Journal of Food Innovation, Nutrition, and Environmental Sciences
May, 2026, Volume 3; Issue 2:97-118
ISSN No:3078-5537

ORIGINAL RESEARCH ARTICLE

Associations of the Empirical Dietary Inflammatory Index (EDII) with Perceived Stress, Physical Activity, Upper Respiratory Symptoms, and Quality of Life Among Malaysian Adults in Klang Valley

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DOI: https://doi.org/10.70851/jfines.2026.3(2).97.118

Article history
Received;
03 January, 2026
Revised;
19 March, 2026
Accepted;
21 March, 2026

Keywords
Inflammatory Diet, Upper Respiratory Symptoms, Perceived Stress, Physical Activity, Quality of Life (QOL), Empirical Dietary Inflammatory Index (EDII), Malaysian Adults, Public Health Nutrition

ABSTRACT

Upper respiratory symptoms represent a significant public health concern globally, affecting quality of life (QOL) and increasing morbidity. Modifiable factors such as diet, stress, and lifestyle are known contributors to respiratory health outcomes. Pro-inflammatory diets, characterized by high consumption of energy-dense, nutrient-poor foods, have been linked to chronic inflammation, weakened immunity, and increased susceptibility to upper respiratory symptoms. Meanwhile, stress and physical inactivity may further exacerbate immune dysfunction and negatively impact QOL. However, the relationship between dietary inflammatory potential, stress, physical activity, upper respiratory symptoms, and QOL remains underexplored, particularly in Malaysia's diverse cultural and environmental context. This cross-sectional study was conducted among 159 adults recruited from community centers, health clinics, and public spaces in Klang Valley, Malaysia. Data were collected using validated instruments, including the Food Frequency Questionnaire to calculate the Empirical Dietary Inflammatory Index (EDII), the Perceived Stress Scale (PSS-10), the Global Physical Activity Questionnaire (GPAQ), and the Wisconsin Upper Respiratory Symptom Survey (WURSS-21). Anthropometric measurements (height, weight, and BMI) were recorded, and quality of life was assessed using a validated QOL questionnaire. Data were analyzed using descriptive statistics, correlation analyses, and multiple linear regression models. A significant negative correlation was observed between anti-inflammatory dietary scores and body weight ($r = -0.121$, $p = 0.003$). Higher pro-inflammatory and EDII scores were significantly associated with poorer QOL and greater upper respiratory symptom severity. Multiple linear regression analysis demonstrated that higher EDII scores were independently associated with poorer QOL [-4.013 (95% CI: -5.116 to -2.910)] and increased upper respiratory symptom severity [2.643 (95% CI: 1.758 to 3.528)], after adjustment for relevant covariates. In conclusion, higher dietary inflammatory potential was associated with poorer quality of life and increased upper respiratory symptom burden among Malaysian adults. These findings highlight the potential importance of anti-inflammatory dietary patterns in promoting respiratory health and overall well-being.

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Peer review under responsibility of Journal of Food Innovations, Nutrition, and Environmental Sciences.

A Publication of EcoScribe Publishers company Limited, Uganda.

1. INTRODUCTION

Respiratory illnesses (e.g., influenza, acute bronchitis, and asthma) represent a significant global burden, affecting millions of individuals and contributing to reduced quality of life (QOL) and increased morbidity and mortality (Wypych et al., 2017). These conditions can impair physical, emotional, and social well-being and are influenced by multiple modifiable lifestyle factors, including diet, stress, and physical activity. As environmental and lifestyle changes continue to shape health patterns globally, understanding the interplay between these factors is essential for improving respiratory health outcomes and overall QOL (Lin et al., 2016). In Malaysia, a diverse and multicultural nation, this issue is particularly relevant due to the country's unique dietary habits, socio-cultural dynamics, and environmental conditions (Reddy & Van Dam, 2020).

The role of diet in respiratory health has gained increasing attention, particularly regarding its ability to modulate immune function and systemic inflammation. Pro-inflammatory dietary patterns, characterized by high consumption of energy-dense, nutrient-poor foods such as red and processed meats, refined grains, and added sugars, have been linked to chronic low-grade inflammation (Rahmani et al., 2021). Chronic inflammation may disrupt immune regulation and compromise the body's ability to respond effectively to infections, thereby contributing to poorer respiratory health and reduced well-being (De Araújo Morais et al., 2021). In contrast, anti-inflammatory dietary patterns rich in fruits, vegetables, whole grains, and bioactive compounds have been associated with more favorable health outcomes and improved QOL, highlighting their importance in disease prevention and health promotion (Chan et al., 2023).

Stress is another important factor influencing health outcomes. Chronic stress has been associated with immune dysregulation and may increase susceptibility to respiratory symptoms, while also influencing dietary behaviours (De Araújo Morais et al., 2021). Evidence suggests that individuals experiencing higher stress levels may be more likely to adopt unhealthy dietary behaviours, including greater intake of pro-inflammatory foods, which may further exacerbate systemic inflammation and negatively affect health status (Al-Otaibi et al., 2023). This highlights the importance of considering both psychological and nutritional factors when addressing respiratory health and QOL. Physical activity also plays a key role in maintaining immune function and overall well-being. Active lifestyles have been associated with lower systemic inflammation, improved lung function, and enhanced immune responses, which may contribute to reduced respiratory symptom burden and improved QOL (Kumar, 2020). However, sedentary behaviours and insufficient physical activity, which are increasingly common in urban settings, may compound the adverse effects of poor dietary habits and chronic stress, increasing the risk of inflammation-related health outcomes (Chen et al., 2024).

