ORIGINAL ARTICLE

Diet Quality and its Associated Factors among Community Dwelling Older Adults in Urban District in Kuala Lumpur, Malaysia

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ABSTRACT

Introduction: Diet quality is an essential factor in determining the adherence towards dietary guidelines. This study aims to assess the diet quality among community-dwelling older adults and identify the factors associated with the diet quality. **Method:** This is a cross-sectional study, conducted among 138 community-dwelling older adults living in PPR flats, Kuala Lumpur. Subjects were randomly recruited in this study. Diet Quality Index (DQI) was used to identify diet quality index of elderly. The Chi-square Test of Independence and Pearson's correlation test were used to determine the association between tested covariates with DQI. **Results:** Majority of the respondents were reported with good diet quality (74.6%), whereas quarter of them (25.6%) had poor diet quality. Significant difference between the diet quality and the adherence on the food groups were observed for all food groups (p<0.05) except for cereal and cereal products and poultry, meat and egg food group The results revealed that increasing age, Malay ethnicity, low education attainment, low financial income, hypertension, low skeletal muscle, high body fat, high visceral fat, high waist circumference, low MUAC and low handgrip strength were associated with the diet quality of the subjects (p<0.05). **Conclusion:** The results of this study provide a new insight on the diet quality of the elderly with good and poor diet quality. More inclusion of factors that are related to the diet quality needs to be emphasized in future studies among older adults as it would play a beneficiary component in improving their nutritional status.

Keywords: Diet quality, Older adult, Skeletal muscle, Handgrip, Financial

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INTRODUCTION

Aging is a biological phenomenon which holds detrimental effects on the nutritional and health status of elderly (1). In Malaysia, the population of older adults are estimated to increase exponentially up to 3.3 million by the year 2020 which is expected to contribute about 9.8% to the total population of the country (2). The ageing process itself contributes to the burden of chronic disease and have an impact on the diet quality of the elderly (3).

Older adults, primarily, required adequate nutrition as it is imperative for the health maintenance and other functional capacity. An optimum intake of diet can be reached by adapting a balance, nutritious and healthy diet (4). Studies on the diet quality has already been explored and discussed deliberately in the past

literature. The evolvement terminology of diet quality has been described as how healthy an individual's diet that suits dietary recommendations. By definition, poor diet quality has been characterized as "reduced intake of fruits, vegetables, fiber, and protein derived from nuts and legumes, and also, overconsumption of saturated and trans fats, sodium, and alcohol, which are associated with higher adiposity and increased risk for weight gain" (5,6). This relatively new concept incorporates in the assessment of quality and variation of the whole diet, which the exploration of associations between dietary intake and health status, rather than just nutrients are permissible (7).

Generally, diet quality is measured by scoring food patterns in terms of the orientation of food intake with the national dietary guidelines and the diversity of healthy food choices within the core food groups. These exhaustive and more refined scoring methods enable the identification of protective dietary patterns and unfavourable intakes (7). The general focus of the indices is to integrate a copious variation of information on eating habits into a single indicator. The advantage of the indicator is apparent as the analysis of dietary behaviour can be singled as one factor, in assessing

myriad compounds of the diet (8).

In Malaysia, dietary assessment among elderly have been focusing on the pre-dominant approach of food frequency questionnaire (FFQ) and dietary recall which has been commonly assessed by Dietary History Questionnaire (DHQ) of daily, 3 days and weekly intake among older adults. Diet quality index has been extensively studied among Malaysian children and adults however the data among older adults population is still scarce. Diet quality assessment among older adults is necesssary as a holistic approach to address the health and nutritional issue in relation to biological age. Inconsistent findings and limited research on the diet quality assessment among older population limit the in-depth discussion to address the pertaining issue. Previous study conducted in attempted to assess the relationship between diet quality and calcium intake has been done among Malaysian elderly (9). However, the inclusion of small sample size and convenient selection of study respondents applied in the sampling method warrant a further research to substantiate such findings. Thus, this study is conducted with the aim to explore on the diet quality index among Malaysian older adults in a larger set of population. The present study aimed to evaluate the diet quality and the factors that associated with the diet quality among community-dwelling older adults.

