ORIGINAL ARTICLE

Dietary Protein Intake, Health-related Quality of Life and Sleep Quality of Malaysians

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ABSTRACT

Introduction: The Malaysian Adult Nutrition Survey and National Health and Morbidity Surveys revealed a significant shift in protein intake with increased meat and seafood consumption. Concomitantly, non-communicable diseases (NCD) increased and were linked to poor health-related quality of life (HRQoL) and sleep quality. Protein intake, particularly from the animal source, is a modifiable nutrition parameter affecting HRQoL and sleep quality. This study investigated the association between different animal proteins, HRQoL and sleep quality in the Malaysian population. **Methods:** One hundred and fifty Malaysian adults were recruited and subjected to validated questionnaires to assess their protein intake, HRQoL and sleep quality. Additionally, their BMI and waist circumference were measured. Associations between all study parameters were analyzed. **Results:** There was no statistically significant association between protein intake, BMI, and waist circumference. Increased diet of white meat and seafood was linked to a lower risk of NCDs, improved overall HRQoL, and better sleep quality. Contrastingly, increased red meat consumption was associated with a higher risk of NCDs, poor physical and social function, and worsening sleep quality. **Conclusion:** The type of animal dietary protein consumed, as well as the frequency with which white and red meat, and seafood are consumed, can all have an effect on HRQoL and sleep quality. More research is needed to evaluate the impact of protein intake levels on HRQoL and sleep quality, including understanding the physiological processes involved. These data will be able to assist health professionals in personalised nutritional and patient management.
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INTRODUCTION

Rapid improvements in the nation's socioeconomic position have substantially impacted community lifestyles, including eating habits and food consumption patterns. Globalisation modifies the current structure by increasing labour absorption, income, and overall prosperity, bringing the domestic economy closer to the global economy (1). Malaysia has recently experienced rapid and substantial socioeconomic developments, which have drastically influenced the habits of the community. These include major changes in Malaysians' food patterns, such as increased animal protein, processed carbohydrates, fats, and oils consumption (2). Many other developing countries have seen similar changes in food preferences, along with an increase in the frequency of non-communicable diseases (NCDs) (3). These modifications were referred to as nutrition transitions; shift from traditional meal pattern and lifestyle to a westernized one (3).

Malaysian policymakers outlined the National Plan of Action for Nutrition in Malaysia (NPANM) in 1996. Two subsequent revisions, NPANM II (2006-2015) and NPANM III (2016-2025), recognized the importance of diet related NCDs prevention and management. Understanding the primary drivers of the nation's nutrition transition is essential for developing and implementing policies that improve health outcomes. Consequently, it is essential to investigate nutritional transitions in accordance with current policies that affect diet, food supply, and behaviour (2). Data from the Malaysian Adult Nutrition Survey (MANS) and National Health and Morbidity Surveys (NHMS) revealed a significant shift in protein intake, with an increase of 49.3% in meat consumption and 38.7% in seafood consumption. Interestingly, the ratio of plant to animal protein decreased, while the prevalence of chronic diseases increased (4,5). In children, researchers

found that overweight and obese children consumed more proteins compared to normal-weight peers which raises the concerns on potential negative impacts on human health (6).

The current Recommended Dietary Allowance for protein for a healthy adult with light physical activity is 0.8 grams per kilogram of body weight per day (7). Dietary protein intakes of 1.0, 1.3, and 1.6 g per kg body weight per day are recommended for adults with limited, moderate, and vigorous physical activity, respectively, to meet functional requirements such as enhancing skeletal-muscle protein accretion and physical strength. Currently, the Ministry of Health, Malaysia, recommends an energy contribution call of 55–70% from carbohydrates, 10–15% from protein, and 20–30% from fat (8). Protein contributes 18.4% of total energy, while carbohydrates and fat contribute 52.4% and 29.2%, respectively. The present average protein consumption exceeded the recommended proportion of energy from protein (9).