The complex relationship between diet, stress, physical activity, and respiratory health extends to their combined impact on QOL. Chronic inflammation has been proposed as a unifying mechanism linking these factors to adverse health outcomes (Furman et al., 2019). Elevated levels of inflammatory markers such as interleukin-6 (IL-6) and C-reactive protein (CRP) have been observed among individuals with unhealthy dietary patterns and lifestyle behaviours, underscoring the importance of targeted strategies aimed at reducing inflammation and improving overall well-being (Fekete et al., 2023). Despite the growing body of evidence, further research is needed to better understand these relationships in specific populations and cultural contexts (West et al., 2016).

Malaysia provides a valuable context for examining these interactions due to its diverse dietary practices, environmental exposures, and lifestyle patterns (Chowdhury et al., 2024). Therefore, this study aimed to examine the associations between dietary inflammatory potential, perceived stress, physical activity, upper respiratory symptoms, and quality of life among adults in Klang Valley, Malaysia. Understanding these relationships may help inform public health strategies focusing on dietary and lifestyle modifications to improve respiratory health and enhance QOL in Malaysian adults.

2. MATERIALS AND METHODS

2.1 Study design

This study adopted a cross-sectional research design to examine the association between inflammatory diet, stress, respiratory infection, and quality of life among adults residing in Klang Valley, Malaysia. The cross-sectional approach is widely recognized for its ability to collect data at a single point in time, making it suitable for exploring relationships between variables and identifying patterns within a specific population. This design enables researchers to assess the prevalence of key factors and their associations effectively, without requiring extended follow-up periods.

Data for the study were collected using validated and standardized tools to ensure reliability and accuracy. The study utilized the Empirical Dietary Inflammatory Index (EDII) to assess pro-inflammatory and anti-inflammatory dietary patterns. The Wisconsin Upper Respiratory Symptom Survey (WURSS-21) was used to assess upper respiratory symptom severity and its impact on daily functioning. According to the validated scoring system, higher total WURSS-21 scores indicate greater symptom severity and functional impairment. The Global Physical Activity Questionnaire (GPAQ) was used to assess physical activity levels, and the Quality-of-Life Questionnaire (QOL-36) was used to evaluate participants' well-being across various dimensions. Higher QOL scores indicate better quality of life. Additionally, anthropometric measurements such as Body Mass Index (BMI) were recorded to assess participants' nutritional status.

The cross-sectional design was particularly advantageous in this context as it facilitated the collection of diverse data, including dietary habits, stress factors, physical activity levels, and respiratory health outcomes, within a defined population at a specific time. This approach provided a comprehensive understanding of the factors influencing respiratory infections and quality of life, serving as a foundation for targeted interventions and future research in this area.

2.2 Research ethics

This study was reviewed and approved by the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM/PPI/111/8/ JEP-2023-211). Ethical guidelines were strictly followed, ensuring participant confidentiality and informed consent. Data collection was conducted in community centers, health clinics, and public spaces in Klang Valley, adhering to ethical research principles. The findings were disseminated to participants, healthcare professionals, and researchers through academic conferences, public health discussions, and peer-reviewed publications.

2.3 Dietary Inflammation Index (EDII) scoring systems

The Empirical Dietary Inflammatory Index (EDII) score was calculated using a structured food checklist developed by the research team based on commonly consumed Malaysian food items. The checklist was designed to assess the frequency of intake of selected pro-inflammatory and anti-inflammatory food groups over the past one week. Participants reported the frequency of consumption for each listed food item using predefined frequency categories. Portion sizes were not assessed, as the instrument was frequency-based. Pro-inflammatory food items (e.g., red meat, processed meat, sugary beverages, refined grains) were assigned positive scores, with +2 marks for high-frequency intake, +1 mark for moderate-frequency intake, and 0 marks for low-frequency intake. Conversely, anti-inflammatory food items (e.g., leafy green vegetables, dark yellow vegetables, oily fish, coffee, tea) were assigned negative scores, with −2 marks for high-frequency intake, −1 mark for moderate-frequency intake, and 0 marks for low-frequency intake.

The total EDII score was calculated by summing all assigned food item scores. Higher positive scores indicated a more pro-inflammatory dietary pattern, whereas lower (negative) scores reflected a more anti-inflammatory dietary pattern. Participants with incomplete checklist responses were excluded from the analysis to ensure data completeness and scoring accuracy. Energy adjustment was not performed, as total caloric intake was not assessed in the checklist. Based on the total EDII score distribution, participants were categorized into three predefined groups: Low EDII (−9 to −2), Moderate EDII (−1 to +1), and High EDII (+2 to +10).

An adapted empirical dietary inflammatory scoring system based on EDII principles was used to estimate the inflammatory potential of participants' diets. Dietary intake was assessed using the study dietary questionnaire, and food items were classified into pro-inflammatory and anti-inflammatory food groups according to the EDII framework. Pro-inflammatory and anti-inflammatory sub-scores were calculated by summing the intake frequencies of the respective food groups. The overall EDII score was computed as the pro-inflammatory score minus the anti-inflammatory score, where higher EDII values indicate a more pro-inflammatory diet.

2.4 Data collection

Data collection for this cross-sectional study was conducted between July and October 2024 in Klang Valley, Malaysia, using community-based recruitment and online questionnaires. Anthropometric measurements were obtained at Hospital Canselor Tuanku Mukhriz (HCTM) when possible, while a subset of participants ($n = 28$) provided self-reported height and weight. Self-reported anthropometric data were used only when in-person measurements were not feasible. **Figure 1** illustrates the recruitment and data collection process. A total of 190 individuals were initially recruited. Of these, 27 participants did not meet the inclusion criteria and were excluded. During data screening, 8 participants were identified as having incomplete questionnaire data. Four participants corrected the errors, while the remaining four did not respond and were excluded from the final analysis. Consequently, the final sample consisted of 159 participants who completed all required questionnaires and anthropometric assessments, including weight, height, and BMI calculations. Anthropometric measurements were obtained at Hospital Canselor Tuanku Mukhriz (HCTM) for most participants ($n = 131$). For participants who were unable to attend in person, self-reported height and weight were collected ($n = 28$).

