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Research Article

Determinants of Poor Diet Quality among Elderly with Low Socioeconomic Status

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ABSTRACT

The purpose of this study was to evaluate the factors that contribute to the elderly with low socioeconomic status eating poor-quality diets. Two hundreds and ninety three (293) senior citizens, including 136 men and 157 women, were sought out from five districts in Kelantan. Data on socio-demography, medical history, empty nest, depressive symptoms and diet history were obtained through an interview-administered method. Anthropometry measurement including height, weight and circumferences (waist, hip, calf and mid-upper arm) were measured. Body composition were measured using body composition monitor to obtain muscle mass and fat mass. Blood pressure were measured using blood pressure monitor. The Asian Working Group for Sarcopenia (AWGS) algorithm was used to determine the diagnosis of sarcopenia. 48.8% of the participants were underweight. The majority of participants fell short of the suggested daily calorie consumption. 42% of the participants had poor diet quality according to Healthy Eating Index (HEI) score. Hypercholesterolemia and poor Short Physical Performance Battery (SPPB) score were found to be risk factors of poor diet quality. Therefore, nutrition interventions are important to help low-income families especially with older adults to improve their nutritional status for reducing risk of sarcopenia and chronic diseases.

INTRODUCTION

Population ageing is defined as a simultaneous decrease in the percentage and number of people under the age of 15 and an increase in the percentage and number of people aged 60 and older (Ismail *et al.* 2021). By 2035, the population of older adults aged 55 and older is predicted to outnumber all children aged 0 to 14 years, and by 2080, the population of older people is predicted to outnumber all children and teenagers aged 0 to 24 years (Harasty & Ostermeier 2020). Reduced energy expenditure, physiological and psychological changes, and chronic sickness are all associated with ageing and may have an impact on the dietary requirements of senior people (Leslie & Hankey 2015). Low Socio-Economic Status (SES) is yet another key factor that has an impact on the quality of older individuals' diets (Nazri *et al.* 2020). Also, according to Nazri *et al.* (2020), there are between 28.9% and 48% of senior people with low SES who are underweight.

Elderly people who are identified as empty nesters are referred to as those who live alone or only with their spouse, while their children may live far away or they may not have any children (Su *et al.* 2020). According to Gao *et al.* (2017), empty nest syndrome significantly harms elderly people's cognitive function, physical health, and psychological well-being. Depression is also the most prevalent mood disorder among elderly people. According to Mina (2017), 15% of the elderly experience depression. Sarcopenia eventually results from a loss of muscle mass brought on by depression, loneliness, and poor physical fitness (Yuenyongchaiwat & Boonsinsukh 2020).

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According to Chen *et al.* (2020), sarcopenia is the age-related loss of both skeletal muscle mass and muscle function, which is measured by muscle strength or physical performance. The risk of malnutrition and poor appetite among the elderly has increased due to poverty, swallowing or chewing issues, unattainable healthy food, being unable to prepare food for themselves, polypharmacy, and social isolation (Rusu *et al.* 2020). Low dietary intake, both in quantity and quality, results in altered body composition, particularly a loss of lean muscle mass. Diet quality can be described as how well a person's food intake matches current recommendations (Putri *et al.* 2018). When compared to the elderly with a good appetite, individuals with a lack of appetite consumed more fats, sweets, soda, and dairy foods while consuming less energy, fibre, protein, fruits, and vegetables (Van der Meij *et al.* 2017). This condition is further worsened among older adults with low SES. According to previous studies, low SES was significantly associated with skeletal muscle loss (Dorosty *et al.* 2016; Jeng *et al.* 2018), which contributed to a decrease in physical performance and muscle strength. This condition might influence the ability to access and prepare food. In a vicious cycle, poor diet quality might amplify the risk of loss of skeletal muscle, especially among the elderly with low SES. Therefore, the current study aimed to investigate the association between diet quality and various health parameters, including empty nest, depressive symptoms, and sarcopenia, among the elderly with poor SES in Kelantan

METHODS

Design, location, and time

This study utilised a quantitative approach with a cross-sectional survey, which was conducted in five districts (Kota Bharu, Pasir Mas, Bachok, Machang, and Tumpat) in Kelantan, Malaysia. This study was conducted from 2020 to 2022 and obtained ethical approval on June 16, 2020, from the Jawatankuasa Etika Penyelidikan Manusia, (JEPeM), Universiti Sains Malaysia, with approval number USM/JEPeM/19070433.