Health-related quality of life (HRQoL), a multi dimensional concept that incorporates well-being and physical, mental, and social functions, is an essential indicator of healthy aging (10). Nutrition is a modifiable lifestyle habit impacting the HRQoL (11). Higher HRQoL has been associated with greater muscle mass and enhanced physical performance (12). On the contrary, the risk of cardiometabolic risk factors (13) is elevated given increased protein consumption, particularly those from animal sources, and after that, it negatively affects the HRQoL (14). Low HRQoL was also associated with poor sleep quality (15). Proteins can regulate our body's internal clock impacting sleep quality (16). Poor sleep quality has been linked to a protein-deficient diet (around 16% of total calories), while a high-protein diet was associated with reduced wake episodes while reducing sleep latency (17). In Malaysia, studies had been conducted to determine relationship between protein intake and quality of life. A study among elderly population had suggested that adequate protein intake is associated with better quality of life (18), which is similar to another study conducted among hemodialysis patients in Malaysia (19). However, both studies did not analyse the relationship between high-protein diet and different dietary protein intake with quality of life.

There is scanty research investigating dietary protein types and their association with HRQoL and sleep quality. Thus, this study aimed to investigate the association between consumption of different animal proteins with HRQoL and sleep quality in the Malaysian population.

MATERIALS AND METHODS

Study Design

This is a cross-sectional study involving Malaysian aged 18-64 conveniently recruited at public places around Malaysia. Pregnant women and individuals who follow a specific diet plan were excluded. Each participant's written informed consent was obtained prior to their participation in the study. The study methodology complied with relevant institutional, national, and international guidelines and legislation. The sample size was calculated considering the minimum number required for a pilot study, which is 50 participants (20). This study recruited 155 respondents, of which 5 were excluded due to incomplete responses. After that, 150 respondents were finalised.

Study Instrument

Participants were subjected to a self-administered questionnaire consisting of five sections as follows:

Section A: Socio-demographic factors consisted of six items, including age, gender, ethnicity, education, occupation and personal monthly income.

Section B: Daily Physical Activity consisted of two items to elicit the exercise duration per day and week.

Section C: The 24-hour food diary elicit participants' dietary record for three days, one weekend and two weekdays (21). This validated food diary is extrapolated to include two additional questions on the type and frequency of daily protein intake. Types of protein include chicken, beef, lamb, fish, pork, duck, sausage, nuggets, eggs and cheese.

Section D: Health Related-Quality of Life Medical Outcomes Study SF-20 (RAND Corporation, USA) is a validated questionnaire. It had six subscale components, namely physical functioning (PF), role functioning (RF), social functioning (SF), mental health (MH), health perception (HP) and pain score (PS).

Section E: Pittsburgh Sleep Quality Index (PSQI) is a validated and reliable tool to assess sleep disorders (22,23). It consisted of 19 items to determine subjective sleep quality, latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction. The Cronbach's alpha value for socio-demographics and daily physical activity was 0.729 and 0.810, indicating good internal consistency reliability.

Anthropometric Measurements

Participants' weight and height were measured using a standard medical weighing scale and measuring tape (Seca, USA), respectively. BMI was calculated and categorized as normal, overweight and obese according to the WHO classification (24). Waist circumference was measured and further classified as

normal and abnormal according to the International Diabetes Federation guideline (25).

Data Analysis

The food frequency questionnaire (FFQ) data were analysed using the Nutritionist Pro software version 6.2 (Axxya Systems, USA). Animal protein intake was categorized into three primary sources: white meat, red meat and seafood. The frequency of consumption for each type of protein was classified as once per day, twice per day and more than twice per day.

Scoring for the SF-20 questionnaire was completed according to developer's recommendation and guidelines (RAND Corporation, USA). Physical and role function limitations were scored to reflect the number of present limitations, with higher points indicating better function. Social function, mental health and health perception points were reversed, so higher values represent improved functionality. The pain score was scaled with higher points indicating increased pain. All scores were analysed using a linear 0 to 100 score and then grouped into ordinal categories to indicate different levels of functioning. PF, SF, MH and HP were categorised as poor, moderate and good; RF was categorised as inadequate and adequate; PS was categorised as no, moderate and high.

For Pittsburgh Sleep Quality Index (PSQI) questionnaire, a lower score denotes better sleep quality. The scores were categorized as good and poor sleepers, with a score of ≤5 and >5, respectively.

Statistical Analysis

All statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software, version 20 (IBM, USA). Pearson's Chi-square test was used to analyse the association between socio-demographics, anthropometric measurements, NCD, HRQoL and sleep quality with the consumption of animal protein and its intake frequency. The association is deemed significant when p-value is <0.05.

Ethical Clearance

Ethical approval for this study was granted by the Institutional Ethics Committee, UCSI University, via approval code UCSI/IEC-2020-FMHS-004.