MATERIALS AND METHODS

Research design and sampling method
This cross-sectional study was conducted among community-dwelling older adults living in People housing Project (PPR) flats, Kuala Lumpur. Out of 148 older subjects recruited, only 138 were included in the study with a total response rate of 93.2%. Subjects were selected using a multistage random sampling from thirty-one PPR flats in Kuala Lumpur. Of all 31 PPR in Kuala Lumpur, 5 were randomly chosen by simple random sampling to be included in the study. The census of resident's name list was obtained from Dewan Bandaraya Kuala Lumpur (DBKL) for the predefined flats. At least 30 subjects were selected from each PPR. Once selected, they were screened before recruited in the study through inclusion and exclusion criteria. The inclusion criteria include - older adults aged 60 and above, resides in the flats and able to ambulate. Subjects were excluded if they were presented with severe sensory deficit which hinders them from performing physical functioning assessment and unstable medical condition or in a palliative care. Approval permission was granted by Ethics Committee for Research Involving Human Universiti Putra Malaysia (JKEUPM-2018-193) prior to data collection. An invitation letter and consent forms were disseminated to subjects who were eligible and they were explained on the risk and benefits obtained from this study.

Diet Quality Index
The diet quality of the subjects was assessed by using the validated Diet Quality Index (DQI) developed and validated among Malaysian adults (10). The Malaysian Dietary Guidelines and Malaysian Food Pyramid were applied in devising the diet quality index (11). The questionnaire was administered using interview method by the researchers. Subjects were assisted to illustrate the portion size with a set of calibrated household measurements equipment such as spoon, bowl and plates.

By referring to the 14 defined key messages in the Malaysian Dietary Guidelines, 7 key messages (key messages 4 to 10) pertaining to the dietary intake were extracted and pooled into collective food items. The selected food items were classified into 12 food groups as follows: "(1) Cereal, cereal products and tubers, (2) Wholegrain cereals, (3) Fruits, (4) Vegetables, (5) Milk and dairy products, (6) Legumes and their products, (7) Fish, (8) Poultry, meat and egg, (9) High-fat protein foods, (10) Fat-rich foods, (11) Salt rich foods, (12) Sugar-rich foods". For a better coherent and illustration, each food group were supplemented with foods examples quoted in the "Malaysian Dietary Guidelines", "Malaysian Food Pyramid" and "Malaysian Adult Nutrition Survey Food Frequency Questionnaire (MANS FFQ)" (12). The scoring method was based on the adherence to dietary guidelines and frequency of consumption of the pre-defined twelve food groups (Table I). The maximum scores for each food groups were 5 if the participants choose 'Daily' or if their choices met the recommendation. The possible composite score for DQI ranges from 0 to 60. The cut-off point for the 25th percentile was < 29.9 which indicate at risk of poor diet quality and >30 indicate that the subjects had a low risk of poor diet quality.

Factors associated with diet quality
An interview-administered Lawton Instrumental Activities of Daily Living (IADL) (13) questionnaires was used to assess the instrumental functional ability among older adults. In this study, the validated of Malay version of IADL (IADL-MV) (14) was applied in the study subjects' ability which includes the ability to use the telephone, shopping, preparing food, housekeeping, doing laundry, using transportation, handling medications and, handling finances. The eight items were coded as 0 and 1. Subject is categorized as having normal functional ability if the subjects are able to do all the 8 activities while those who scored less than 7 were categorized as disabled (15).

The depression level of the subjects was assessed using the 14-items Malay version of the Geriatric Depression Scale (M-GDS-14). M-GDS-14 comprises of 14 items, making it a relatively easy scale to be used especially in the frail elderly. It suited well with the elderly as it

Table I: Classification of food group according to Malaysian Dietary Guideline and Malaysian Food Pyramid