Sampling

The convenience sampling method was employed in this research. A total of 293 participants were required based on sample size calculation using the simple proportion formula (Jacob *et al.* 2019) with a confidence level value of 1.96, precision set at 5%, and an additional drop-out rate of 5%.

Elderly aged 60 years and older, with a low education level (illiterate or with primary education) and low household income (<MYR 4,360) were recruited. Those on wheelchairs, with severe hearing or vision problems, severe health problems including end-stage renal failure on hemodialysis, stroke, cancer, amputees, severe depressive symptoms denoted by a Geriatric Depression Scale (GDS) score of 12 or higher, or those who were under-going physical rehabilitation or physiotherapy were excluded from this study.

Data collection

An interview-administered method was used to obtain the participant’s information, including sex, ethnicity, age, employment and marital status, education level, living arrangement, household income, and smoking status. Self-reported chronic diseases were noted together with the medications consumed. A history of falls, either indoors or outdoors, for the past 12 months was also recorded. We also recorded participants’ vitamin, mineral, or herbal supplement intakes. The Omron Blood Pressure Monitor was used to monitor their blood pressure. Participants were required to be seated at ease during the measurement.

The Body Composition Monitor HBF-214 was used to monitor weight. Stadiometer was used to measure height, which was recorded to the closest centimeter. Arm span was used to gauge height in older people with scoliosis. Height estimation using arm span was calculated using the formula by Shahar and Pooy (2003). By dividing weight in kilograms by the square of height in meters, the Body Mass Index (BMI) was determined. The Nutritional Screening Initiative (NSI) (1991) cut-off point for senior people served as the basis for classifying BMI.

Waist circumference was used to assess abdominal obesity. Men with readings of less than 90 cm or women with readings less than 80 cm have a high risk of cardiovascular disease. The width of the pelvis at the hip is measured as the hip circumference. The midway point between the tip of the acromion and the olecranon process distance circumference is measured as MUAC (Hu *et al.* 2021). Undernutrition was evaluated using MUAC, where values less than 23 cm and

22 cm, respectively, in men and women denote muscular wasting. Men's and women's calf circumferences had cut-off points of 30.1 cm and 27.3 cm, respectively, for measuring muscle mass loss. For analysis purposes, the mean of two readings was taken.

The Body Composition Monitor was used to monitor body composition. The Skeletal Muscle Index (SMI) needed to be calculated in relation to body composition. Men with low muscle mass were detected at 7 kg/m^2 and women at 5.7 kg/m^2 (Fung *et al*. 2019). The formula for SMI is:

$$SMI = \frac{Muscle\ mass}{Height^2}$$

Dietary History Questionnaire (DHQ) was employed to evaluate the elderly's regular food consumption (Rivan *et al.* 2022). The Healthy Eating Index (HEI), which was derived from the study by Karupaiah *et al.* (2013), was employed to determine the participants' dietary quality, with a score range of 0 to 100. In HEI, there were nine elements. Using the most recent Malaysian Food Pyramid 2020 for serving sizes of vegetables, fruits, milk and dairy products, cereals and grains, as well as poultry, meat, fish, legumes, and eggs, it was determined whether each component was in compliance. Additionally, four individual nutrient consumptions were also evaluated, including sodium, saturated fat, cholesterol, and total fat. Each group had a score between 0 and 10, which was determined proportionally for the in-between whole number responses. The formula for the overall score was:

$$\frac{Score\ derivide\ from\ the\ 9\ components}{90} \times 100\%$$

The overall HEI score is divided into three groups. Scores below 51 denote poor diet quality; scores between 51 and 80 denote intermediate or need for improvement; and scores above 80 indicate high diet quality.

Sarcopenia is defined as having reduced muscle mass and low skeletal strength or poor muscle performance, under the most recent Asian Work Group for Sarcopenia (AWGS) standards (Chen *et al.* 2020).

Severe sarcopenia is identified when the participant scores low in all three components. Hydraulic hand dynamometer was used to quantify muscle strength by measuring the hand grip strength. Men's and women's values of less than 28.0 kg and less than 18.0 kg, respectively, were used to indicate poor hand grip strength (Chen *et al.* 2020). The Short Physical Performance Battery (SPPB) was used to determine muscle performance. A balancing test, a sit-to-stand test, and a gait speed test were among the three sets of tests that were administered. Three different standing positions were used in the balance test, including tandem, side-by-side, and semi-tandem. The SPBB total score can be between 0 and 12. Better muscle function, particularly at the lower extremity, is indicated by a higher score (Yasuda *et al.* 2017). Low physical performance is identified for those who got less than nine points (Chen *et al.* 2020).