RESULTS

Participants' Socio-demographic and Protein Intake

Socio-demographic characteristics, along with types and frequency of protein intake of the participants, were summarised in Table II. The study included 88 (58.7%) males and 62 (41.3%) females. Most participants were Malays (n=66), over one-quarter were Chinese (n=47) and slightly less than one-quarter were Indians (n=37). Half of the participants (50%) were between the age of 18- 25, while 20.7%, 20% and 9.3% were between the age of 26-35, 36-45 and 46 and above, respectively (mean age 33.2 years; SD 18-64 years). More participants preferred eating white meat (54.7%) than red meat (43.3%) for more than two servings daily. Seafood is consumed once daily by 55% of participants compared to white and red meat.

Age, gender, ethnicity, education level, and occupation were significantly associated ($p<0.05$) with white meat consumption, while age and occupation were significantly associated ($p<0.05$) with red meat consumption. Seafood consumption was significantly associated ($p<0.05$) with ethnicity and occupation. Younger participants aged 18-25 consumed white meat more than twice daily, while most participants from other age groups consumed white meat once or none daily. Most Chinese (72.3%) and Malay (56.1%) participants consumed white meat more than twice daily, while the majority of Indian (37.8%) participants consumed white meat once or none daily. Male participants favoured a high intake of white meat (72.7%) and red meat (57.9%). Monthly income was not significantly associated with types and frequency of protein consumption.

Impact of Protein Intake on Anthropometric Measurements

The association between protein intake and anthropometric measurements, particularly BMI and waist circumference, was investigated. Table III summarises the association between protein intake, BMI and waist circumference. Protein intake was not significantly associated with participants' BMI or waist circumference.

Table I : Subscale scores of SF-20 corresponding to functional level

SF-20 Domain	Functional Level Cut-Points		
Physical Function	≤33.3 (Poor)	33.4-66.7 (Moderate)	≥66.8 (Good)
Role Function	≤50 (Inadequate)	≥51 (Adequate)	
Social Function	≤60 (Poor)	61-80 (Moderate)	≥81 (Good)
Mental Health	≤52 (Poor)	53-76 (Moderate)	≥77 (Good)
Health Perception	≤36.8 (Poor)	36.9-54.95 (Moderate)	≥54.96 (Good)
Pain Score	0 (No Pain)	20 (Moderate)	≥40 (High)

Table II : Association of Protein Intake and Socio-demographic Factors

Socio-demographic factors	White meat consumption / day (%)			p value	Red meat consumption / day (%)			p value	Seafood consumption / day (%)			p value
	Once/None	Twice	>Twice		Once/None	Twice	>Twice		Once/None	Twice	>Twice	
Age												
18-25 (n=75)	29.3	24.0	46.7	<0.01**	29.3	25.3	45.4	0.20	25.3	53.3	21.4	0.76
26-35 (n=31)	77.4	3.2	19.4		16.1	41.9	41.9		16.1	54.8	29.1	
36-45 (n=30)	54.8	32.3	12.9		26.7	33.3	40.0		13.3	60.0	26.7	
46-56 (n=14)	50.0	16.7	33.3		33.3	16.7	50.0		16.7	50.0	33.3	
Gender												
Male (n=88)	23.9	11.4	72.7	<0.01**	20.5	21.6	57.9	<0.01**	12.5	45.5	42.0	0.15
Female (n=62)	25.5	41.8	32.7		37.1	40.3	22.6		30.6	69.4	0	
Ethnicity												
Malay (n=66)	21.2	22.7	56.1	<0.01**	31.8	36.4	31.8	0.10	21.2	48.5	30.3	0.01*
Chinese (n=47)	14.9	12.8	72.3		25.5	27.7	46.8		12.8	59.6	27.6	
Indian (n=37)	37.8	32.5	29.7		21.6	18.9	59.5		27.0	62.2	10.8	
Level of education												
Postgraduate (n=44)	27.3	18.2	54.5	0.03*	27.3	27.3	45.4	0.90	13.6	65.9	20.5	0.13
Bachelor (n=60)	30.0	26.7	43.3		28.3	28.3	43.4		26.7	53.3	20.0	
Secondary (n=28)	0	25.0	75.0		25.0	32.1	42.9		10.7	53.6	35.7	
Primary (n=18)	27.8	11.1	61.1		27.8	33.3	38.9		27.8	38.9	33.3	
Occupation												
Unemployed (n=27)	37.0	22.2	40.8	<0.01**	26.0	37.0	37.0	<0.01**	29.6	66.7	3.7	<0.01**
Government sector (n=30)	43.3	10.0	46.7		16.7	10.0	73.3		56.7	20.0	23.3	
Private sector (n=26)	11.5	23.1	65.4		38.5	19.2	42.3		3.8	57.7	38.5	
Student (n=66)	12.1	27.3	60.6		28.8	37.9	33.3		4.5	66.7	28.8	
Monthly income												
RM0 (n=62)	24.2	25.8	50.0	0.29	32.3	27.4	40.3	0.95	19.4	56.5	24.1	0.18
RM1-RM2000 (n=37)	13.5	16.2	70.3		21.6	29.7	48.6		16.2	51.4	32.4	
RM2001-RM5000 (n=39)	25.6	20.5	53.9		25.6	30.8	43.6		20.5	61.5	18.0	
RM5001-RM10000 (n=12)	41.7	25.0	33.3		25.0	33.3	41.7		33.3	41.7	25.0	
Rate of exercise												
None (n=52)	25.0	15.4	59.6	0.36	33.8	25.4	40.8	0.47	15.4	63.5	21.1	0.32
<3 days per week (n=46)	19.6	30.4	50.0		19.6	28.3	52.1		17.4	54.3	28.3	
>3 days per week (n=51)	34.3	31.4	34.3		25.0	29.5	45.5		25.5	49.0	25.5	