Food Group	Dietary Recommendations	Scoring criteria	Scores
Cereals, cereal product and tubers	KM 4: "Eat adequate amounts of rice, other cereal products (preferably whole grain) and tubers." KR 1: "Consume at least 4 servings of cereal foods daily." MFP level 1: "Eat 4 to 8 serving in a day."	Daily (4-8 servings) Daily (> 8 servings) Daily (<4 servings) 2-6 times/ week 1 time/ week 1-3 times/ month Rarely/ Never	5 4 4 3 2 1 0
Cereals, cereal product and tubers	KM 4: "Eat adequate amounts of rice, other cereal products (preferably whole grain) and tubers." KR 1: "Consume at least 4 servings of cereal foods daily." MFP level 1: "Eat 4 to 8 serving in a day."	Daily (4-8 servings) Daily (> 8 servings) Daily (<4 servings) 2-6 times/ week 1 time/ week 1-3 times/ month Rarely/ Never	5 4 4 3 2 1 0
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Fish	KM 6: "Consume moderate amounts of fish, meat, poultry, egg, legumes and nuts." KR 1. "Consume fish more often, if possible daily." MFP Level 3: Recommended daily serving of fish is 1	Daily (1 serving) Daily (> 1 serving) Daily (< 1 serving) 2-6 times/ week 1 time/week 1-3 times/ month Rarely/Never	5 4 4 3 2 1 0
Poultry, meat, egg	KM 6: "Consume moderate amounts of fish, meat, poultry, egg, legumes and nuts." MFP Level 3: Recommended daily serving of poultry, meat and egg is 1/2 to 2	Daily (- 2 serving) Daily (> 2 serving) Daily (< serving) 2-6 times/ week 1 time/week 1-3 times/ month Rarely/Never	5 4 4 3 2 1 0
High fat protein food	KM 8: "Limit intake of foods high in fat and minimize fats and oils in food preparation." KR 1. "Limit the intake of saturated fats to less than 10% of total daily calorie intake." KR 2. "Limit the intake of foods high in cholesterol."	More than 1/day 1/day 2-6 times/ week 1 time/week 1-3 times/ month Rarely/Never	0 1 2 3 4 5
Fat-rich foods	KM 8: "Limit intake of foods high in fat and minimize fats and oils in food preparation." KR 1. "Limit the intake of saturated fats to less than 10% of total daily calorie intake." KR 4. "Limit foods containing trans fatty acids."	More than 1/day 1/day 2-6 times/ week 1 time/week 1-3 times/ month Rarely/Never	0 1 2 3 4 5
Salt-rich foods	KM 9: "Choose and prepare foods with less salt and sauces." KR 2. "Reduce consumption of highly salted foods and condiments." MFP Level 4: "Limit intake of foods high in fats, oils, sugar and salt and minimize the use of fats, oils, sugar and salt in food preparation."	More than 1/day 1/day 2-6 times/ week 1 time/week 1-3 times/ month Rarely/Never	0 1 2 3 4 5
Sugar-rich foods	KM 10: "Consume foods and beverages low in sugar." KR 1. "Eat foods low in sugar." KR 2. "Drink beverages low in sugar." MFP Level 4: "Limit intake of foods high in fats, oils, sugar and salt and minimize the use of fats, oils, sugar and salt in food preparation."	More than 1/day 1/day 2-6 times/ week 1 time/week 1-3 times/ month Rarely/Never	0 1 2 3 4 5

KM: key message; KR: key recommendation; MFP: Malaysian Food Pyramid

free from questions of somatic symptoms and only used a simple yes or no response format. The score for depression level ranged from 0 to 14. The subjects who scored 0 until 5 indicating normal, while the subjects who scored more than 5 were considered at risk of depression (16).

Cognitive status of the subjects were assessed using the Mini Mental State Examination in Malay version (17). It tests a broad range of cognitive functions, including orientation, recall, attention, calculation, language manipulation and constructional apraxia. A score of 17 and less is an indicator of cognitive impairments, and score of 18 and higher as normal.

Health status of subjects is measured based on the self-reported chronic diseases. The eight pre-defined chronic diseases included on the present study are cardiovascular disease (including hypertension), cardiac disease, lung disease, diabetes, cancer, cerebrovascular (stroke), renal failure and arthritis. Self-reported chronic disease is the most straightforward indicator of prevalence of self-reported chronic morbidity. Previous studies have established the validity of specific self-reported chronic diseases (18), which the result are dependent on the type of disease. Lifestyle factor that is measured in the study is the smoking status. The answers are categorized into three options of (1) yes and still smoking; (2) yes but already quit smoking and (3) never smoked.

