ORIGINAL ARTICLE

Energy and Protein Intake and Its Association with Malnutrition Risk among Community-Living Older Adults in Kuantan, Pahang

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ABSTRACT

Background: Inadequate dietary intake among older adults poses a public health concern as it could lead to adverse effects, including malnutrition risk and poor health outcomes. Thus, this study aimed to assess the energy and protein intake of community living older adults in Kuantan, Pahang, and its association with malnutrition risk. Another objective was to identify sources of protein foods commonly consumed in this studied population. **Methods:** A cross-sectional study was conducted among community-living older adults in Kuantan, Pahang. The dietary intake data were obtained from the diet history method. Malnutrition risk was assessed using Mini Nutritional Assessment-Short Form (MNA-SF). Anthropometric measurements of weight and height were performed for body mass index (BMI) calculation. Data was analysed using descriptive statistics, one-sample t-test, and one-way ANOVA. P-value was set at $p<0.05$ as statistically significant. **Results:** A total of seventy-three (n=73) community living older adults participated in this study, with a mean age of 65.88±5.67 years, and a mean BMI was 26.023±4.21 kg/m^2. Findings showed that energy and protein intake of the respondents were significantly lower than the Recommended Nutrient Intake (RNI). The most common protein sources consumed by the respondents were animal-based sources, particularly fish (80.8%). Eating at home was more practiced by respondents than eating out. Advancing age was significantly associated with malnutrition risk. No significant differences between MNA-SF categories with energy and protein intake were identified. **Conclusion:** Energy and protein intake were inadequate among older adults in this present study. Malnutrition risk was prevalent in this population, with older age groups being significantly at risk. Strategies to address nutritional issues among Malaysian community older adults are warranted for optimum nutritional and health status.

INTRODUCTION

Ageing is a global phenomenon that has various implications on health, with significant impacts on medical care and health policy (Noto, 2023). According to the World Health Organization (WHO), one in six people worldwide will be aged 60 years or older (WHO, 2025). Furthermore, the population aged 60 years and above is expected to increase from 1 billion in 2020 to 1.4 billion in 2030. In addition, by 2050, this population is expected to double (2.1 billion). The number of people aged 80 years and older is expected to triple between 2020 and 2050, reaching 426 million. In Malaysia, the proportion of older adults aged 60 years and above is also projected to accelerate significantly to 15.3% in 2030, to approximately 5.8 million (Abdullah et al., 2024). Malaysia is expected to become an ageing nation by 2030, with significant implications for health services and support systems (DOSM, 2023).

Ageing is a biological process defined as a progressive loss of function accompanied by decreasing fertility, increasing death, and possible diseases (Kirkwood & Austad, 2000; Viña et al., 2007). As the population ages, maintaining adequate nutritional status becomes a crucial component of healthy ageing. Energy and protein intake are particularly important among older adults, as they play vital roles in maintaining muscle mass, immune function, and overall health (Bauer et al., 2013; Volkert et al., 2019). Insufficient intake of these nutrients may lead to undernutrition, sarcopenia, frailty, and increased morbidity and mortality (Norman et al., 2021).

Older adults living in the community often face multiple challenges that can compromise their nutritional intake. Factors such as physiological changes, reduced appetite, poor dentition, limited income, social isolation, and chronic illnesses can influence dietary patterns and nutrient adequacy (Park & Kang, 2024). Hence, understanding the energy and protein intake among this group is essential for developing appropriate public health

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strategies and community interventions to promote healthy ageing.

Several studies in Malaysia have reported alarming concerns regarding inadequate dietary intake and malnutrition risk among older adults. Suzana et al. (2013), reported that 43.1% male and 42.1% female elderly participants were at risk of malnutrition according to the Mini Nutritional Assessment-Short Form (MNA-SF). Similarly, Abdul Mutalib et al. (2023) found that 11% of elderly participants were malnourished and 48% were at risk of malnutrition, despite having higher energy consumption compared to the Recommended Nutrient Intake (RNI). In another study, Ahmad et al. (2021) found that sociodemographic characteristics such as rural residence and low education level were associated with malnutrition risk among older adults, with the cumulative prevalence of malnutrition and risk of malnutrition of 30.8%.

