Research Article

Adherence of Malaysian Older Persons to the "Variety" Characteristic based on the Malaysian Dietary Guidelines

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ABSTRACT

Dietary variety, a key indicator of diet quality, is essential for ensuring nutrient adequacy and supporting healthy ageing. However, limited data exist on how Malaysian older adults achieve dietary variety as outlined in national guidelines. This study evaluated how well Malaysian older adults follow the "Variety" recommendations of the Malaysian Dietary Guidelines (MDG 2010/2020 and MDG-OP 2023). A cross-sectional study was conducted among 256 community-dwelling older adults (≥60 years) in Mukim Plentong, Johor Bahru. Dietary data were collected using a 7-day Diet History Questionnaire (DHQ) and analyzed using six variety indicators (V1–V6) within MY.DQI-OP, capturing between- and within-food group diversity. Descriptive statistics summarized adherence rates, and socio-demographic characteristics were assessed via structured interviews. Fewer than 10% (9.4%) of respondents consumed at least one serving from all five major food groups daily. Within-group diversity was particularly low, with only 2.7% consuming different fruits at each meal and 0.4% consuming different colored vegetables at lunch and dinner. Although 64.5% and 70.7% met frequency recommendations for dark green leafy and non-leafy vegetables, diversity remained limited. Most (69.1%) relied on a single protein source weekly. Low income, food insecurity (23%), and financial insufficiency (12.9%) emerged as likely barriers to achieving variety. Poor adherence to variety recommendations highlights risks of nutrient inadequacy and underscores the need for culturally tailored interventions to improve diet diversity among Malaysian older adults.

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1. Introduction

The global population is ageing rapidly, with the proportion of older adults projected to double by 2050 (United Nations, 2020). Malaysia is transitioning toward an aged nation, with individuals aged 60 years and above expected to comprise 15% of the population by 2030 (Department of Statistics Malaysia, 2021). This demographic shift carries significant health implications, as older adults face increased vulnerability to

chronic diseases, malnutrition, and food insecurity (Hasnan et al., 2021; Salleh et al., 2020). Ensuring optimal dietary intake is crucial for promoting healthy ageing, preserving functional capacity, and preventing nutrition-related morbidities.

Dietary variety is widely recognised as a fundamental aspect of a healthy eating pattern, as it improves the likelihood of fulfilling the body's diverse nutrient requirements (NCCFN, 2010). Among older adults, maintaining dietary variety is particularly crucial due to age-related physiological changes, diminished appetite, dental issues, limited mobility, and reduced social support, all of which may restrict food choices and nutrient intake (Kant et al., 2004; Ghosh et al., 2021). A varied diet enhances the likelihood of achieving nutrient adequacy, supports immune function, and reduces the risk of malnutrition and chronic diseases such as cardiovascular disease, osteoporosis, and cognitive decline (Kobayashi et al., 2013; Jang et al., 2021. Hatløy et al. (1998) identified "variety" as a critical characteristic indicative of good diet quality when developing the Diet Diversity Score, highlighting its role in capturing dietary adequacy. Similarly, established diet quality indices (dqi), including the Healthy Eating Index 1995 (HEI), Diet Quality Index-International (DQI-I), the Australian Diet Quality Index (Aussie-DQI), and the New Zealand Diet Quality Index for Adolescents (NZDQI-A), also incorporate variety as a key component in assessing overall diet quality, reflecting its importance in promoting nutrient adequacy and balanced dietary patterns (Wong et al., 2013; Zarrin et al. 2013; Kennedy et al. 1995; Kim et al., 2013).

Despite its recognised benefits, measuring dietary variety in a consistent and culturally appropriate manner remains a challenge. There is no universal consensus on how variety should be defined, operationalised, or scored, particularly for older populations in different cultural contexts (Jayawardena et al., 2013). Approaches have ranged from simply counting the number of food items consumed within a specific time frame to assessing variety across major food groups, or examining diversity within individual food groups. Such inconsistencies limit the comparability of findings between studies and may compromise the ability of these indices to accurately reflect nutrient adequacy and overall dietary quality. Moreover, most existing diet quality indices have been developed in Western populations and may not fully reflect local dietary patterns or national guidelines in countries like Malaysia. This highlights the need for a standardised, culturally relevant approach to measure variety in a way that aligns with national dietary guidelines and captures the actual dietary patterns of Malaysian older adults.