Self-reported physical activity was assessed using the Physical Activity level for Elderly in Malay version (PASE-M). The Malay version has been validated among older community-dwelling population in Malaysia (19). Circumference at mid-arm (MUAC), waist (WC), and calf (CC) and arm span were measured using non-stretchable circumference measuring tape (Lufkin measuring tape) with standard procedure . Height was measured using the stadiometer (SECA stadiometer). Body weight, skeletal muscle mass and visceral fat were measured using body impedance analysis (OMRON-BIA).

Statistical analysis

The data analysis was performed by using IBM SPPS Statistics 23. Exploratory data analysis (EDA) was used to check the data normality for all variables. In descriptive analysis, continuous variables were expressed in mean, standard deviation (SD) and median while categorical variables were expressed as frequency (n) and percentage (%) in cross tabulation. Subsequently, independent samples T-test was used to compare the difference in dieta uality score between 2 subgroups of a categorical variable. For inferential statistical analysis, Pearson's product moment correlation was used to test the correlation between continuous variables. The associations between categorical variables (sex, ethnicity, marital status, education level, living arrangement and smoking) were analysed using Chi-square test of independence. In this study, the diet

quality index is divided into two groups namely low and good diet quality as the dependent variable. Assumption tests have been done to ensure all the results from every statistical analysis test were valid. Non parametric tests were used if any of the assumption was not met. Data with a p value less than or equal to 0.05 were considered statistically significant.

RESULTS

Background of subject

Sociodemographic background of the subject is presented in Table II. Of the total subjects, the range of age of the subjects were from 60 to 84 years old with mean age of 68.0 ± 5.98 years old. More than half of the subjects were females (58%) and 42.0% were male. In terms of ethnicity, most of the subjects were Malay (68.1%), followed by Chinese (10.1%) and Indian (21.7%). Based on the marital status, half of the subjects were married (51.4%). About 48.6% of them were identified as either widow or widower, divorced or single (48.6%).

Table II: Sociodemographic characteristic of subject (n=138)

Socio-demographic characteristics	Male, n = 42 n (%)	Female, n= 96 n (%)	Subjects n= 138, n (%)	Mean (SD)
Age				68.01 ± 5.989
Ethnicity				
Malay	44 (39.9)	51 (53.7)	95 (68.8)	
Chinese & Indian	14 (32.6)	29 (67.4)	43 (31.2)	
Marital status				
Single/ Divorce/ Widow/ Widower	16 (23.9)	51 (76.1)	67 (48.6)	
Married	42 (59.2)	29 (40.8)	71 (51.4)	
Education level				
Non-formal	6 (25)	18 (75)	24 (17.4)	
Primary	18 (36)	32 (64)	50 (36.2)	
Secondary & Tertiary	34 (53.1)	30 (46.9)	64 (46.4)	
Monthly Income				1022 ± 1450.93
>1500/ month	12 (75)	4 (25)	16 (11.6)	
<RM 1500/ month	45 (37.2)	76 (62.8)	121 (87.7)	
Employment status				
Working	35 (61.4)	8 (10.0)	43 (31.2)	
Not working/Retired	22 (38.6)	72 (90.0)	95 (68.8)	
Living status				
Alone	4 (23.5)	13 (76.5)	17 (12.3)	
With family	53 (44.2)	67 (55.8)	120 (87)	
Functional Limitation				
Functional Disability	13 (34.3)	25 (65.8)	38 (27.5)	
Normal	45 (45)	55 (55)	100 (72.5)	
Depressive Symptoms				
Normal	52 (46)	61 (54)	113 (81.9)	
At risk of depression	6 (25)	18 (75)	24 (17.4)	
Cognitive Status				
Normal	51 (46.4)	59 (53.6)	110 (79.7)	
Cognitive Impairment	7 (75.0)	21 (75.0)	28 (20.3)	
Physical activity level				
Low physical activity	9 (33.3)	18 (66.7)	27 (19.6)	
Normal	49 (44.1)	62 (55.9)	111 (80.4)	
Smoking status				
Yes, still smoking	23 (39.7)	3 (3.8)	25 (18.1)	
Yes, but already quit	15 (25.9)	0 (0)	15 (10.9)	
Never smoking	20 (34.5)	77 (96.2)	97 (70.3)	

In the context of education attainment, most of the subjects received secondary and tertiary education (46.4%), followed by primary education (36.2%) and non-formal education (17.4%). Majority of the subjects were living with their family (87%) and had a household income less than RM1500 per month (87.7%). According to Department of Statistics Malaysia (2016), the median household income for Malaysian per month was RM5,228 and based on the median income according to the state, Kuala Lumpur recorded as the highest income of RM9,073 per month. Apparently, the study subjects received significantly less than the median household income among Malaysian. More than half of the subjects are not working (68.8%). Among those who were working, majority of them were male (81.4%) compared to female (18.6%).