2.5 Statistical analysis

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 29.0 (IBM Corp., Armonk, NY, USA). Prior to inferential testing, data were screened for completeness, outliers, and normality. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test, given that the total sample size exceeded 100 participants.

For normally distributed variables ($p > 0.05$), parametric tests were applied. Continuous variables were presented as mean ± standard deviation (SD), and comparisons between two groups were conducted using independent sample t-tests. For comparisons across more than two groups, one-way analysis of variance (ANOVA) was used. For non-normally distributed variables ($p < 0.05$), non-parametric tests were applied. These variables were presented as median and interquartile range (IQR). Group comparisons were performed using the Mann–Whitney U test (for two groups) or Kruskal–Wallis H test (for more than two groups). Categorical variables were presented as frequencies and percentages. Associations between categorical variables were examined using the Chi-square test or Fisher's Exact test, as appropriate. Correlation analyses were conducted to examine the relationships between inflammatory dietary scores (pro-inflammatory score, anti-inflammatory score, and EDII score) and study outcomes. Pearson correlation coefficients were used for normally distributed variables, whereas Spearman rank correlation coefficients were applied for non-normally distributed variables. Multiple linear regression analyses (enter method) were performed to determine the independent associations between EDII score and key outcome variables, including quality of life (QOL) and upper respiratory symptom severity (WURSS-21). Regression models were progressively adjusted for potential confounders. Model 1 was adjusted for age, years of education, and BMI. Model 2 was further adjusted for relevant clinical variables, and Model 3 included additional psychosocial factors such as perceived stress (PSS). Multicollinearity was assessed using variance inflation factor (VIF), and no significant multicollinearity was detected. The level of statistical significance was set at $p < 0.05$ for all analyses. Results were presented in tables to facilitate clear interpretation of findings

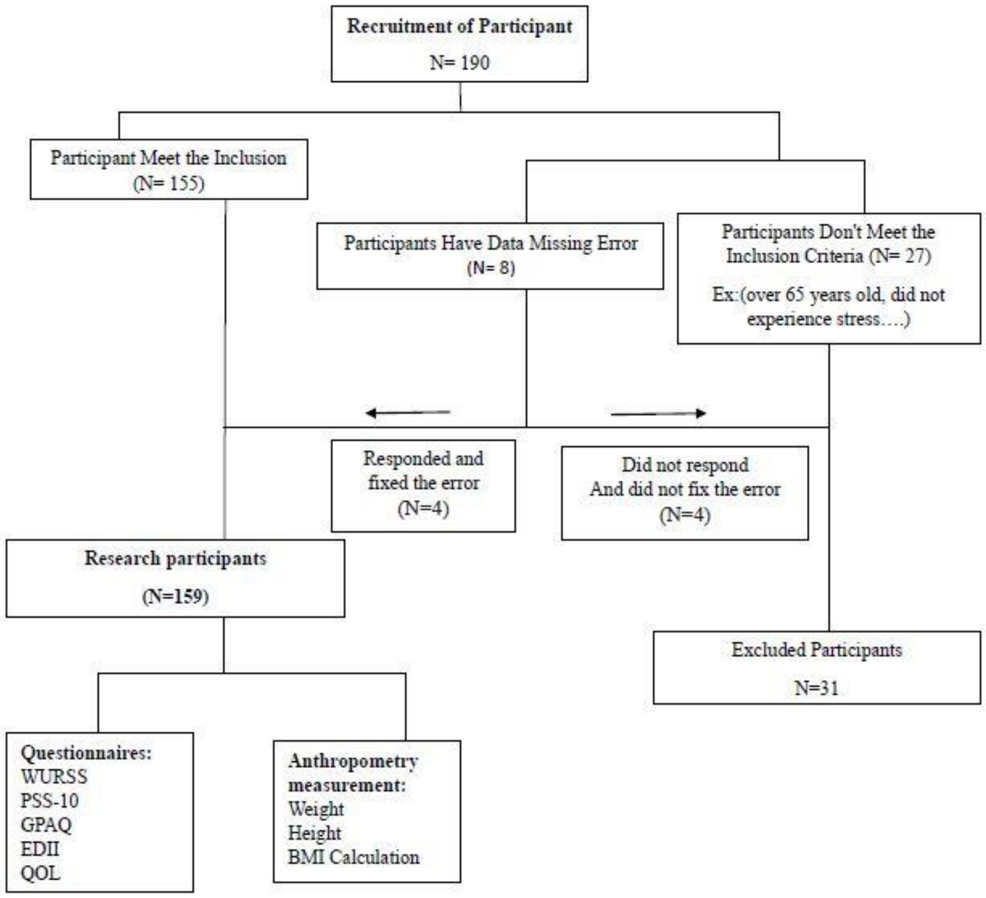

Figure 3.1. Flow Chart of The Study

3.0 RESULTS

3.1. General results

The results of this study provide a comprehensive overview of the association between inflammatory diet, stress, respiratory infection, and quality of life among adults in Klang Valley, Malaysia. Utilizing a cross-sectional design, data were collected from a diverse sample population to explore the complex interplay of dietary patterns, psychosocial stressors, respiratory health, and overall well-being. Various validated instruments were employed, including the Empirical Dietary Inflammatory Index (EDII), Perceived Stress Scale (PSS-10), Wisconsin Upper Respiratory Symptom Survey (WURSS-21), Global Physical Activity Questionnaire (GPAQ), and Quality of Life Questionnaire (QOL-36).

Table 1. Sociodemographic Profile According to Gender.