To address this gap, the Malaysian Diet Quality Index for Older Persons (MY.DQI-OP) was developed as a culturally specific tool for assessing diet quality among Malaysian older adults, using the Malaysian Dietary Guidelines (MDG) as its primary reference within the MY.DQI-OP, diet quality is defined as adherence to the characteristics of healthy eating outlined in the MDG, with Variety included as one of four core components alongside Adequacy, Moderation, and Overall Balance. To operationalise Variety, the researchers systematically reviewed the MDG to identify Key Messages, Key Recommendations, and "How to Achieve" sections containing the keyword variety or related terms, which were then used to develop scoring items for this component. All items and components of the MY.DQI-OP, including the Variety component, were subjected to face and content validation by a panel of five experts in nutrition, dietetics, geriatrics, and public health. The experts unanimously agreed (100%) that the items were relevant, culturally appropriate, and aligned with national dietary guidelines, including the Malaysian Dietary Guidelines (MDG) 2010, MDG 2020, and the MDG for Older Persons 2023. Although the validation process strengthened the tool's credibility for assessing diet quality among older adults, detailed findings on face and content validity are currently being prepared for publication.

Specifically, the study aims to address the research question: To what extent do Malaysian older adults achieve dietary variety, as defined by the Malaysian Dietary Guidelines, as items listed in MY.DQI-OP? The objective of this paper is to report on the adherence of Malaysian older adults to the "Variety" component of a healthy diet, as recommended by the Malaysian Dietary Guidelines (MDG). Dietary variety, a key characteristic of diet quality, was assessed using the MY.DQI-OP items to determine the extent to which older adults meet the national dietary guidelines.

2. Materials and Methods

2.1 Study Design and Respondents

This cross-sectional study was conducted as part of the development and validation process of the Malaysian Diet Quality Index for Older Persons (MY.DQI-OP). The study was carried out in Mukim Plentong, Johor Bahru, Johor, Malaysia. The location was selected due to its high population density and diverse mix of urban and semi-urban older adults, which reflects a realistic community profile. The area has a significant number of low- to middle-income elderly residents, making it relevant for studying dietary variety and food insecurity. Existing collaboration with local leaders and community centers facilitated participant recruitment and smooth data collection. Additionally, the location was logistically accessible for the research team and suitable for conducting interviews with older adults. Community-dwelling older adults aged 60 years and above were recruited through purposive and convenience sampling from the local community. Respondents were identified with the assistance of the Village Head, Village Subcommittee, and community centres, such as the Senior Citizens Activity Centre (Pusat Aktiviti Warga Emas, PAWE). Respondents were eligible if they were free from severe cognitive impairment, were able to communicate effectively, and provided informed consent. Those with severe illness or who were unable to complete dietary assessments were excluded. The final sample comprised 256 respondents. Reported energy intakes were screened for plausibility using the Goldberg cut-off method. Cases identified as potential mis reporters were not excluded from the analysis but were rechecked for accuracy, as retaining these cases was deemed appropriate given the characteristics of the older adult population. Ethical approval was obtained from the Ethics Committee for Research Involving Human Subjects Universiti Putra Malaysia (Jawatankuasa Etika Universiti Penyelidikan Melibatkan Manusia, JKEUPM).

2.2 Data Collection Procedure

Data on socio-demographic and socio-economic status were obtained through an interview-based questionnaire. Income category was based on the National Health & Morbidity Survey for Older Persons 2018. Respondents' food security status was assessed using the six items of the USDA-Household Food Security Survey Module (USDA-HFSSM). Dietary data were derived from the 7-day Diet History Questionnaire (DHQ) (Suzana, Earland and Suriah, 2000), which captured detailed information on usual food and beverage consumption of respondents. Respondents were asked to recall all foods and beverages, including snacks, typically consumed each day over the past seven days, along with details on where and with whom each meal was eaten. For each item reported, researchers collected information on the type or brand, portion size, cooking methods, and home recipes. All dietary information was recorded using the Dietary History Questionnaire (DHQ), which reflects the proportion of food intake over the seven-day period. Portion sizes were estimated using standard household measures and food photographs. Average daily intake of food was calculated as food proportion of daily intake, multiplying by the gram amount of the specified proportion. This process was administered by trained enumerators to accommodate potential memory limitations in older adults.