The prevalence of subjects being functionally dependent was 27.5% which was more prominent among female subjects (65.8%). About 17.4% of the subjects were identified as having depressive symptoms and the number was significantly higher among female subjects. The prevalence of study subjects being cognitively impaired was 20.3% which was significantly higher among female (75.0%) older adults compared to male (25.0%) (χ^2=4.181, p<0.05). Assessment on the self-reported physical activity level revealed that majority of the subjects were engaging in active lifestyle while and only 19.6% that comprised of males (33.3%) and female (66.7%) had low physical activity. For the smoking status, 70.3% of the subjects were reported to have never engaged in cigarettes smoking and almost all of the female subjects were reported being so. A proportion of 18.1% of the subjects claimed that they are still smoking, and 10.9% have ever since quit from smoking and 70.3% were reported to have never smoked.

Diet quality index of subjects

Majority of the subjects were identified to have a good diet quality (74.6%). About a quarter (25.6%) of the subjects were at risk of having poor diet quality. No significant difference between the status of diet quality index among gender (χ^2=0.824, p>0.05). Table III refers to the adherence of subjects to the Malaysian Dietary Guidelines and recommendations from the Malaysian Food Pyramid stratified by twelve food groups. Among all the 12 food groups listed, wholegrain cereals (68.8%), legumes and their products and sugar-rich foods were listed as the top three non-adherence food group among the subjects. Whereas, cereal, cereal products and tubers, vegetables and high-fat protein foods are the food groups that were highly adhered among the subjects. Significant difference between the diet quality and the adherence on the food groups were observed for all food group except for cereal and cereal products and poultry, meat and egg food group (Table III).

Factors associated with diet quality

Based on Table IV, a significant association was found

Table III: Adherence to the Malaysian Dietary Guidelines and recommendations from the Malaysian Food Pyramid stratified against diet quality

Food group (serving)	Non -adherence	Adherence	χ^2	p-value
Cereal, cereal products and tubers	2 (1.4)	136 (98.6)	0.651	0.420
Wholegrain cereals	95 (68.8)	43 (31.2)	6.224	0.013
Fruits	31 (22.5)	107 (77.5)	14.554	0.000
Vegetables	14 (10.1)	124 (89.9)	4.996	0.025
Milk and dairy products	84 (60.9)	54 (39.1)	21.984	0.000
Legumes and their products	91 (65.9)	47 (34.1)	4.126	0.042
Fish	15 (10.9)	123 (89.1)	4.035	0.045
Poultry, meat and egg	42 (30.4)	96 (69.6)	2.026	0.155
High-fat protein foods	21 (15.2)	117 (84.8)	4.005	0.045
Fat-rich foods	54 (39.1)	84 (60.9)	24.332	0.000
Salt-rich foods	64 (46.4)	74 (53.6)	5.121	0.024
Sugar-rich foods	89 (64.5)	49 (35.5)	11.873	0.001

Chi Square test of Association
*Significant at level 0.05; ** Significant at level 0.01 for Pearson Chi-Square

between age and diet quality index. The diet quality was poorer as the age increased (r= -0.183, p<0.01). A significant association was demonstrated between ethnicity and diet quality of the subjects (χ^2 = 11.154, p = 0.001). Taking into account the heterogeneity of ethnicity in Malaysia, Malay subjects (88.6%) were found to have a greater proportion of having poor diet quality compared to Chinese and Indian. By referring to the ethnicity subgroups, the prevalence of poor diet quality was higher among Malay (33.0%), followed by Indian (10.0%) and Chinese (7.1%). As the majority of the study respondents were Malay, the association between lower socioeconomic status with diet quality are clear. Based on the Household Income by ethnicity, Malay earned the least while Chinese household acquired the highest income mean (20). Those who received lower level of education were associated with poor diet quality index (χ^2 = 8.444, p =0.038). As expected, diet quality has been found to be declining with lower monthly income (r=-0.896, p<0.05).