To assess the malnutrition risk in older adults, validated screening tools such as the Mini Nutritional Assessment–Short Form (MNA-SF) are required. MNA-SF is a short, valid screening tool that has been developed to identify malnutrition in a community setting (Kaiser et al., 2009). The MNA-SF consists of 6 items that have been developed from 18 items of the full MNA, but still retain the accuracy and validity (Rubenstein et al., 2001). It evaluates several key parameters, including food intake, weight loss, mobility, psychological stress, neuropsychological problems, and body mass index (BMI) or calf circumference (Guigoz, 2006). This tool is particularly suitable for community settings as it is simple, quick to administer, and has been validated in diverse populations, including Malaysian older adults (Shahar & Siti Saifa, 2007).

As Malaysia faces the demographic shift, assessing the dietary intakes, specifically energy and protein, and malnutrition risk using MNA-SF is needed for a comprehensive understanding of the nutritional well-being of older adults. Combining these assessments helps identify those at risk of malnutrition and informs targeted interventions to improve dietary practices and overall health outcomes. Despite existing national data, there is limited evidence that specifically explores energy and protein intake with malnutrition risk among urban older adults within a local context in Pahang. Therefore, this study aimed to determine the energy and protein intake and evaluate its association with malnutrition risk among community-living older adults in Kuantan, Pahang, using the MNA-SF tool.

MATERIALS AND METHODS

Study Design and Population

A cross-sectional study was conducted among urban community-living older adults in Kuantan, Pahang. The participants who were 60 years old and above, living in Kuantan, Pahang, and willing to participate in this study were selected.

Sampling Method

According to the Department of Statistics Malaysia (DOSM, 2020), Kuantan has a population of 128,247 with 5.3% of older adults. Hence, the estimation of sample size was calculated by using a formula (Naing et al., 2006) where the standard value of confidence level 95% was set as 1.96, absolute precision was set as 5% and the estimated prevalence of malnutrition among community living older adults in Kuantan was 5%. Therefore, after calculating, a total of seventy-three (n=73) respondents were required as the sample size in this study.

A convenient sampling method was conducted for the recruitment of the participants. Thus, participants who fulfilled the inclusion criteria were provided with an informed consent form to fill in for their voluntary participation. The respondents were informed that their identities would remain anonymous and that the data collected would be used for research purposes only.

Data Collection

The participants were informed about this study. Hence, the participants who voluntarily participated in this study were interviewed on their demographic data, diet history, and MNA-SF questions.

Anthropometric measurements

The weight and height of respondents were measured using a weighing scale (SECA 803, Hamburg, Germany) and a portable stadiometer (SECA 213, Hamburg, Germany), respectively. Measurements of weight (kilogram) and height (metre) were needed to calculate body mass index (BMI). Furthermore, weight changes of the respondents were also asked to identify the amount of weight loss, if any. This information was collected to fill in the MNA-SF questionnaire.

Dietary intake assessment

The dietary intake assessment was collected face-to-face with the elder respondents. The questions that were asked

were about mealtimes, place of eating, food intake, types of food, amount or quantity of food taken, and the most frequent food intake. The diet history method was utilized as it provides both information, dietary intake and food habits of the individuals, and it shows a better understanding of undernutrition and overnutrition (Shahar et al., 2000). The diet history was analysed by using Nutritionist Pro Software version 2006 to obtain the total energy and protein intake.

Next, open-ended questions were asked to explore participants' protein intake preference, including whether they commonly consumed animal-based or plant-based protein sources, and the frequency of intake for specific foods such as beef or lamb, chicken, fish, and legumes. The common sources of protein were then identified based on the reported frequency of consumption per week.

MNA-SF questionnaire

The MNA-SF was administered by a researcher. It is a validated tool that consists of 6 questions and takes only 5 minutes to complete (Kaiser et al., 2009) and has been validated in the Malaysian older adults population (Suzana & Siti Saifa, 2007). The components of MNA-SF are as follows:

A. Has food intake declined over the past 3 months due to loss of appetite, digestive problems, or chewing or swallowing difficulties?
B. Weight loss during the last 3 months
C. Mobility
D. Has suffered psychological stress or acute disease in the past 3 months?
E. Neuropsychological problems
F. Body Mass Index (BMI) OR
F2. Calf Circumference

MNA-SF has a maximum score of 14. Participants' malnutrition risk has been categorized into three groups: well-nourished (score 12-14 points), at-risk of malnutrition (8-11 points), and malnourished (0-7 points) (Kaiser et al., 2009). Patient has satisfactory nutritional status if the score is ≥12 and 14.