2.2.1 Assessing adherence towards variety in diet based on Malaysian Dietary Guidelines

Dietary variety was assessed using six items (labelled as V1 to V6) within the Variety component of the Malaysian Diet Quality Index for Older Persons (MY.DQI-OP). These items were developed based on the Malaysian Dietary Guidelines (MDG 2010 / MDG 2020) and Malaysian Dietary Guidelines for Older Persons (MDG-OP 2023) to capture both between-food group and within-food group variety. For item V1: Overall Food Group Variety, assessed whether respondents consumed at least one serving from each of the five major food groups per day. Adherence criteria was categorized by the number of food groups missed per day (0, 1, 2, 3, ≥4). Respondents has the highest adherence when there is no food group missed. Items V2, V3, V4 and V5 assessed within group Variety of fruits and vegetables. These include consumption of different fruits during each meal (V2), intake of different dark green leafy vegetables (V3), intake of

different non-leafy vegetables (V4), and consumption of different coloured vegetables at lunch and dinner (V5). The adherence is met and categorised as 'Yes' when respondents adhere to the recommended practice outlined in the MDG. Item V6 capture adherence of variedness for protein sources, including fish, meat, poultry, eggs, legumes, and nut, which then categorized as highest adherence when respondent's intake is from ≥3 different protein sources per week and lowest adherence when respondents have zero intake of protein sources.

2.2.1 Considering meaningful intake of foods

All food items were analysed to determine their respective food group servings. For this study, at least 1 serving per day from each of the five food groups (cereals/grains, fruits, vegetables, protein sources, milk/dairy) is required to be counted as meaningful intake. Meaningful intake in the context of the MY.DQI-OP refers to the minimum quantity of a selected food or nutrient that is sufficient to contribute substantially to the diet and demonstrate a real dietary benefit, rather than just a trivial or incidental amount. The threshold of "one serving" is selected because smaller amounts (like just a few bites) would not significantly contribute to daily nutrient requirements (Kim et al., 2003). However, for item V6, intake of more than half the serving size per day is considered to be meaningful consumption. By consuming a variety of protein sources, older adults can achieve a more balanced nutrient intake, reduce dependency on a single protein source, and enhance overall diet quality (Stuart et al., 2015; Kim et al., 2003). Adherent was defined as an older adult who: 1) Consumed foods from all five major food groups, i.e grains and cereals, vegetables, fruits, protein sources (meat, fish, legumes), and dairy daily, and 2) Achieved within-group diversity thresholds, such as at least three different types of vegetables, two types of fruits, and three types of protein sources (animal- or plant-based) over the recall period, consistent with MDG recommendations. Participants who did not meet both criteria were classified as non-adherent.

2.3 Data Analysis

Data were analysed using SPSS version 29.0. Descriptive statistics (means, standard deviations, medians, and interquartile ranges) summarize socio-demographics characteristics of respondents. Frequencies and percentages were computed for all items (V1 to V6) to describe the prevalence of adherence across the sample. Adherent was identified as respondents who had met 100% criteria of frequencies and percentages described adherence levels for each item reflecting "Variety".

3. Results and Discussion

3.1 Socio-demographic Characteristics of Respondents

This study involved 256 older adults, with a mean age of 67.4 ± 5.9 years. Their demographic and socioeconomic profiles are summarized in Table 1. Most participants were classified as younger-old, and nearly 80% were housewives or unemployed. A significant proportion relied on personal savings, family assistance, or continued employment during later life to sustain their livelihood. Only 7.8% of the respondents lived alone, while the remaining 92.2% resided with spouses and/or family members. Economically, the majority fell into the low-income category. Such characteristics, which have also been reported in earlier studies (Cheng et al., 2015; Fakhruddin et al., 2016), indicate a heightened vulnerability to food insecurity and poor diet quality among this population. Within this study group, 23% of older adults were affected by food insecurity, with 12.9% specifically reporting financial difficulties due to insufficient funds for daily necessities.