Based on the chronic disease diagnosed, none showed a significant association with diet quality except for hypertension (χ^2 = 4.246, p = 0.039). No association between functional ability, cognitive impairment and depression with diet quality index. Diet quality has been shown to be significantly associated with anthropometric measurement namely skeletal muscle (p<0.05), body fat (p<0.05), visceral fat (p<0.01), waist circumference (p<0.05), mid-upper arm circumference (p<0.05) and handgrip strength (p<0.05).

DISCUSSION

The present study explored the relationship between functional ability, depressive symptoms, health status and lifestyle factor with diet quality index. Almost

Table IV: Factors associated with diet quality

Diet Quality Classification	n (%)			
	Good diet quality (n=50) n(%)	Poor diet quality (n=35) n(%)	χ2/r	p-value
Sex			0.824[a]	0.364
Male	41 (70.7)	17 (29.3)		
Female	62 (77.5)	18 (22.5)		
Age	67.39 ± 5.72	69.34 ± 6.15	0.974[b]	0.003**
Ethnicity			9.076[a]	0.011
Malay	63 (61.2)	31 (88.6)		
Chinese	13 (12.6)	1 (2.9)		
Indian	27 (26.2)	3 (8.6)		
Marital status			0.155[a]	0.693
Married	54 (52.4)	17 (51.4)		
Single/divorce/widowed/widower	49 (47.6)	18 (48.6)		
Education level			8.444[a]	0.038*
Non-formal	12 (11.7)	5 (14.3)		
Primary	36 (35.0)	21 (60.0)		
Secondary	48 (46.6)	8 (22.9)		
Higher	7 (6.8)	1 (2.9)		
Monthly financial income	1157. 29 ± 1670	798.44 ± 670.16	0.896[b]	-0.011**
Living status			1.010[a]	0.315
Living alone	11 (10.7)	6 (17.1)		
Living with others	92 (89.3)	29 (82.9)		
Number of chronic diseases	1.56 ± 1.35	1.43 ± 1.17	0.100[b]	0.244
Hypertension	59 (57.3)	13 (37.1)	4.246[b]	0.039*
Functional	7.52 ± 1.43	7.49 ± 1.07	0.001[b]	0.993
Depression	7.75 ± 2.61	7.34 ± 1.98	0.047[b]	0.588
Cognitive status	23.00 ± 6.10	22.11 ± 5.49	0.041[b]	0.630
Smoking			0.669[a]	0.413
Smoking	8 (22.9)	17 (16.7)		
Not smoking	27 (77.1)	85 (83.3)		
BMI	30.25 ± 38.33	26.04 ± 4.91	0.389[b]	0.074
Skeletal Muscle	24.80 ± 18.12	22.83 ± 3.96	0.615[b]	0.043*
Body Fat	34.80 ± 7.34	34.68 ± 7.14	0.749[b]	0.028*
Visceral Fat	13.34 ± 6.47	12.86 ± 6.58	0.968[b]	-0.003**
Waist circumference	100.98 ± 141.61	86.98 ± 9.68	0.557[b]	-0.051*
MUAC	23.39 ± 7.05	27.03 ± 3.54	0.585[b]	0.047*
Handgrip strength	33.34 ± 19.54	28.17 ± 21.44	0.627[b]	0.042*
Physical Activity	275.13 ± 161.19	251.81 ± 140.31	0.464[b]	0.063

[a]Chi Square test of Association, [b]Pearson Product Moment Correlation
*Significant at level 0.05; ** Significant at level 0.01; *** Significant at level 0.001

one-fourth of the study subjects were identified as having poor diet quality which highlight the alarming prevalence of poor diet quality among older adult population. Previous study which attempted to report the diet quality index among Malaysian elderly has shown that the diet quality was moderately satisfied (9). In adequacy components, fruits, fiber and calcium intake were not meeting the recommendation. 76% of the subjects did not take any fruits daily whereas 96% of them did not meet fiber intake from recommendation of MDG (9). However, our study found that older adults has high adherence to the MDG for fiber groups of fruits (77.5%) and vegetables. This finding is supportive with previous study which reported a higher frequency intake of fiber food group among elderly (21). This is related to the fact that elderly with scarce in economic resources are highly dependent on a cheaper food alternative. This can be seen where the adherence of protein intake is mostly from the cheaper sources of legumes and its product (69.6%); compared other protein based food which generally costs higher such as fish (10.9%)