Parameter	Mean ± SD / n (%)			P value
	Men (n=63)	Women (n=96)	Total (n=159)	
Age(year)[c]	31 ± 9.23	32.9 ± 9.08	32.49 ± 9.13	.74
Marital status [a]				
Single	35 (53.6)	50 (51.5)	85 (53.4)	.39
Married	28 (46.4)	46 (48.5)	74 (46.6)	
Education level [b]				
High School	2 (3.0)	5 (5.0)	7 (4.0)	
College	30 (46.9)	45 (45.6)	75 (47.8)	.923
Postgraduate	31 (49.1)	46 (49.4)	77 (48.2)	
Working Status [a]				
Student	35 (55)	41(42)	76 (47)	.144
Working	28 (45)	55 (58)	83 (53)	
Household income [(RM) a]				
Less than RM4850	22 (34.9)	40 (41.6)	62 (38.9)	
Within RM4850 – RM 10959	37 (58.7)	50 (52)	87 (54.7)	.680
More than 10960	4 (6.4)	6 (6.4)	10 ((6.4)	
Smoking [b]				
Smoker	1 (1.5)	1 (1)	2 (1.2)	
Non-smoker	57 (90)	95 (99)	152 (95.5)	.009*
Past smoker	5 (8.5)	0	5 (3.3)	
Working status, [a]				
Employed	28 (44.4)	55 (57.3)	83 (52.2)	.77
Student	35 (55.6)	41 (42.7)	76 (47.8)	

a - Chi Squared Test
b - Fisher's Exact Test
c - Independent Sample T-Test
Test Note: *Significant at $p<0.05$

As shown in **Table 1**, the study included 159 participants, comprising 63 men (39.6%) and 96 women (60.4%). The mean age of participants was 32.49 ± 9.13 years, with no significant difference between men (31 ± 9.23 years) and women (32.9 ± 9.08 years) (p = 0.74). Marital status was almost equally distributed, with 53.4% of participants being single and 46.6% married. Regarding education level, 48.2% had completed postgraduate studies, while 47.2% had attained a college-level education.

In terms of working status, 52.2% were employed, while 47.8% were students. Household income showed that most participants (54.7%) had an income within RM4850 to RM10,959, while 38.9% earned less than RM4850, and 6.4% earned more than RM10,959. Smoking status revealed a significant difference (p = 0.009), with 95.5% being non-smokers, 2% smokers, and 2.5% past smokers. The distribution of working status was balanced between employed (52.2%) and students (47.8%) (p = 0.144).

Table 2. Perceived stress, respiratory infection, and quality of life according to gender

Parameter	n (%)			
	Men (n=63)	Women (n=96)	Total (n=159)	P value
PSS Score				
- Low stress	6 (9.5)	13 (13.5)	18(11.0)	.414
- Moderate stress	52 (82.5)	77 (80.0)	129 (80.3)	
- High perceived stress	5 (8.1)	6 (6.5)	11 (8.7)	
WURSS Score				
- Minimal illness	48 (75.4)	79 (81.9)	127 (78.2)	.348
- Severe illness	15 (24.6)	17 (18.1)	32 (21.8)	
QOL Score				
- Poor	9 (13.4)	13(13.5)	22 (13.4)	.410
- Moderate	29 (46.6)	54 (56.0)	83 (51.3)	
- Good	25 (40.0)	29 (30.5)	54 (35.3)	

PSS= Perceived stress score

WURSS= Wisconsin Upper Respiratory Survey

QOL= Quality of Life

*Significance level $p<0.05$, Mann-Whitney

Table 2 highlights the distribution of perceived stress, respiratory infection severity, and quality of life (QOL) among men and women in the study. For perceived stress, the majority of participants reported moderate stress levels, with 82.5% of men and 80% of women categorized in this group. A smaller proportion experienced low stress (11% overall) and high perceived stress (8.7% overall), with no significant difference between genders (p = 0.414). Regarding respiratory infections measured by WURSS scores, most participants (78.2%) experienced minimal illness, with slightly higher rates among women (81.9%) compared to men (75.4%). Severe illness was reported by 21.8% of participants, with no significant gender differences observed (p = 0.348). For quality of life (QOL) scores, 54% of participants were classified as having a "good" quality of life, with 40% of men and 30.5% of women in this category. Moderate QOL was reported by 51.3% overall, and 13.8% reported a poor QOL. Gender differences in QOL scores were also not statistically significant (p = 0.410).

Table 3 presents the frequency of consumption of pro-inflammatory and anti-inflammatory foods according to gender. Among pro-inflammatory foods, a higher percentage of participants consumed red meat, processed meat, and organ meat less than twice per week, with no significant gender difference (71% of men vs. 73.9% of women; p = 0.253). The consumption of other pro-inflammatory foods, such as sugary beverages (SSB), eggs, and tomatoes, was also similar between men and women (p = 0.253). White rice was consumed by 90% of participants at less than three bowls per day, with no significant gender differences (p = 0.274). Bread and noodles consumption remained consistent across genders, with most participants consuming them less than seven times per week (p = 0.822). For anti-inflammatory foods, gender differences were observed in the consumption of leafy green vegetables, with 49% of men consuming them more than 14 times per week compared to 59% of women (p = 0.446). Dark yellow vegetable consumption showed no significant variation, with most participants consuming them six times or less per week (82% of men and 81% of women; p = 0.654). Regarding fruit juice and oily fish, 48% of men and 41% of women consumed them more than twice per week, with no significant difference (p = 0.437). Coffee and tea were predominantly consumed at one cup or less per day by 100% of men and 79% of women, with 21% of women consuming two or more cups per day (p = 0.268). Alcoholic beverages, including wine and beer, were uniformly consumed at low frequencies, with all participants reporting less than two glasses per week or fewer than five bottles per week, and no gender-based comparisons were applicable.

Table 3. Pro-Inflammatory and Anti-Inflammatory Food Group according to gender.