Table 1. Demographic and socioeconomic characteristics of respondent

Variables	N (256)	%	Mean ± SD	Median (IQR)
Age (years)				
60-74	222	86.7		
≥75	34	13.3		
Min-max: 60-91	256	100	67.4 ± 5.9	66 (7)
Gender				
Male	118	46.1		
Female	138	53.9		
Marital Status				
Married	189	73.8		
Separated/ Widow/ Widower	63	24.6		
Ethnicity				
Malay	254	99.2		
Non-Malay	2	0.8		
Living arrangement				
Living alone	20	7.8		
Living with others				
~ with spouse	43	16.8		
~ with spouse, children and grandchildren	151	59.0		
~ Parents, children and grandchildren	39	15.2		
~ Others	3	1.2		
House ownership status				
Own	240	93.8		
Rent/ Others	16	6.2		
Household size[1]				
1 to 4	172	67.2		
>4	84	32.8		
Min-max: 0 to 14			3.94 ± 2.1	4(3)
Respondent's education level				
No formal education	19	7.4	-	
Primary school	136	53.1		
Secondary and tertiary education	100	39		
Respondent's occupation status				
Employed / Retired but still employed	51	19.9		
Unemployed/ housewife	121	47.3		
Retired/Pensioner	84	32.8		
Monthly Individual Income (RM)[2]				
Low < RM 1000	117	45.7		

Variables	N (256)	%	Mean ± SD	Median (IQR)
Moderate RM 1000- 1999	81	31.6		
High > RM 2000	58	22.7		
Min-max: 0 to 8650			1373 ± 1352	1000 (1364)
Perception of Income Status				
Having financial problems because not enough money for daily needs	33	12.9		
Enough money for daily needs only	111	43.4		
Enough money to buy whatever we want	53	20.7		
Enough money to buy whatever we want with saving	59	23.0		
Food Security Status				
Food secure	197	77		
Food insecure	59	23		

[1]Average household size was 4.31 based on the average family size (persons) by Malaysian Census (2010).
[2] Income category based on the National Health & Morbidity Survey for Older person 2018.

3.2 Malaysian Older Adults' Adherence Towards "Variety" Indicators

Table 2 summarizes respondents' distribution across specific variety indicators. Overall, dietary variety was markedly low among this population. Fewer than one in ten respondents (9.4%) achieved the MDG recommendation of consuming at least one serving from all five major food groups daily. Nearly 40% missed two food groups, and over 50% missed at least one, suggesting widespread dietary imbalance. Adherence to within-group diversity was even poorer. Only 2.7% consumed different fruits across meals, and a negligible 0.4% (1 person) consumed different coloured vegetables for both lunch and dinner. Although a majority met the minimum frequency for green leafy (64.5%) and non-leafy vegetables (70.7%), diversity within these groups was generally low. Protein intake was predominantly fish-based, with 69.1% relying on a single protein source per week, and just 10.9% consuming three or more distinct protein sources (including poultry, eggs, legumes, and nuts).

Table 2. Respondent's adherence to variety characteristic (N=256)

Component	Item(s) name	Scoring Criteria	n	%
Variety	V1- Overall Food Group Variety	≥1 serving from each food group/day	24	9.4
		Any 1 food group missing/day	84	32.8
		Any 2 food groups missing/day	99	38.7
		Any 3 food groups missing/day	44	17.2
		≥ 4 food groups missing/ day	5	2.0
		None from any food groups	0	0.0
	V2- Within-group variety for **fruit groups**	Take ≥1 serving of different fruits during each meals	7	2.7
		Did **not** take ≥1 serving of different fruits during each meal	249	97.3

V3- Within-group variety for the vegetables group **(green leafy vegetables)**	Take ≥1 serving of different dark green leafy vegetables 2-3 times a week	165	64.5
	Did not take ≥1 serving of different dark green leafy vegetables 2-3 times a week	91	35.5
V4- Within-group variety for vegetables group **(non-leafy vegetables)**	Take ≥1 serving of non-leafy vegetables 2-3 times a week	181	70.7
	Did not take ≥1 serving of non-leafy vegetables 2-3 times a week	75	29.3
V5- Within-group variety for vegetables group **(colored vegetables)**	Have different colored vegetables for lunch and dinner	1	0.4
	Did not take different colored vegetables for lunch and dinner	255	99.6
V6- Within-group variety for **protein source** (fish, meat, poultry, egg, legumes and nuts	≥3 different sources/week	28	10.9
	2 different sources/week	51	19.9
	From 1 source/week	177	69.1
	None	0	0.0

Overall, these findings are alarming. The first indicator of variety measured in this study is considered highly important. Meeting the recommendation of consuming at least one serving from each major food group on a daily basis has the potential to ensure nutrient diversity in the diets of older adults, thereby reducing the risk of nutrient deficiencies that could compromise their health. In previous study by Jaafar et al. (2024), the notable inadequacy of minerals (calcium, magnesium, potassium) and vitamins (vitamin B6, B12, vitamin E and vitamin K) could be avoided by taking variety of food from rice, whole grains and cereals, fruits, vegetables and milk groups. While 70.7% consumed at least one serving of non-leafy (V3) vegetables 2–3 times per week, and 64.5% met the same frequency for dark green leafy vegetables (V4), diversity within vegetable types remains limited. Being an adherent (to have different kinds of fruits and vegetables for each meal; item V2 and V5) is quite impossible for the respondents. During interviews with the respondents, they reported that they usually had the same meals over lunch and dinner as they only cook the dishes once per day. This is again critical for ensuring that older persons obtain a range of micronutrients and antioxidants.