and poultry, meat and eggs (30.4%). This may have suggested that although one may have an overall of good diet quality, attention should be drawn on the food groups as each play a exceptional and important role in maintaining overall health. Age was found to be significantly associated with diet quality. The diet quality is found to be declining with age. It was supported by the previous study that stated that the worsening of diet quality with increasing age could be a reflection for the changing in health consciousness (8). Declining in the poor diet quality as age increased might be explained by the worsening in appetite and poor nutritional status which were highly prevalent among older aged group. This vulnerable group often experience such geriatric-associated symptoms which hinder them from getting appropriate and sufficient dietary intake.

In the present study, significant association was demonstrated between financial income and diet quality. Those who earned higher income were found to have a better diet quality compared to the counterparts.

As a person aged, they experienced financial insecurity due to retirement or physical condition which may have reduced their capability to work at full task. Elderly received much lesser income compared to their adulthood salary, which mostly dependent on the allowance from children, family members and financial aids from the government or organisation. As being said, lower financial status will affect their dietary pattern and influence their decision in making purchase. A guaranteed financial income had shown that purchasing power would affect the determination of the food intake (22) as financial independent allow them to be decisive in their food intake.

Interestingly, this study found that the diet quality of the subject differed by ethnicity. Chinese and Indian older adults showed the highest proportion of good diet quality index compared to Malay. This finding is consistent with those reported among younger adults and children which reported that Indian subjects had a better diet quality compared to Malay subjects (23). Such finding mainly be played by the distinct ethnic dietary pattern as their own socio-cultural entity in determining their food preferences. Traditionally, Chinese value the foods as a "medicine" which regard foods consumption as a core eccentric of healthy lifestyle, hence the higher prevalent of good diet quality index. A study which approached was to compared the motives of food choice found that both Chinese ethnic in Taiwan and Malaysia were comparable and almost similar (24). The authors suggest these resemblances may have arisen from the mutual cultural tenets and, by implication, may signify that culture could be a predominant factor than geographical location in shaping the food choices.

Furthermore, those who attained a higher education were found to have a better diet quality. This was also reported in the previous findings which highlighted the positive impact of high education on diet quality (25,26). Such finding is expected as those who resides in PPR were having low socioeconomic status, potentially due to lower educational level. Education is associated with increasing knowledge related to nutrition as it is one of the indicators in the integration of knowledge into practice (27). People who obtained a higher education have a better exposure of knowledge on healthy lifestyle and have a better purchasing power to engaged in a healthy dietary habit.

Hypertension remained as the single chronic disease that is associated with diet quality. Study conducted in Japan fund that low adherence to Healthy Diet Indicator was associated with untreated hypertension (28). Finding was also compounded by the fact that low and diastolic blood pressure were significantly associated with high diet quality (29). Salt-rich food groups in the dietary component of diet quality may be the dietary component which is closely related to the prevalent of hypertension. High sodium based food has been known to have an abrasive effect on the blood pressure and cardiovascular disease which in turn will reduced the nutritional status in overall.

This study did not find a significant association between functional ability with diet quality among older adults. Although not much studies have been done to address this particular association, a study conducted previously has found that functional limitations were associated with a 9% increment in the incidence of perceived poor-quality diet (30). Older adults generally are inclined to loss of independence due to the functional and muscle decline following ageing. The increased dependency on others might as well influence the diet quality as they have a limited opportunity in food selections and at disadvantage in accessing food variations. In this sample of population, the mean age of the study subjects was generally younger and the prevalent of functional limitation is low. Thus, the relationship between functional ability with diet quality is rather weak and unable to establish a significant association given that the functional limitation is more prominent among octogenarian.

In the past decades, many epidemiological studies have attempted to explore the relationship between dietary pattern with depression (31–33). In the present study, no significant association was found between poor diet quality with depressive symptoms. This finding is substantiate by the previous systematic review examining the association between dietary patterns and depression, which the protective effect of healthy dietary pattern and depression were not demonstrated. Conversely, a recent meta-analysis however affirmed that the healthy dietary pattern is closely associated with decreased risk of depression, while, unhealthy dietary pattern such as Western-diet is associated with increased likelihood of depression risk. (34). Although the result of these finding is still conflicting, unhealthy eating behaviour may have an interrelation with depressive symptoms as those with depression appeared to have greater inclination towards sweetened foods (35) with frequent consumption fast foods than individuals without depression (36,37).