Data Analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 12.0. Next, descriptive analysis was used to obtain the mean and standard deviation (SD) for age, energy, and protein intake. Moreover, the comparison of energy and protein intake with recommended nutrient intake (RNI) was analysed by using a sample T-test. The association between energy and protein intake with MNA-SF score categories (normal nutritional status, at risk of malnutrition, and malnourished) was analysed using One-Way ANOVA. The significance level was set at $p<0.05$.

Ethics Application

Ethics approval was obtained from the International Islamic University Malaysia (IIUM) Research Ethics Committee (IREC) (IREC NO: 618).

RESULTS

Demographic Data

A total of seventy-three (n=73) respondents from Kuantan were recruited for this research. From the total respondents, there were n=37 (50.7%) male and n=36 (49.3%) female older adults. The age of the respondents ranges from 60 - 84 years old. All respondents were Malay. Table 1 shows the age and BMI of the respondents. The mean age was 65.88±5.67. The mean BMI was 26.023±4.21, and the BMI ranged from 19.5 to 36.8 kg/m^2.

Table 1: Demographic data of the respondents (n=73)

Variable	Mean±SD	Range
Age in years	65.88±5.67	60-84
BMI (kg/m^2)	26.023±4.21	19.5-36.80

Dietary Intake

Table 2 presents the mean energy and protein intake per day compared with the Recommended Nutrient Intakes (RNI) for Malaysian elderly. The mean±SD energy intake of the respondents was 1287.50±404.11, which was significantly lower than the recommended energy requirement by RNI (1896.58±115.79). Besides, the protein intake, 47.40±14.28, was also significantly lower than the recommended protein requirement by RNI (55.10±4.03). The one-sample t-test showed that the results demonstrated significant differences, as the *p*-value was <0.001 (*p*-value<0.05) for both energy and protein intake compared with RNI.

Table 2: Mean±SD energy and protein intake compared with RNI

Variable	Intake Mean±SD	RNI Mean±SD	*p*-value*
Energy (kcal/day)	1287.50±404.11	1896.58±115.79	<0.001
Protein (g/day)	47.40±14.28	55.10±4.03	<0.001

*One Sample t-test

Dietary Practices

Table 3 shows the frequencies and percentages of respondents' dietary practices related to place of eating, preferred type of protein, and preferred protein sources. 84.9% (n=62) of the respondents eat at home, while 15.1% (n=11) of the respondents practice eating out. 98.6% of respondents preferred animal-based protein sources, whilst only 1.4% preferred legumes and soy products. The most preferred protein source by respondents was fish (80.8%). While other preferred protein sources by the respondents were: chicken (15.1%), beef/lamb (2.7%), and 1.4% preferred legumes and soy products.

Table 3: The dietary practices of respondents (n=73)

Dietary practices	Frequency (n)	Percentages (%)
Place of eating		
- Home	62	84.9
- Outside	11	15.1
Preferred type of protein		
- Animal	72	98.6
- Legumes, soy product	1	1.4
Preferred protein sources		
- Beef/lamb	2	2.7
- Chicken	11	15.1
- Fish	59	80.8
- Legumes and soy products	1	1.4

The Association between Age, Energy, and Protein Intake with MNA-SF score

Table 4 shows the association between age, energy, and protein intake with the MNA-SF score. According to the MNA-SF score, 11% were malnourished, 52% at risk of malnutrition (n=38), and 37% were in the normal nutritional status category, respectively. From the MNA-SF score, the results indicated malnutrition risk status of the respondents was associated with the respondents with advancing age, who were identified as malnourished and had poor nutrition. The respondents with a mean age of 71.63±4.27 were in the malnourished category, 66.47±6.11 were at risk of malnutrition, whilst 63.33±3.70 were in the normal nutritional status category, respectively. There was a statistically significant difference between age and the MNA-SF screening score category as determined by one-way ANOVA with p-value<0.001. A Tukey post hoc test revealed that the age in the MNA-SF score was significantly different among normal nutritional status and at-risk-of-malnutrition respondents (p=0.047), normal nutritional status and malnourished respondents (p<0.001), and at-risk-of-malnutrition and malnourished respondents (p=0.033).

Table 4: The association between age, energy, and protein intake with the MNA-SF score

Variables	Malnourished (n=8)	At risk of malnutrition (n=38)	Normal nutrition status (n=27)	Levene's test *p*-value*
Age in years mean±SD	71.63±4.27	66.47±6.11	63.33±3.70	<0.001
Energy (kcal) mean±SD	1064.52±387.21	1305.95±408.46	1327.60±396.18	0.132
Protein (g) mean±SD	43.33±15.72	47.41±14.31	48.59±14.16	0.229

*One-Way ANOVA

The mean energy intake of the respondents in the malnourished category was 1064.52±387.21, and at risk of malnutrition was 1305.95±408.46, which were lower than the mean energy intake of respondents in the normal nutrition status category (1327.60±396.18). Nevertheless, there was no significant difference between energy intake

with MNA-SF score categories (malnourished, at risk of malnutrition, and normal nutrition status) (p=0.132). Besides, no significant difference was detected between protein intake with MNA-SF score (p=0.229).