*p<0.05

**p<0.01

Table III : Association between protein intake, BMI and waist circumference

Protein Intake	BMI (%)			p value	Waist Circumference (%)		p value
	Normal	Overweight	Obese		Normal	High	
White Meat							
Once/None	48.6	25.7	25.7		60.0	40.0	
Twice	51.5	30.3	18.2	0.9	33.3	66.7	0.9
>Twice	50.0	31.7	18.3		46.3	53.7	
Red Meat							
Once/None	21.9	29.3	48.8		43.9	56.1	
Twice	18.2	31.8	50.0	0.9	47.7	52.3	0.9
>Twice	20.0	29.2	50.8		46.2	53.8	
Seafood							
Once/None	46.7	26.7	26.7		53.3	46.7	
Twice	54.2	30.1	15.7	0.6	45.9	54.1	0.4
>Twice	43.3	32.4	24.3		57.8	42.2	

Association of Protein Intake on NCD

Fig. 1 depicts the association between protein intake with incidences of NCD. A significant association ($p<0.05$) was found between the frequency of all three types of protein intake and its association with NCD. The findings of this study indicated that (1) low consumption of white meat, (2) low consumption of seafood and (3) high consumption of red meat was associated with incidences of NCD. Participants were reported to have obesity (34.6%), hypertension (30.8%), diabetes (30.8%) and hypercholesterolemia (3.8%).

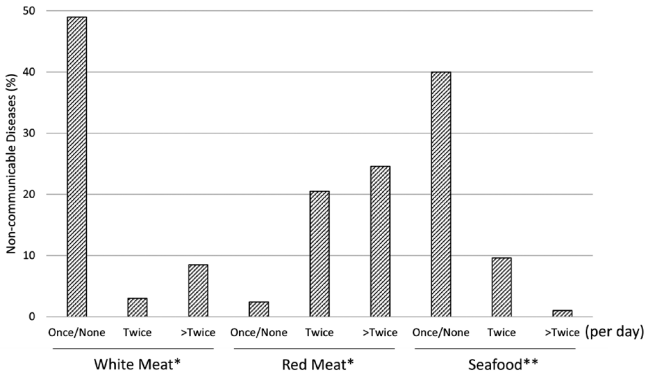

Fig. 1 : Association between protein intake and NCDs. Data presented as percent of participants and analysed using Pearson's Chi-square analysis. *$p<0.05$; **$p<0.01$

Association of Protein Intake on Health-related Qualities of Life

Table IV shows the association between protein intake and health-related quality of life. Participants consuming white meat more than twice daily had improved physical function, while 51.4% of participants consuming white meat once daily reported having poor physical health ($p<0.01$). Higher intake of white meat was found to be significantly associated ($p<0.05$) with social function, mental health and pain. On the other hand, a high intake of red meat was significantly associated ($p<0.05$) with poorer physical function and moderate social function but better mental health. Seafood consumption was significantly associated ($p<0.05$) with physical function. Participants with lower seafood consumption exhibited poor physical function. In comparison, participants with higher seafood consumption exhibited better physical and social function, good mental health and no experience of pain.