Abdominal obesity, high body fat percentage and visceral fat were found to be significantly associated with diet quality index in this study. These findings have been demonstrated earlier among elderly population where lower waist circumference is a significant predictor of good global diet quality (38). Evidence from longitudinal study highlighted the importance of fostering a high-quality diet during mid-to-late adulthood as it is protective against the adverse metabolic effects associated with visceral abdominal adipose tissue (VAT) (39). Accumulation of fat especially on the abdominal area is a great contributor of adverse consequences of excess body weight which lead to cardiometabolic distress. Earlier studies have been focusing on the energy dense intake to be the dietary marker of adiposity.

However, it is intriguing that non-qualitative aspects of diet such as dietary fiber, calcium, fructose, and also dietary pattern as described by diet index score have a primary impact on VAT, while subcutaneous fat (SAT) may be determined largely by excessive in total energy intake (40).

Systematic review has shown that reduction of VAT and SAT can be achieved with the combination of healthy effect of nutrient-dense and low-energy foods which particularly rich in unsaturated fatty acids and other bioactive compounds. In contrast, unhealthy dietary pattern homogenise the effects of less nutritious and high energy-dense foods consumption, which lead to increment amount of VAT and SAAT (40).

Apart from adiposity, muscle wasting was also found to be positively associated with diet quality. This suggests that muscle wasting as indicated by low mid-upper arm circumference is declining with poor diet quality. The finding has been substantiated in previous study where a consumption of a highly varied diet is closely related to with larger arm circumference (41). A low dieta quality reflected a poor in the varied selection of food items within food group which offer less than the desirable nutrients for maintaining an optimum health and muscle integrity. This is especially true for older population as the incidence of muscle wasting and sarcopenia is highly prevalent due to functional decline.

Physical assessment of handgrip and muscle mass showed that the hand grip strength and muscle mass is declining with poor diet quality. The finding has been demonstrated in other previous studies (42,43). Individuals who engaged with high prudent diet score appeared to have higher grip strength (42). Notably, one longitudinal study reported that a greater variation of dietary intake is associated with lower risk of weakening in hand grip strength (44). In contrast, other prospective studies have not able to demonstrate a significant association between diet quality score with hand grip strength (45–47). Systematic review conducted to study on the diet quality and sarcopenia revealed that the implication of diet on muscle strength might be distinct across gender , however the evidence was inconsistent (48). Muscle strength has been generally known to be vastly influenced by nutrition and specific dietary components that are suggestive to portray signfiicant role in the age-associated decline in physical performance. This may be especially true for protein-rich food group which is essential for muscle anabolism and repair tissue damage due to aneroxia of ageing. Of interest a study found that dietary pattern score with higher "vegetables-fruits", and higher "snacks-drinks-milk products" were associated with lower prevalence sarcopenia in older men (43).

To the best of our knowledge, this is the first study that assessed diet quality and its associated factors among older adults in Malaysia. However, there were some limitations that need to be considered in this study. Firstly, it was a cross-sectional design and it limits the interpretation of some associations to be considered as cause and effect relationship. Besides, the limitations inherent to dietary surveys such as errors in the estimation of food portions and food exchanges should not be ignored given that the occurrence of over-reporting and under-reporting the intakes of the subjects are inevitable. Furthermore, this study has been conducted among older adults living in the urban setting which make it less suitable to be generalized to the whole older adults' population in Malaysia.

CONCLUSION

In a sample of older adults residing in urban setting of Kuala Lumpur, men and women aged 60 years and above with poor diet quality report to have significant associations with age, ethnicity, low education attainment, low financial income, hypertension, low skeletal muscle, high body fat, high visceral fat, high waist circumference, low MUAC and low handgrip strength. Further investigation with a large population study with the inclusion of greater components of geriatric syndromes will grant a better understanding on the role of diet quality among older adults. This findings emphasised the importance of addressing the overall diet quality in warranting a promising and effective population-based health programs and policies towards a healthy ageing.

ACKNOWLEDGEMENTS

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