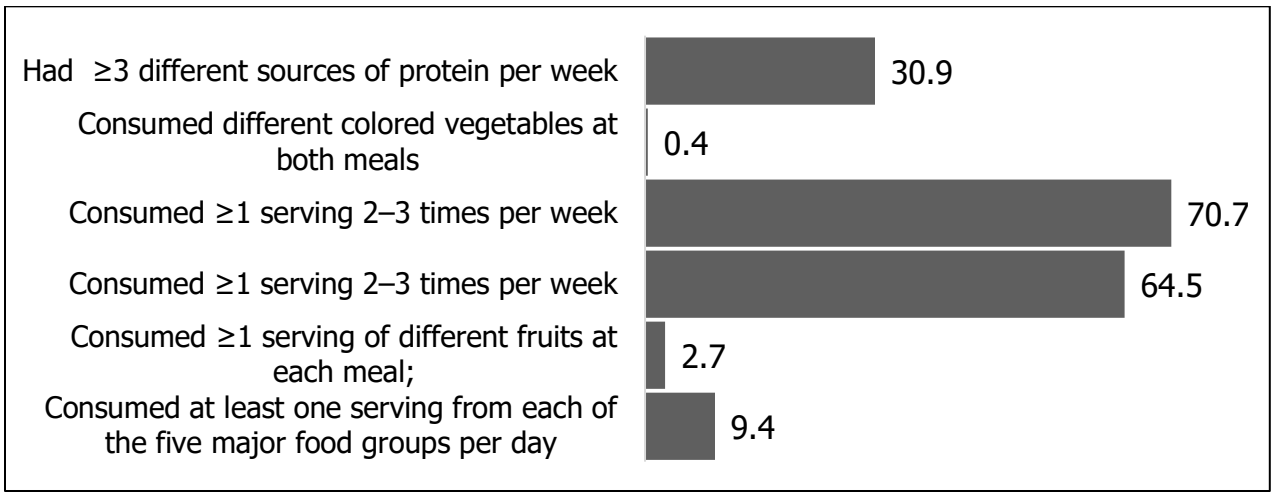

Figure 1. Percentage of adherent towardsvariety characteristics as outlined in Malaysian Dietary Guideline (MDG 2010/2020 and MDG-OP 2023).

Protein variedness (V6) showed moderate adherence, with only 30.9% of respondents achieving ≥3 different protein sources per week, likely driven by a heavy reliance on fish as the primary source. Detailed examination of their protein sources reveals that most protein sources came from fish, eggs, and ikan bilis. Fish and eggs are likely among the top 10 daily consumed foods (Norimah et al., 2008). Meat and nuts intake however, are less reported among respondents due to several issues such as chewing difficulties and limited access to fresh produce and mainly financial constraints. Some respondents reported consuming meat only during the Hari Raya Korban (Eid al-Adha) celebration, suggesting limited access to or infrequent intake of animal-based protein sources throughout the year. This is consistent with the observed socio-economic characteristics of this study population, which the majority of respondents are low-income, with 23% prevalence of food insecurity and 12.9% reporting direct financial insufficiency. This pattern may reflect economic constraints and highlights potential challenges in achieving adequate dietary variety, particularly in the intake of animal-based protein sources. This overlap suggests that economic vulnerability may be a key barrier to meeting variety recommendations.

4. Conclusion

These results emphasise the need to explore predictors of low adherence, particularly income level, marital status, and household composition, to better understand their combined effects on dietary variety and overall diet quality among Malaysian older adults. The low overall dietary variety observed underscores the potential risk of micronutrient inadequacy, poor diet quality, and adverse health outcomes among Malaysian older adults. Improving variety, particularly for under-consumed groups, will require targeted nutrition education, affordable access strategies (e.g., community food programs), and culturally tailored interventions to support healthy ageing.

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