The state of the empty nest was assessed using a single-item statement that asked, "Whom are you living with?". According to Gao *et al.* (2017), the elderly was viewed as empty-nester if the response was alone or with a spouse.

To evaluate depressive symptoms, a 15-item Geriatric Depression Scale (GDS-15) was employed. There was a "yes" or "no" binary response option for each question. Participants who had a score of five or higher had a higher likelihood of experiencing depression symptoms.

Data analysis

Predictive Analytics Software (PASW) (IBM, United States) was used to enter and evaluate the acquired data. Based on the distribution of the data's normality, The Mean (SD) and Median (IQR) were reported. The frequency (%) of the category data was presented. For multivariate analysis, binary logistic regression was conducted to find predictors of low diet quality. Age and income were taken into account in the logistic regression model's adjustment for confounding variables. The p-value cut-off for significance was established at 0.05.

RESULTS AND DISCUSSION

The study has 293 participants in all. Table 1 displays the sociodemographic details of the participants. In this study, there were 157 women and 136 men. The majority of participants, 113 men (83.1%) and 91 women (58%), were married. In comparison to women (n=44, 28.0%), men (n=46, 33.8%) had a higher prevalence of empty nest syndrome ($p<0.001$).

Participants' anthropometry, body composition, blood pressure, sarcopenia, and depressive symptoms were displayed in Table 2. Men were found to be more likely to be

Table 1. Sociodemographic details of participants

Variables	Men (n=136)	Women (n=157)	Total (n=293)	*p*
Age^{+}	69.5 (8.0)	68.0 (8.0)	68.0 (9.0)	0.069^{a}
Income^{++}			0.065^{b}	
<MYR900	120 (88.2)	148 (94.3)	268 (91.5)	
MYR900−2,500	16 (11.8)	9 (5.7)	25 (8.5)	
Marital status^{++}				<0.001^{b*}
Married	113 (83.1)	91 (58.0)	204 (69.6)	
Unmarried/Widowed	23 (16.9)	66 (42.0)	89 (30.4)	
Occupation (Current)$^{++}$				<0.001^{b*}
Government/Private/Self-work	57 (41.9)	28 (17.8)	85 (29.0)	
Unemployed	79 (58.1)	129 (82.2)	208 (71.0)	
Occupation (Previous)$^{++}$				<0.001^{b*}
Government/Private/Self-work	122 (89.7)	98 (62.4)	220 (75.1)	
Unemployed	14 (10.3)	59 (37.6)	73 (24.9)	
Education years^{+}	7 (3.0)	7 (8.0)	7 (8.0)	0.189^{a}
Living with^{++}				<0.001^{b*}
Spouse/Alone	46 (33.8)	44 (28.0)	90 (30.7)	
Spouse & child	71 (52.2)	60 (38.2)	131 (44.7)	
Child only	19 (14.0)	53 (33.8)	72 (24.6)	
Smoking status^{++}				<0.001^{b*}
Yes	64 (47.1)	0 (0.0)	64 (21.8)	
No	72 (52.9)	157 (100.0)	229 (78.2)	

$^{+}$: Median (IQR); $^{++}$: n (%); ^{a}: Mann-Whitney test; ^{b}: Pearson Chi Square; *: Significant at p<0.05; MYR: Malaysian Ringgit

underweight (56.6%) than women (42.0%), while women were more likely to be overweight (33.1%) than men (22.8%) (p<0.05).

Men had a mean proportion of muscle mass in their bodies that was significantly higher than women's, at 30.0% and 24.4%, respectively. Additionally, men had a median Skeletal Muscle Index (SMI) of 6.9 kg/m^2 compared to women's 6.1 kg/m^2 (p<0.001), which was substantially higher in men.

Men's median handgrip strength for sarcopenia was 26.5 kg compared to women's 18.3 kg (p<0.001), which is a significant difference. Men (n=71, 52.2%) were substantially more likely than women (n=55, 35.0%) to have low muscle strength. It was discovered that the median gait speed test time was substantially longer in women than in men (p<0.001). Women took much longer to complete the sit-to-stand test than men did (p<0.001), which is another difference. The prevalence of poor physical performance as measured by SPPB was higher in women (n=114, 91.7%) than in men (n=93, 68.4%) (p<0.001). Women were less likely to have sarcopenia (n=28, 17.8%) than men (n=37, 27.2%). For the GDS score and subjective memory impairment, there was no statistically significant association with gender.