Parameter		(n=%) Men (n=63)	Women (n=96)	Total (n=159)	P value
Pro-Inflammatory Food					<.001
Red meat, processed meat, organ meat	< 2 times/week	45 (71)	71 (73.9)	116 (72)	
	2-6 times/week	18 (29)	25 (26.1)	43 (28)	.283[a]
Other fish, eggs, SSB, tomatoes	< 5 times/week	36 (57)	61 (63)	97 (61)	
	5-6 times/week	10 (16)	19 (20)	29 (18)	.283[a]
	≥ 7 times/week	17 (27)	16 (17)	33 (24)	
White Rice	< 3 bowls/day	56 (89)	90 (94)	146 (91)	.274[a]
	≥ 3 bowls/day	7 (11)	6 (6)	13 (9)	
Bread/Noodles	< 7 times/week	62 (98)	94 (98)	156 (98)	.822[b]
	≥ 7 times/week	1 (2)	2 (2)	3 (2)	
Anti-Inflammatory Foods					
Leafy green vegetables	< 7 times/week	17 (27)	20 (21)	37 (23)	
	7-13 times/week	15 (24)	19 (20)	34 (21)	.446[a]
	≥14 times/week	31 (49)	57 (59)	88 (56)	
Dark yellow vegetables	6 times or less/week	52 (83)	78 (81)	130 (81)	.654[a]
	≥ 7 times/week	11 (17)	17 (19)	28 (19)	
Fruit juice, oily fish	< 2 times/week	33 (52)	41 (43)	74 (46)	.437[a]
	> 2 times/week	30 (48)	55 (57)	85 (54)	
Coffee, tea	1 cup or less/day	63 (100)	76 (79)	139 (87)	.268[b]
	≥ 2 cups/day	0 (	20 (21)	20 (13)	
Wine	< 2 glass/week	63 (100)	96 (100)	159 (100)	N/A
Beer or other alcohol beverages	< 5 bottle/week	127 (100)	32 (100)	159 (100)	N/A

5-6 bottle/week 7-13 bottle/week

Table 4. Anthropometry Profile (with BMI Category) According to Gender [Stated as (%) or mean SD]

Anthropometry Measurement	Mean ± SD / n (%)			p-value
	Men (n=63)	Women (n=96)	Total (n=159)	
Height cm [b]	167 ± 6.5	158.4 ± 7.8	162.7 ± 7.15	.106
Weight kg [b]	71.7 ± 7.6	65.2 ± 12.3	68.4 ± 9.95	< .001*
BMI [b]	26.7 ± 3.5	25.4 ± 3.2	26.05 ± 4.1	< .001*
BMI Category [b]				
Under weight	0(0)	3(3.1)	3(1.8)	
Normal	10(15)	16(16.5)	26(16.3)	
Overweight	9(14)	16(16.5)	25(15.7)	< .001*
Obese 1	36(57)	44(45.8)	80(50.3)	
Obese 2	8(14)	17(18)	25(15.9)	

a. Chi Squared Test

b. Independent Sample T Test

*Note: Significant at p<0.05

Table 4 summarizes the anthropometric characteristics and BMI categories of participants by gender. The mean height of men was 167 ± 6.5 cm compared to 158.4 ± 7.8 cm in women; however, this difference was not statistically significant (p = 0.106). The mean weight of men (71.7 ± 7.6 kg) was significantly higher than that of women (65.2 ± 12.3 kg) (p < 0.001). Similarly, men had a significantly higher BMI (26.7 ± 3.5) compared to women (25.4 ± 3.2) (p < 0.001). Regarding BMI categories, 16.3% of participants were classified as having normal BMI, while 15.7% were overweight. Obesity was prevalent in 50.3% of the total sample, with 57% of men and 45.8% of women categorized as Obese Class I. For Obese Class II, the prevalence was 14% in men and 18% in women. The distribution of BMI categories differed significantly between genders (p < 0.001).

Table 5 demonstrates the correlation between pro-inflammatory, anti-inflammatory, and EDII scores with anthropometric parameters. A significant positive correlation was found between BMI and both the pro-inflammatory score (r = 0.166, p = 0.036) and EDII score (r = 0.267, p < 0.001). Similarly, BMI showed a significant positive correlation with the anti-inflammatory score (r = 0.184, p = 0.020). Weight exhibited a significant negative correlation with the anti-inflammatory score (r = -0.121, p = 0.003) but showed no significant relationship with either the pro-inflammatory (r = 0.249, p = 0.061) or EDII scores (r = 0.125, p = 0.116). In contrast, height was significantly negatively correlated with EDII scores (r = -0.197, p = 0.013) but had no significant correlation with either pro-inflammatory (r = -0.005, p = 0.954) or anti-inflammatory scores (r = -0.232, p = 0.798). These findings suggest a notable relationship between inflammatory dietary patterns and BMI, highlighting the influence of pro-inflammatory and anti-inflammatory diets on anthropometric outcomes.

May, 2026, Volume 3; Issue 2: 97-118
ISSN No:3078-5537

Table 5. Pro-Inflammatory, Anti-Inflammatory and EDII Score with anthropometry Profile (Stated as r value).

Parameter	Pro-Inflammatory Score		Anti-Inflammatory Score		EDII Score	
	r	p	r	p	r	p
Weight	0.249	0.061	-0.121	0.003	0.125	0.116
Height	-0.005	0.954	-0.232	0. 01*	-0.197	0.013*
BMI	0.166	0.036*	0.184	0.020*	0.267	<0.001*

*Significant at p<0.05, using Pearson correlation

Table 6. Pro-Inflammatory and Anti-Inflammatory Food Group with PSS status.