DISCUSSION

This study assessed energy and protein intake among community living older adults in Kuantan, Pahang and its association with malnutrition risk was explored.

Energy and Protein Intake

This study revealed that the energy and protein intake were lower than the recommendation. The findings are in line with a research among Malaysian community living older adults in agricultural settlements (Zainudin, Hamirudin, Sidek, & A. Rahman, 2020). Another study among older adults in rural regions of Peninsular Malaysia also reported inadequate energy intake, although a notable higher intake among male (1412 ± 461 kcal/day) than female (1201 ± 392 kcal/d) was identified (Shahar et al., 2007). A more recent study by Ja'afar et al. (2024) reported 34.9% Malaysian community living elderly had lower energy intake than recommendation, with the use of different dietary methodology using food frequency questionnaire in comparison to diet history method in our study.

Adequate energy and nutrients intake is essential to ensure optimum nutritional status to prevent health deterioration, which could lead to poor health outcomes, hospitalization and mortality (Norman, Haß, & Pirlich, 2021). The multiple contributors to insufficient intake are physiological changes in which anorexia of aging predominates, diminished appetite (Picca, Calvani, Coelho-Júnior, Landi, & Marzetti, 2022; Tsutsumimoto et al., 2020). The anorexia of ageing is synonymous with older adults, in which declining dietary intake is a notable phenomenon in this vulnerable population (Picca et al., 2022).

Poor appetite has been documented as a predictor of low energy intake among Malay older adults residing in an urban region (Mohamad, Suzana, Noor Ibrahim, & Norshafarina, 2010), which shared similar demographics with our studied population. Prolonged energy deficit could further lead to protein-energy malnutrition, which is characterized by deterioration of both protein and energy intake, a significant issue among older adults. A pioneer study in Malaysia demonstrated that both protein and energy intake of community living older adults are inadequate, with significant deterioration across older age groups (Suriah et al., 1996). This condition not only deteriorates older adults' nutritional status but also associated with decreased muscle mass and functional impairment (Agarwal, Miller, Yaxley, & Isenring, 2013). The adverse effects include sarcopenia; a low muscle mass with poor muscle strength with a greater susceptibility to fall among older adults (Zhong et al., 2022).

Inadequacy of protein intake in this present study is consistent with findings in other study among Malaysian community living older adults (Zainudin et al., 2020). Another Malaysian study assessing nutrient deficiencies in this vulnerable population indicating an alarming rate of 85% inadequate protein intake (Ja'afar et al., 2024). Nevertheless, contrasting findings were reported by Mohd Fakhruddin, Shahar, Aziz, Yahya, and Rajikan (2016); in which most elder subjects have adequate intake particularly among female elderly. Protein is a vital nutrient for muscle protein synthesis, with a significant role in functional status and independent activities of daily living (Alamilla, Paulussen, Askow, & Burd, 2021; Nunes, Currier, Lim, & Phillips, 2021). Suboptimal protein intake is often accompanied with other nutrient deficiencies that could lead to frailty, poor cognition and impaired quality of life (Del Carmen Alvarez-Nuncio & Ziegler, 2024).

Dietary Practices of Older Adults

Interestingly, our research revealed that older adults have a strong preference for fish and a low preference for plant-based sources. Findings in a study among the majority Malay older adults in Mukim Plentong, Johor Bahru, also showed that fish was the highest protein consumed, including eggs and anchovies (Fadzwi, Sulaiman, Ibrahim, & Appannah, 2025). This can be attributed to the sociocultural acceptance of fish among the Malay community in Malaysia and its texture, which requires less chewing than meat and poultry. Regular fish consumption provides essential amino acids and is are good source of omega-3 fatty acids; beneficial for preserving muscle mass and metabolic health (Mendivil, 2021). Moreover, legumes and soy products are less synonymous among Malays as habitual protein sources. Notably, research on the type of protein sources consumed among older adults is scarce in Malaysia, which warrants further investigation. Results

from the Malaysian Adults Nutrition Survey (MANS) among the population aged 18-59 years old reported that most respondents residing in urban regions consumed chicken and eggs, whilst marine fish sources were recorded as higher among urban (51%) than rural (34%) counterparts (Norimah et al., 2008).