According to Nik Mohd Fakhruddin *et al.* (2016), energy intake below the 2.5th percentile and beyond the 97.5th percentile were signs of dietary under- and over-reporting. Out of 293 participants, 14 were removed from additional analysis because of under- and over-reporting. The overall dietary analysis, therefore, included 279 subjects. With 1,156.7 kcal/day and 1,032.0 kcal/day, respectively, the median daily energy intake of men (1,156.7 kcal/d) was substantially higher than that of women (1,032.0 kcal/d) (Table 3; p<0.001). The median protein (p=0.004), fat (p=0.025), carbohydrate (p<0.001), PUFA (p=0.002), MUFA (p<0.001), SFA (p<0.001), vitamin A (p=0.003), thiamin (p=0.002), niacin (p=0.001), riboflavin (p<0.001), vitamin E (p=0.002), folate (p=0.022), phosphorous (p<0.001), potassium (p=0.011), and zinc (p<0.001) were also significantly higher in men. However, women consumed more sugar (24.8 g/day) compared to men's (19.5 g/day), (p=0.025). Except for sodium, neither the men nor the women who were enrolled in this study met the micronutrient guidelines. Both men and women were found to consume more sodium than the RNI guideline.

The participants' average HEI scores were displayed in Table 4. Forty-two percent of

Table 2. Anthropometry, blood pressure, body composition, sarcopenia and depressive symptoms

Variables	Men (n=136)	Women (n=157)	Total (n=293)	*p*
Anthropometry				
Weight+	60.7 (6.2)	55.6 (18.0)	58.6 (17.2)	<0.001[a*]
Height+	161.5 (9.2)	149.8 (7.3)	154.3 (12.9)	<0.001[a*]
BMI+++				0.039[c*]
Underweight	77 (56.6)	66 (42.0)	143 (48.8)	
Normal	28 (20.6)	39 (24.8)	67 (22.9)	
Overweight	31 (22.8)	52 (33.1)	83 (28.3)	
Waist circumference+	82 (17.5)	85 (19)	83 (18)	0.485[a]
Hip circumference+	90.5 (11.3)	92.5 (13.8)	91.5 (12)	0.161[a]
MUAC+	27 (5.1)	27 (5.6)	27 (5.4)	0.644[a]
Calf circumference+	32.4 (5)	31 (5.1)	31.7 (4.5)	<0.001[a*]
Blood pressure				
Systolic+	145.0 (37.0)	152.0 (30.0)	150.0 (35.0)	0.029[a*]
Diastolic+	78.5 (15.0)	80.0 (16.0)	79.0 (15.0)	0.288[a]
Body composition				
Muscle Mass (%)++	30.0 (2.3)	24.4 (2.4)	27.0 (3.7)	<0.001[b*]
Fat Mass (%)+	26.5 (5.4)	36.5 (6.8)	31.1 (10.4)	<0.001[a*]
SMI+ (kg/m^2)	6.9 (1.7)	6.1 (1.0)	6.4 (1.4)	<0.001[a*]
Low Muscle Mass+++	72 (52.9)	56 (35.7)	128 (43.7)	0.003[c*]
Sarcopenia				
Handgrip+ (kg)	26.5 (12.0)	18.3 (6.0)	21.5 (9.0)	<0.001[a*]
Low Muscle Strength+++	71 (52.2)	55 (35.0)	116 (39.6)	0.003[c*]
Balance Test Mark+	4.0 (0.0)	4.0 (0.0)	4.0 (0.0)	0.012[a*]
Gait Speed Time+ (s)	6.0 (1.9)	6.6 (2.6)	6.3 (2.1)	<0.001[a*]
Sit-to-stand Time+(s)	14.9 (4.2)	17.8 (4.4)	16.5 (5.0)	<0.001[a*]
SPPB Total Mark+++				<0.001[c*]
Poor physical performance	93 (68.4)	114 (91.7)	237 (80.9)	
Sarcopenia+++				0.007[c*]
No sarcopenia	67 (49.3)	106 (67.5)	173 (59.0)	
Sarcopenia	37 (27.2)	28 (17.8)	65 (22.2)	
Severe sarcopenia	32 (23.5)	23 (14.6)	55 (18.8)	
Depressive symptoms				
GDS+++				0.090[c]
Low Risk	104 (76.5)	106 (67.5)	210 (71.7)	
High Risk	32 (23.5)	51 (32.5)	83 (28.3)	