Association of Protein Intake Association and Sleep Quality

The findings of this study reported a significant association for frequency of protein intake frequency and sleep quality ($p<0.05$) (Table V). Participants consuming white meat once or none daily (80.0%), red meat once or none daily (61.0%) or seafood twice daily (72.3%) had better sleep quality. Consumption of all types of animal protein more than twice daily was associated with poor sleep quality.

DISCUSSION

Meat intake is becoming more and more significant in the Malaysian diet as proportion of meat items in food baskets rises relative to other grain commodities (26). The consensus was that the demand and consumption of meat continue to grow in developing countries due to increased available income (27). Nonetheless, this study's preferred choice of protein and consumption frequency was

Table IV : Association between protein intake and health-related quality of life

Protein Intake	White Meat (%)			p Value	Red Meat (%)			p Value	Seafood (%)			p Value
	Once/None	Twice	>Twice		Once/None	Twice	>Twice		Once/None	Twice	>Twice	
Physical Function												
Poor	51.4	48.5	35.4		18.5	52.3	68.3		76.7	7.2	10.0	
Moderate	45.7	21.2	23.2	<0.01**	47.7	18.2	7.3	<0.01**	20.0	59.0	57.6	<0.01**
Good	2.9	30.3	41.5		33.8	29.5	24.4		3.3	32.5	32.4	
Social Function												
Poor	68.6	12.1	15.9		31.7	27.3	24.6		43.3	32.5	27.0	
Moderate	17.1	39.4	74.4	<0.01**	14.6	70.5	66.2	<0.01**	53.3	26.5	10.8	0.02*
Good	14.3	48.5	8.5		53.7	0.0	9.2		3.3	41.0	62.2	
Role Function												
Inadequate	22.9	27.3	57.3	0.11	36.6	43.2	46.2	0.62	3.3	32.5	97.3	0.11
Adequate	77.1	72.7	42.7		63.4	56.8	53.8		96.7	67.5	2.7	
Mental Health												
Poor	42.9	12.1	15.9		17.1	0	26.2		56.7	10.8	16.2	
Moderate	48.6	72.7	69.5	0.01*	75.6	50.0	35.4	<0.01**	40.0	71.1	10.8	0.03*
Good	8.6	15.2	14.6		7.3	50.0	38.5		3.3	18.1	73.0	
Perception of Health												
Poor	15.2	18.3	22.9		19.5	0	38.8		3.3	32.5	0	
Moderate	15.2	59.8	31.4	0.11	24.4	43.2	13.8	<0.01**	50.0	15.7	100	<0.01**
Good	69.7	22.0	45.7		56.1	56.8	55.4		46.7	51.8	0	
Pain												
No Pain	62.9	21.2	70.0		17.1	13.6	0		0	63.9	89.2	
Moderate	37.1	57.6	22.0	0.02*	61.0	52.3	35.4	0.13	13.3	15.7	0	0.11
High	0	21.2	7.3		22.0	34.1	64.6		86.7	20.5	10.8	

*p<0.05

**p<0.01

Table V : Association between protein intake and sleep quality

Protein Intake	Sleep Quality (%)		p value
	Good	Poor	
White Meat			
Once/None	80.0	20.0	
Twice	60.6	40.4	0.01*
>Twice	36.4	63.2	
Red Meat			
Once/None	61.0	39.0	
Twice	36.4	63.6	0.03*
>Twice	58.5	41.5	
Seafood			
Once/None	63.3	36.7	
Twice	72.3	27.7	<0.01**
>Twice	3.0	97.0	

*p<0.05

**p<0.01

mainly driven by age, gender and ethnicity but not associated with monthly income. A local study also reported similar findings that the choice of animal protein consumption was primarily affected by ethnicity and culture but not income (28). The results of this study concluded that Malaysian adults favour white meat. Intake of white meat was 30% higher than seafood and 11% higher than red meat. Urban households eat more meat, particularly chicken, whereas rural households eat more fish. Malay participants were most predisposed to consume beef, while Chinese participants were more likely to consume pork. Indian participants ingested the least amount of total protein (28).