Eating at home is the most frequent practice of our studied population than eating out, in line with previous research (Zainudin, Hamirudin, A. Rahman, & Sidek, 2019). The cost of eating out is commonly higher than self-prepared food at home. Nevertheless, a balanced diet is an utmost importance in daily intake. A systematic review highlighted that home-delivered meals services can improve energy and protein intake in older adults, which could prevent further nutrition and health deterioration (Walton, Rosario, Pettingill, Cassimatis, & Charlton, 2019). This approach could be an alternative to improve dietary intake among Malaysian older adults.

The Association between Age, Energy, and Protein Intake with MNA-SF score

This present study demonstrated that 11% were malnourished, whilst 52% were at risk of malnutrition. Meanwhile, the most recent Malaysian nationwide study in older adults reported a lower prevalence using a similar MNA-SF screening tool with 7.3% malnutrition and 23.5% at risk of malnutrition, respectively (Ahmad et al., 2021). In agricultural settlements, Suzana, Boon, Chan, and Normah (2013) revealed a 42.5% of older adults were at risk malnutrition in Selangor; whilst lower prevalence of 25.7% was identified by Zainudin et al. (2019) in Pahang. Meanwhile, Sheikh Hishamuddin et al. (2023) reported 30% were malnourished and at-risk among older adults attending health clinics. A pilot study in similar population origin documented 64% malnutrition risk (Muhamad, Hamirudin, Zainudin, Sidek, & A. Rahman, 2019).

Our study demonstrated that advancing age is significantly associated with malnutrition risk. The finding is parallel with other Malaysian studies in agricultural settlements (Zainudin et al., 2019) and another study in a health clinic setting (Sheikh Hishamuddin et al., 2023). Previous research indicated that older adults with financial limitations is associated with malnutrition risk (Zainudin et al., 2019). Nevertheless, energy and protein intake showed no significant difference with MNA-SF categories in the present study. The findings highlight the multifactorial influences and determinants of malnutrition risk beyond dietary intake, with other well-documented potential contributors related to physiological, psychological, functional, and social support (Tomasiewicz, Polański, & Tański, 2024).

A nationwide survey demonstrated that food insecurity is a predictor of malnutrition risk among older adults, which is related to food accessibility and affordability (Ahmad et al., 2021). Food insecurity is also associated with malnutrition risk, level of education, living in a rural region, and income (Salleh et al., 2020) in which food cost is prioritized over nutrient-dense food in dietary intake. Several other factors may also be simultaneously contributing to malnutrition, such as lack of appetite, diminished taste and smell, presence of acute or chronic diseases, and poor dietary intake (Norman et al., 2021). Although the mean BMI of this studied population was in the recommended range, within 24- 27 kg/m^2 for Malaysian elderly (Ministry of Health, 2023), this clearly indicates that BMI is not a sole indicator of nutritional status in older adults. To address malnutrition risk on time, nutrition screening within a community setting is required, and health clinic settings have been identified as ideal (Sheikh Hishamuddin et al., 2023). Nutrition intervention using a specifically tailored nutrition resource kit for the malnourished and at-risk older adults was well-accepted by the older adults themselves (Noor Azam et al., 2022).

Limitations and Strengths

The limitations of this study are its preliminary characteristics, which limit the generalizability to a larger population. The cross-sectional study design also limits the causality and precludes inference of dietary intake and malnutrition risk. The identified strength of this study is the use of the diet history method to assess usual dietary intake in comparison to other methods, which might not be suitable for older adults, although a recall bias might be present. Moreover, the MNA-SF tool is a validated tool for older adults with high sensitivity and specificity to identify those who are at malnutrition risk was an instrument utilized in this study. It is worth noting that this study provides insights into the energy and protein intake of older adults' dwellers in Kuantan, an underrepresented urban region in Malaysia's aging research landscape.

CONCLUSION

This study demonstrates that the energy and protein intake of older adults in Kuantan were significantly lower than recommendations. Most respondents practiced eating at home and indicated a preference for animal-based protein sources, particularly fish. There was a statistically significant difference between age and the MNA-SF categories, but no significant difference between energy and protein intake. For future research, a larger sample size and inclusion of multiethnicity are recommended. In addition, effective nutrition education strategies are essential to ensure optimum nutritional

status among community-living older adults along with timely nutrition screening and intervention.

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