MUAC: Mid-Upper Arm Circumference; SPPB: Short Physical Performance Battery; BMI: Body Mass Index; SMI: Skeletal Muscle Index; GDS: Geriatric Depression Scale; +: Median (IQR); ++: Mean (SD): +++: n (%); [a]Mann-Whitney test; [b]: Independent t-test; [c]: Pearson Chi Square; *: Significant at p<0.05

participants reported eating diets of poor quality. The median daily serving size of cereal for men was, however, significantly greater than for women, at 5.5 and 5.0, respectively (p<0.001). Although it was still less than the advised intake, the median daily serving size for protein meal among men was substantially higher than that of women, at 1.0 and 0.5, respectively (p=0.010). Men's overall fat and saturated fat consumption was significantly higher, with 40.7% and 6.5% of daily energy, respectively.

Those without sarcopenia had median HEI values that were substantially higher than those of sarcopenic and severely sarcopenic participants (55.56, 53.33, and 49.44, respectively) (p=0.043).

The results of the binary logistic regression that was carried out to identify the predictors of poor food quality are displayed in Table 5. Self-reported hypertension, high cholesterol, renal disorders, and diabetes, together with BMI, weight, SMI, SPPB, handgrip, sarcopenia, empty nest, and GDS, were the independent variables

Table 3. Energy and nutrients consumption adherence to the Malaysian recommended nutrient intake among the participants

Nutrients[+]	Men (n=129)	RNI	% RNI	Women (n=147)	RNI	% RNI	p^a
Energy (kcal/d)	1,156.7 (369.2)	2,030	57.0	1,032.0 (335.3)	1,770	58.3	<0.001*
Protein (g/d)	38.4 (13.6)	58	66.2	34.8 (13.9)	50	69.6	0.004*
Carbohydrate (g/d)	150.0 (56.7)	-	-	133.3 (48.4)	-	-	<0.001*
Fat (g/d)	40.7 (17.8)	56–68	72.7	37.8 (19.5)	49–59	77.1	0.025*
SFA (g/d)	6.4 (5.7)	-	-	4.6 (5.2)	-	-	<0.001*
MUFA (g/d)	2.4 (3.3)	-	-	1.4 (1.9)	-	-	<0.001*
PUFA (g/d)	1.0 (1.5)	-	-	0.7 (0.9)	-	-	0.002*
Fibre (g/d)	2.1 (2.2)	20–30	10.5	2.2 (1.9)	20–30	11.0	0.436
Sugar (g/d)	19.4 (25.6)	-	-	24.5 (21.2)	-	-	0.025*
Vitamin A (RE/d)	324.5 (424.2)	600	54.1	270.4 (232.7)	600	45.1	0.003*
Vitamin C (mg/d)	56.5 (81.9)	70	80.7	56.0 (51.7)	70	80.0	0.199
Vitamin D (μg/d)	0.7 (1.9)	20	3.5	3.9 (38.7)	20	19.5	0.465
Vitamin E (mg/d)	1.9 (2.2)	10	19.0	1.3 (1.2)	7.5	17.3	0.002*
Thiamin (mg/d)	0.5 (0.3)	1.2	41.7	0.5 (0.3)	1.1	45.5	0.002*
Riboflavin (mg/d)	0.8 (0.6)	1.3	61.5	0.6 (0.4)	1.1	54.5	<0.001*
Niacin (mg/d)	7.2 (3.9)	16	45.0	6.4 (2.9)	14	45.8	0.001*
Folate (μg/d)	61.1 (44.8)	400	15.3	50.5 (41.6)	400	12.6	0.022*
Sodium (mg/d)	1,380.8 (1,013.8)	1,200	115.1	1,352.3 (1,012.8)	1,200	112.7	0.397
Potassium (mg/d)	987.0 (511.4)	4,700	21.0	923.4 (552.0)	4,700	19.6	0.011*

RNI: Recommended Nutrient Intake; [+]: Median (IQR); [a]: Mann-Whitney test; [*]: Significant at p<0.05