Parameter		n (%) Low Stress (n=19)	Moderate stress (n=129)	High Stress (n=11)	Total (n=159)	P-value
Pro-Inflammatory Food						
Red meat, processed meat, organ meat	< 2 times/week	19 (100	89 (69)	3 (27.3)	111 (72.7)	
	2-6 times/week	0	40 (31)	8 (72.7)	48 (27.3)	.018 [b]
Other fish, eggs, SSB, tomatoes	< 5 times/week	15 (78.9)	74 (57.4)	2 (18.2)	91 (60)	
	5-6 times/week	2 (10.5)	25 (19.4)	1 (9.1)	29 (18)	.366 [b]
	≥ 7 times/week	2 (10.5)	30 (23.3)	8 (72.7)	40 (22)	
White Rice	< 3 bowls/day	18(94.7)	119 (92.2)	2 (18.2)	139 (88.8)	.425 [b]
	≥ 3 bowls/day	1 (5.3)	10 (7.8)	9 (81.8)	20 (11.2)	
Bread/Noodles	< 7 times/week	19 (100)	127 (98.4)	1 (1.9)	147 (96.1)	
	≥ 7 times/week	0	2 (1.6)	10 (90.9)	13 (3.9)	0.171 [b]

Anti-Inflammatory Foods						
Leafy green vegetables	< 7 times/week	5 (26.3)	71 (55)	5 (45.5)	88 (55.3)	
	7-13 times/week	2 (10.5)	28 (21.7)	4 (36.4)	34 (21.4)	.590 [b]
	≥14 times/week	12 (63.2)	30 (23.3)	2 (18.2)	37 (23.3)	
Dark yellow vegetables	6 times or less/week	5 (21.1)	106 (82.2)	9 (81.9)	130 (39)	.557 [a]
	≥ 7 times/week	15 (78.9)	22 (17.8)	2 (18.1)	29 (61)	
Fruit juice, oily fish	< 2 times/week	10 (52.6)	69 (53.5)	6 (54.5)	85 (53.5)	.431[a]
	> 2 times/week	9 (47.4)	60 (46.5)	5 (45.5)	74 (46.5)	
Coffee, tea						
	1 cup or less/day	19 (100)	128 (99.2)	10 (99)	157 (98.8)	.328 [b]
	≥ 2 cups/day	0	1 (0.8)	1 (1)	2 (1.2)	
Wine	< 2 glass/week	19 (100)	129 (100)	11 (100)	159 (100)	
	>2-6 glass/week					N/A
	7-20 glass/week					
Beer or other alcohol beverages	< 5 bottle/week	0	0	0	0	
	5-6 bottle/week	0	0	0	0	N/A
	7-13 bottle/week	19	129	11	159	

a Chi-Square, b Fisher Exact Test, Note: *Significant at p<0.05,

Table 6 presents the association between pro-inflammatory and anti-inflammatory food consumption and perceived stress status (PSS) levels. Among pro-inflammatory foods, a statistically significant difference was observed for red meat, processed meat, and organ meat consumption ($p = 0.018$). All individuals in the low-stress group (100%) consumed these foods less than twice per week, compared to 69% in the moderate-stress group and 27.3% in the high-stress group. Conversely, higher consumption (2–6 times/week) was more prevalent among participants with high stress (72.7%) compared to those with moderate stress (31%), while none of the low-stress participants reported higher intake.

For other pro-inflammatory foods (other fish, eggs, SSB, and tomatoes), no significant differences were observed across stress categories ($p = 0.366$). Similarly, white rice consumption did not significantly differ between groups (p = 0.425), with the majority of participants in all stress categories consuming less than three bowls per day. Bread and noodles intake also showed no significant association with stress levels (p = 0.171). Regarding anti-inflammatory foods, no statistically significant differences were observed in leafy green vegetable consumption across stress groups (p = 0.590). Although a higher proportion of low-stress participants consumed leafy green vegetables ≥14 times per week (63.2%) compared to moderate (23.3%) and high-stress groups (18.2%), the difference was not statistically significant. Similarly, dark yellow vegetable consumption did not differ significantly across stress levels (p = 0.557). Fruit juice and oily fish intake also showed no significant association with stress status (p = 0.431), although slightly higher frequent consumption (>2 times/week) was observed among moderate-stress participants (46.5%) compared to low (47.4%) and high-stress groups (45.5%).

Coffee and tea consumption did not significantly differ across stress categories (p = 0.328), with nearly all participants consuming one cup or less per day. Alcohol consumption, including wine and beer, was negligible across all groups and therefore no statistical comparison was applicable.

Table 7. Pro-Inflammatory and Anti-Inflammatory Food Group with respiratory status.

Parameter		Mild illness (n=127)	Moderate to Severe illness (n=32)	Total (n=159)	P-value
		n (%)			
Pro-Inflammatory Food					
Red meat, processed meat, organ meat	< 2 times/week	100 (78)	16 (50)	116 (72)	.002*[a]
	2-6 times/week	27 (22)	16 (50)	43 (28)	
Other fish, eggs, SSB, tomatoes	< 5 times/week	84 (66)	13 (41)	97 (62)	<.001*[b]
	5-6 times/week	26 (20)	3 (9)	29 (18)	
	≥ 7 times/week	17 (14)	16 (50)	33 (20)	
White Rice	< 3 bowls/day	123 (97)	9 (29)	132 (83)	<.001* [b]
	≥ 3 bowls/day	4 (3)	23 (71)	27 (17)	
Bread/Noodles	< 7 times/week	112 (88)	7 (22)	119 (74)	0.565[a]
	≥ 7 times/week	15 (12)	25 (78)	40 (26)	
Anti-Inflammatory Foods					
Leafy green vegetables	< 7 times/week	33 (25)	21 (65)	37 (23)	.251 [b]
	7-13 times/week	27 (21)	4 (13)	34 (21)	
	≥14 times/week	67 (54)	7 (22)	88 (54)	

