraschek, Kovell, Appel, Miller III, Sacks, Christenson, & Mukamal, 2020), and reducing mortality rate (Trichopoulou, Orfanos, Norat, Bueno-de-Mesquita, Ocké, Peeters, & Nagel, 2005; Hu, Steffen, Coresh, Appel, & Rebholz, 2020). Other studies have also argued that food expenditure were significantly associated with chronic diseases (Maillot *et al*., 2007; Bukambu, Lieffers, Ekwaru, Veugelers, & Ohinmaa, 2019; Garza, Datubo-Brown, Gaillard, & Jeminiwa, 2019; Verly Jr *et al*., 2020). The observation that student's believed that healthy diets are more costly seems to be among the factors resulting in poor dietary plans with many health implications (Ward, Verity, Carter, Tsourtos, Coveney, & Wong, 2013). Encouraging students to adopt healthy lifestyles may not be efficient if high food expenditure budget on healthy diets represents a barrier to dietary change (Nelson, Dick, & Holmes, 2002; Vozoris, Davis, & Tarasuk, 2002; Darmon *et al.,* 2006). Also, the promotion of healthier food that are affordable but low in energy-dense may decrease the rate of obesity among the students and such food include carrots, cabbage, dried fruits and legumes, powdered milk, nuts, canned fish, and liver (Darmon *et al*., 2006). Several knowledge gaps exist in the present study "food expenditure pattern on diets and its relationship to health risk factors among Nigerian Students in Universiti Putra Malaysia". While we aimed to examine the findings of the present study as a result of interventions designed to promote food development programs, good food expenditure and encouraged food producers to produce cheap nutritional food at an affordable cost in order to enhance healthy diet.

Table 4 Correlations between Health Risk Factors and Food Expenditure (*N*=233)

Category	Y	X
Y (Health Risk Factor)	1	-
X (Food Expenditure)	0.14*	-

*Note = *Correlation is significant at the 0.05 level.*

Conclusion

Increase in food expenditure on diets was significantly associated with a minimal increase in health risk factors among the University students. For an average University student food expenditure budget, this can lead to a real obstacle to healthy eating. Interventions aimed at improving public health and nutritious diets are required to promote healthier lifestyles and avoid health risk factors at all levels in order to provide a regulatory structure that will strengthen food production programs,

enable food producers to produce cheap quality food at affordable price and also enhance nutritional education on healthy food expenditure.

There are certain limitations in the present study. Food expenditure data was recorded based on 30 days which could change over time since students daily food expenses could lead to a less accurate record of the usual amount of money spend on food. Participants might have bought food to exchange with fellow students or invited friends to dine in a restaurant which they might recorded as part of their food expenditure. These may result to overestimate or underestimate of the actual amount spend on food. Lastly, participants in this present study are only Nigerian students in Universiti Putra Malaysia of age (25 – 45) years old. Thus, the findings should not be generalized beyond this population because it may not represent the whole population of Nigerian students studying in Malaysia. Future study should be conducted with a sample more representative of the entirety of Nigerian students studying in Malaysia.

Policy implications of the study are to foster effective nutritional policies. Nutritional policy for public health is not only designed to foster healthy diets but also to reduce barriers to food expenditure on diets and healthy foods. In order to build good food expenditure at all levels, the government, dietetics professionals and Ministry of Health Malaysia should strategize in order to provide a legal framework that will improve food development programs and encouraged food producers to produce cheap nutritional food at affordable cost and also improve on nutritional education on healthy food expenditure. Government and University administrators should provide more means to regulate the prices of nutritional foods, reduce tax and levies on healthy foods in order to encourage more food spending on healthy food among the public.

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