Table 4. Total and component healthy eating index scores

HEI categories	Men (n=136)	Women (n=157)	Total (n=293)	p
Total HEI score[+]	54.4 (14.4)	53.3 (16.7)	53.3 (16.1)	0.766[a]
HEI rating[++]				0.219[b]
Poor	55 (40.4)	68 (43.3)	123 (42.0)	
Intermediate	81 (59.6)	89.5 (54.8)	167 (57.0)	
Good	0 (0.0)	3 (1.9)	3 (1.0)	
Serving per day				
Grouping A[+]				
Cereals	5.5 (2.5)	5.0 (2.5)	5 (2.5)	<0.001[a*]
Vegetables	0 (0.0)	0 (0.0)	0 (0.0)	0.870[a]
Fruits	0 (0.5)	0 (1.0)	0 (1.0)	0.126[a]
Dairy products	0 (0.0)	0 (0.0)	0 (0.0)	1.000[a]
Protein food	1 (1.5)	0.5 (1.0)	0.5(1.0)	0.010[a*]
Grouping B[+]				
Total fat	40.7 (17.9)	37.9 (19.1)		0.034[a*]
Saturated fat	6.5 (5.8)	4.6 (5.2)		<0.001[a*]
Cholesterol	31.6 (75.7)	25.4 (66.7)		0.280[a]
Sodium	1,382.4 (1,019.8)	1,361.1 (1,045.7)		0.448[a]

[+]: Median (IQR); [++]: n (%); [a]: Mann-Whitney test; [b]: Pearson Chi Square; HEI: Healthy Eating Index

for the model. Fourteen-point five percent (Nagelkerke R2) of the variation in the quality of the diet was shown in the model. An excellent match was found by the Hosmer and Lemeshow Test (p=0.086). According to Table 5, people with high cholesterol had a higher likelihood (2.4 times) to eat poorly than participants with normal cholesterol (95% CI:0.107–5.209; p=0.027). Additionally, a higher SPPB total score, which denoted superior physical performance, was

Table 5. Risk factors of poor diet quality

Variables	B	S.E.	Exp (B)	95% CI for Exp (B)		*p*
				Lower	Upper	
High blood pressure	-0.332	0.388	0.718	0.336	1.536	0.393
High cholesterol	0.876	0.395	2.402	1.107	5.209	0.027*
Diabetes	0.426	0.424	1.531	0.668	3.513	0.314
Renal diseases	-0.046	0.857	0.955	0.178	5.122	0.957
Weight	0.039	0.031	1.040	0.979	1.104	0.205
Body mass index	-0.055	0.058	0.947	0.845	1.061	0.345
Skeletel muscle index	-0.049	0.266	0.952	0.565	1.605	0.854
Handgrip	-0.032	0.028	0.969	0.917	1.023	0.250
Short physical performance battery	-0.249	0.113	0.780	0.624	0.974	0.028*
Sarcopenia	-0.249	0.265	0.779	0.463	1.311	0.347
Empty nest	0.171	0.343	1.186	0.606	2.322	0.619
Geriatric depression scale	-0.475	0.380	0.622	0.295	1.309	0.211

Exp (B): Odd Ratio; SE: Standard Error; CI: Confidence Interval; Model has been adjusted for confounding factors including age and income

Dependent variable: HEI Score (0: Good and intermediate diet quality; 1: Poor diet quality); *: Significant at $p<0.05$

linked to a lower risk of having a poor diet (95% CI:0.624–0.974; p=0.028).

The purpose of this study was to look into the predictors of poor diet quality among the elderly with poor SES.

In the current study, sarcopenia prevalence is 22.2%, and severe sarcopenia prevalence is 18.8%. According to a review by Woo *et al.* (2019), which covered Asian nations including Hong Kong, China, Taiwan, Malaysia, Singapore, Vietnam, and Indonesia, it was found that Hong Kong (16.6%), Taiwan (19.9%), and Singapore (13.7%) had the highest prevalence of sarcopenia among the elderly.

In the current study, the recommendations for energy and nutrient consumption for both men and women were not met. Similar findings were found in research conducted by Nik Mohd Fakhruddin *et al.* (2016) on 2,322 senior citizens in Malaysia, which found that neither men nor women met the RNI. Additionally, the current study discovered that men (1,156.7 kcal/d) consumed much more energy on a median basis than women (1,032.0 kcal/d). This finding is comparable to one made by Bennett *et al.* (2018) in a study among 200,000 adults from the United Kingdom, which found that men consumed significantly more energy and macronutrients, with a difference of 1,358 kJ in daily total energy consumption.