Dark yellow vegetables	6 times or less/week	56 (45)	27 (84)	63 (39)	.117 [a]
	≥ 7 times/week	71 (65)	5 (16)	96 (61)	
Fruit juice, oily fish	< 2 times/week	22 (17)	21 (65)	27 (17)	.255 [a]
	> 2 times/week	105 (82)	11 (35)	132 (83)	
Coffee, tea	1 cup or less/day	38 (30)	28 (87)	42 (26)	.128 [b]
	≥ 2 cups/day	89 (70)	4 (13)	117 (74)	
Wine	< 2 glass/week	127 (100)	32 (100)	159 (100)	N/A
	>2-6 glass/week				
	7-20 glass/week				
Beer or other alcohol beverages	< 5 bottle/week	127 (100)	32 (100)	159	N/A
	5-6 bottle/week 7-13 bottle/week				

Note: *Significant at p<0.05, a Chi Squared Test, b Fisher Exact Test

Table 7 illustrates the consumption of pro-inflammatory and anti-inflammatory foods categorized by respiratory status (mild illness vs. moderate to severe illness). Among pro-inflammatory foods, individuals with moderate to severe respiratory illness reported significantly higher consumption of red meat, processed meat, and organ meat 2–6 times per week (50%) compared to those with mild illness (22%) ($p = 0.002$). Similarly, the consumption of other pro-inflammatory foods, such as sugary beverages, eggs, and tomatoes, 7 or more times per week, was significantly more common among those with moderate to severe illness (53%) compared to mild illness (14%) ($p <$

0.001). The consumption of white rice also showed a significant difference, with moderate to severe illness participants consuming 3 or more bowls per day more frequently (25%) than those with mild illness (3%) (p = 0.001). For anti-inflammatory foods, leafy green vegetable consumption of more than 14 times per week was higher among participants with mild illness (54%) compared to those with moderate to severe illness (34%), although this difference was not statistically significant (p = 0.251). Dark yellow vegetable consumption patterns did not differ significantly between the two groups, with most participants consuming them fewer than 6 times per week (p = 0.117). Fruit juice and oily fish were consumed more than twice per week by 83% of participants with mild illness, compared to 66% of those with moderate to severe illness, but the difference was not statistically significant (p = 0.255). Coffee and tea consumption remained similar across both groups, with most participants consuming one cup or less per day (p = 0.128). Alcohol consumption, including wine and beer, was uniformly low across all respiratory status categories, with all participants reporting less than 2 glasses or 5 bottles per week.

Table 8. Pro-Inflammatory, Anti-Inflammatory and EDII Score with QOL domains.

Parameter	Pro-inflammatory		Anti-Inflammatory		EDII Score	
	r	p	r	p	r	p
QOL Score	-.439	<.001*	.12	<.001*	-.569	<.001 *
Physical function	-.154	<.001*	.204	.03 *	-.256	<.001 *
Physical limitation	.030	.708	-.047	.555	-0.39	.622
Emotional limitation	.007	.934	.054	.495	.044	.580
Energy fatigue	.082	.304	-.276	.06	-.080	.315
Emotional well being	-.163	.021*	.166	.412	-.212	.034 *
Social function	-.031	.696	.207	.078	.073	.359

Note: *Significant at p<0.05, r Spearman correlation

Table 8 presents the correlations between pro-inflammatory, anti-inflammatory, and EDII scores with overall quality of life (QOL) and its domains. A significant negative correlation was observed between the pro-inflammatory score and overall QOL (r = -0.439, p < 0.001). The EDII score demonstrated a stronger negative correlation with QOL (r = -0.569, p < 0.001). The anti-inflammatory score showed a weak but statistically significant positive correlation with QOL (r = 0.12, p = 0.03). Regarding QOL domains, pro-inflammatory scores were negatively correlated with physical function (r = -0.154, p < 0.001) and emotional well-being (r = -0.163, p = 0.021). The anti-inflammatory score was positively correlated with physical function (r = 0.204, p = 0.03), while no other domains showed significant associations. The EDII score was negatively correlated with physical function (r = -0.256, p < 0.001) and emotional well-being (r = -0.212, p = 0.034). Other domains (physical limitation, emotional limitation, energy/fatigue, and social function) were not significantly associated with dietary inflammatory scores. poorer quality of life, particularly in physical and emotional well-being domains.

Table 9 highlights the correlation between pro-inflammatory, anti-inflammatory, and EDII scores with the Quality of Life (QOL), Perceived Stress Scale (PSS), Wisconsin Upper Respiratory Symptom Survey (WURSS), and Global Physical Activity Questionnaire (GPAQ). The pro-inflammatory score showed a significant negative correlation with QOL (r = -0.439, p < 0.001) and GPAQ (r = -0.308, p < 0.001), while it demonstrated a significant positive correlation with WURSS (r = 0.381, p < 0.001). However, the pro-inflammatory score did not show a significant correlation with PSS (r = 0.227, p = 0.091). The anti-inflammatory score exhibited a positive but insignificant correlation with QOL (r = 0.12, p = 0.03) and GPAQ (r = 0.236, p < 0.001). Conversely, it showed a significant negative correlation with WURSS (r = -0.247, p < 0.001). No significant correlation was found between the anti-inflammatory score and PSS (r = -0.094, p = 0.425). The EDII score was significantly negatively correlated with QOL (r = -0.569, p < 0.001) and GPAQ (r = -0.380, p < 0.001), while it was positively correlated with WURSS (r = 0.433, p < 0.001). No significant association was observed between EDII and PSS (r = -0.064, p = 0.425). These results suggest that pro-inflammatory and EDII scores negatively impact quality of life and physical activity while being associated with higher respiratory symptoms, as measured by WURSS

Table 9. Pro-Inflammatory, Anti-Inflammatory and EDII Score with QOL, PSS, WURSS and GPAQ questionnaires.