In Southeast Asia, an average of 22.1% of men and 28.3% of women are overweight or obese, according to the Global Burden of Disease Study. Malaysia had the highest rate within the region, with 48.3% of men and 48.6% of women obese (29). Similarly, the 2015 Malaysian National Health and Morbidity Survey (NHMS) reported an overweight and obesity prevalence of 47.7% (5). Observational studies in the United States found high protein intake improves one's body composition (30) and reduces both BMI and waist circumference (31). Results of this study indicated that BMI and waist circumference might not be affected by the choice of protein and their frequency of intake. Possible factors include variations in total protein intake quantity which may be due to differing culinary cultures between geographical regions. Studies that found a link between high daily protein intake and obesity were generally from Western population with a higher mean total protein intake of >53 g/day (32). In contrast, two studies with a mean of total protein intakes of 37.4 g/day and 25.9 g/day demonstrated negative relationship between protein intake and obesity (33,34). Park et al., 2018 concurred that there might be a threshold where higher protein intake can aggravate obesity (33).

Findings from this study indicated the consumption frequency of white meat, seafood and red meat were all associated with the incidence of NCDs. Participants who consume more white meat and seafood had lower incidence of NCDs, whereas those who have high intake of red meat had higher incidence of NCDs. Numerous epidemiological studies and recent meta-analyses found excessive red and processed meat frequently linked with excess energy, fat consumption and an elevated risk of chronic NCDs like type 2 diabetes, cardiovascular disease, and cancer, as well as all-cause mortality (35). In this study, participants consuming red meat more than twice daily had reduced physical and social function, possibly increasing the incidence of NCDs.

Healthy eating habits were linked to improved HRQoL in the physical and mental domains of older people (36). Nevertheless, total meat abstinence in the diet can lead to higher rates and risks of anxiety, self-harm behaviours and depression (37). In this study, white meat and seafood consumption was associated with physical and social function as well as mental health. Participants who consume more white meat and seafood had better physical, social and mental function score. Previous studies suggested a positive relationship between seafood

consumption, quality of life, mental health and physical activity (38). Conversely, white meat consumption and a balanced diet were associated with a lower incidence of cardiovascular disease and metabolic diseases (39,40). On the other hand, a recent Australian study found no association between total dietary protein consumption and HRQoL while increased protein intakes from red meat were linked to a decline in HRQoL scores during a 12-year period (41). Likewise, this study observed more moderate and poor mental health issues in participants who consumed red meat more than twice daily. Red meat consumption was associated with an increased risk of depressive symptoms, especially among men and those of normal weight, whereas white meat consumption was associated with a decreased risk of depression (42).

Results of this study found significant association of higher intake of protein with poor sleep quality. Consumption of animal protein generally goes alongside with saturated fat and high total calorie intake especially in Malaysian diet (43). A study found that red meat consumption is linked to higher apnoea and hypopnea indices, along with increased severity of obstructive sleep apnoea as evaluated by polysomnography (44). Obstructive sleep apnoea development may also be influenced by insulin resistance, inflammation, and oxidative stress. In addition to these, obese patients with obstructive sleep apnoea frequently have hypertriglyceridemia and decreased levels of HDL cholesterol (45). These abnormalities also contribute to the documented higher risk of cardiovascular morbidity and death associated with obstructive sleep apnoea (46). Patients with severe obstructive sleep apnoea have been found to consume diets higher in cholesterol, protein, total fat, and saturated fatty acids (47). Conversely, short sleep duration and poor sleep quality have been shown to modify dietary intake by increasing appetite and encouraging the consumption of foods high in fat and other energy sources (48). The dysregulation of hunger and satiety hormones and the amplification of the activation of hedonic stimuli processing in the central nervous system are two processes that appear to underlie these relationships (49,50). These may further contribute to the higher intake of animal protein that may trap poor sleepers in a vicious cycle.

CONCLUSION

Type of protein intake and its frequency can be a factor affecting HRQoL and sleep quality. This study found that a high intake of white meat and seafood generally improved the physical, social and mental functional components in HRQoL and associated with reduced NCDs. However, consumption of these protein at more than twice a day significantly impact sleep quality. On the other hand, increased red meat consumption was shown to improve physical function, social function and sleep quality. However this is also accompanied with increased occurrence of NCDs.

This study is a cross-sectional study which limits its ability to establish a causal and effect relationship. Follow-up research detailing the protein intake amount associated with HRQoL and sleep quality while dissecting the exact physiology processes involved are necessary. In addition, future longitudinal research may be warranted to determine the causal relationship between type and frequency of protein consumption with HRQoL and sleep quality.

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