In addition, the current study discovered that women consumed substantially more sugar than men. This result is comparable to the results from the Bennett *et al.* (2018) study, which discovered that women were considerably more likely than men to consume more sugar than was advised.

The participants' median daily intake of dietary fiber, which is lower than the RNI's recommendation of 20–30 g, is low (2.1–2.2 g). Inadequate fiber consumption can cause constipation and poor bowel function, which can negatively impact quality of life (Kehoe *et al.* 2021).

Forty-two percent of the participants had poor diet quality in total. The overall mean HEI score was 79.3, according to Karupaiah *et al.* (2013) study of urbanised women in Malaysia. Due to a socioeconomic gradient in diet quality caused by the price of food, the current study's participants had lower HEI scores than those in the study by Karupaiah *et al.* (2013) (Darmon & Drewnowski 2015). Because these foods are more expensive than less nutritious food options, healthy food groups are less frequently consumed (Rao *et al.* 2013).

The reported median serving size for dairy products, vegetables, and fruits is 0, which is less than the advised serving. Given that the majority of participants in this research did not reach the recommended intake amount for the majority of the micronutrients and fiber, the poor HEI point for the components of fruits, vegetables, and dairy products may result in poor nutrition.

This research discovered that subjects without sarcopenia had considerably better median HEI scores than sarcopenic and severely sarcopenic participants. According to Na *et al.*

(2020), the group with a poor diet had a larger odd ratio of sarcopenia than the group with a healthy diet.

Low protein intake is a potential explanation for the link between sarcopenia and poor diet quality. The essential amino acids required for the synthesis of muscle protein are primarily found in dietary proteins. Age-related fast catabolism of muscle protein occurs in the body, and older people's protein intake has been linked positively to fat-free mass (Geirsdottir *et al.* 2013). For the elderly with sarcopenia, the Society for Sarcopenia, Cachexia, and Wasting Disease has advised balanced protein intake (1–1.5 g/kg/day), more energy intake, and amino acid supplementation (Noce *et al.* 2021). Additionally, the elderly without sarcopenia are advised by the European Society for Clinical Nutrition and Metabolism (ESPEN) to consume protein at a rate of 1.2–1.4 g/kg/day to help maintain their muscle mass and prevent sarcopenia (Deutz *et al.* 2014).

In addition, eating fruits and vegetables proved crucial for sarcopenia. According to Tan *et al.* (2018), fruits and vegetables are rich in antioxidant nutrients like vitamin C, magnesium, and vitamin E that have the potential to lower inflammatory markers like interleukin-6 and C-reactive protein. Antioxidant-rich diets may mitigate or even reverse the pathophysiological and cognitive changes that come with ageing. Inadequate antioxidant consumption and increased inflammation from poor diet quality may both have a deleterious impact on the pathophysiology of depression (Gopinath *et al.* 2014).

High cholesterol and an SPPB score are risk factors for poor diet quality, according to the study's adjusted binary logistic regression model. When compared to those with normal cholesterol levels, participants with high cholesterol had a higher likelihood (2.4 times) of having poor diet quality. This decreases the quality of their diet and raises the risk of hypercholesterolemia.

The current study also discovered that a decrease in the risk of poor diet quality was connected with higher SPPB total scores, which indicated good physical performance. According to a study by Robinson *et al.* (2018), older people who had better diet quality throughout adulthood performed physically better, with faster chair rise times and longer standing balancing times. Higher consumption of vegetables, fruit, and wholegrain bread are indicators of a diet with higher quality.

As far as we are aware, this is the first research to attempt to evaluate the quality of the diet among the elderly during the COVID-19 pandemic, specifically those with low SES. The risk factors for the diet quality of this particular population throughout the outbreak were also examined in this study. The current research was subject to a few limitations. First off, as this research used a cross-sectional design, it prevented the assessment of direction and the potential causation of association. Therefore, this research was unable to develop a causal relationship between diet quality and sarcopenia. Additionally, the fact that every participant in the current study is Malay may restrict the generalisability of the findings. Racial differences in diet quality may result from a variety of social and religious practices as well as other reasons.

CONCLUSION

In conclusion, as 42% of participants had low diet quality, the dietary quality of elderly with low socioeconomic status is concerning. Hypercholesterolemia and low SPPB score are the factors that determine a poor diet's quality. To prove a link between poor dietary quality and sarcopenia, longitudinal studies are essential.

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DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

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