Parameter	Pro-inflammatory		Anti-inflammatory		EDII	
	r	p	r	p	r	p
QOL [b]	-.439	<.001*	.12	<.001*	-.569	<.001*
PSS [b]	.227	.091	-.094	.237	-.064	.425
WURSS [b]	.381	<.001*	-.247	.002*	.433	<.001*
GPAQ [b]	-.308	<.001*	.236	.003*	-.380	<.001*

b Spearman Correlation
*Significant at p<0.05

Table 10. EDII consuming status with anthropometry profile (Stated as r value) and (QOL, PSS, WURSS and GPAQ) questionnaires.

Parameter	Mean ± SD / Median (IQR)				P value
	Low EDII	Moderate EDII	High EDII	Total	
Weight [a]	67.05 ± 11.05	66.8 ± 9.82	71.79 ± 7.6	67.6 ± 10.24	.102
Height [a]	163.72 ± 8.10	160.58 ± 8.67	159.73 ± 7.33	161.95 ± 8.34	.034*
BMI [a]	24.55 ± 4.12	25.42 ± 3.28	27.5 ± 2.08	25.33 ± 3.70	.002*
QOL [b]	19.5 (6)	19 (8)	20 (4.75)	19.5 (6.25)	<.001*
PSS [b]	7.5 (7)	13 (22)	32 (24.75)	17.5 (53.75)	<.001*
WURSS [b]	525 (405)	1632 (2050)	4570 (5152.5)	2242.3 (2535.83)	.008*
GPAQ [b]	68.9 (29.6)	47.7 (12.77)	31.5(15.84)		<.001*

a= One way ANOVA
b= Kruskal-Wallis H
*Significant at p<0.05

Table 10 presents the differences in anthropometric measurements and questionnaire outcomes across low, moderate, and high EDII consumption status groups. BMI differed significantly between groups (p = 0.002), with the highest mean BMI observed in the high EDII group (27.5 ± 2.08), followed by the moderate (25.42 ± 3.28) and low EDII groups (24.55 ± 4.12). Height also showed a significant difference across groups (p = 0.034), whereas weight did not differ significantly (p = 0.102).

Regarding quality of life (QOL), significant differences were observed across EDII categories (p < 0.001). Participants in the low EDII group demonstrated better QOL scores compared to those in the high EDII group. Perceived stress levels (PSS) also increased significantly across EDII categories (p < 0.001), with the highest stress levels observed among participants in the high EDII group.

For respiratory symptoms measured using WURSS-21, significant differences were identified across EDII groups (p = 0.008). Participants in the high EDII group demonstrated the highest median WURSS score, followed by the moderate EDII group, while the low EDII group demonstrated the lowest median WURSS score. As higher WURSS scores indicate greater upper respiratory symptom severity, these findings suggest that participants consuming more pro-inflammatory diets experienced a greater

respiratory symptom burden compared to those consuming more anti-inflammatory dietary patterns.
Physical activity levels (GPAQ) also differed significantly across EDII categories ($p < 0.001$), with the highest activity levels observed in the low EDII group and the lowest levels observed in the high EDII group. These findings collectively suggest that higher dietary inflammatory potential is associated with poorer quality of life, greater perceived stress, increased respiratory symptom severity, and lower physical activity levels.

Table 11. Relationship between EDII score and Quality of life (OQL) using multiple linear regression models.

Parameter	B (95% CI) QOL			
	Unadjusted	Adjusted Model 1	Adjusted Model 2	Adjusted Model 3
EDII Score	-4.002 (-5.099 - -2.905)	-3.895 (-5.020 - -2.770)	- 4.493 (-5.699 - -3.287)	-4.013 (-5.116 - -2.910)

Using multiple linear regression, method enter.
P< 0.05 significance value
QOL= quality of life.
B. Unstandardized B value.
CI = confidence intervals.
** Model 1 was adjusted for age, years of study, and BMI. Model 2 was additionally adjusted for Wisconsin Upper Respiratory Symptom Survey (WURSS). Model 3 was additionally adjusted for perceived stress scale PSS and other earlier values.

EDII Score is related to QOL of which is poorer EDII, the better QOL adjusted for age, BMI and years of education.

Table 12. Relationship between EDII score and Wisconsin Upper Respiratory Survey (WURSS) using multiple linear regression models.

Parameter	B (95% CI) WURSS			
	Unadjusted	Adjusted Model 1	Adjusted Model 2	Adjusted Model 3
EDII Score	2.670 (1.787 – 3.553)	2.624 (1.737 - 3.510)	3.146 (2.13 – 4.157)	2.643 (1.758 – 3.528)

Using multiple linear regression, method enter.
P< 0.05 significance value
WURSS= Wisconsin Upper Respiratory Survey.
B. Unstandardized B value.
CI = confidence intervals.
** Model 1 was adjusted for age, years of study, and BMI. Model 2 was additionally adjusted for quality of life (QOL). Model 3 was additionally adjusted for perceived stress scale PSS and other earlier values.

Relationship between EDII Score and Quality of Life (QOL)in table 11 presents the association between EDII score and QOL using multiple linear regression models. In the unadjusted model, a higher EDII score was significantly associated with poorer QOL (B = -4.002, 95% CI: -5.099 to -2.905). After adjusting for age, years of study, and BMI in Model 1, the association remained significant (B = -3.895, 95% CI: -5.020 to -2.770). Further adjustment for WURSS in Model 2 slightly strengthened the association (B = -4.493, 95% CI: -5.699 to -3.287). In the fully adjusted Model 3, which included PSS, the relationship remained significant (B = -4.013, 95% CI: -5.116 to -2.910). These results suggest that higher EDII scores are consistently linked to poorer QOL, even after controlling for confounding factors.

Relationship between EDII Score and WURSS in table 4.12 explores the relationship between EDII scores and WURSS using multiple linear regression models. In the unadjusted model, a higher EDII score was associated with worse respiratory symptoms (B = 2.670, 95% CI: 1.787 to 3.553). This relationship persisted in Model 1 after adjusting for age, years of study, and BMI (B = 2.624, 95% CI: 1.737 to 3.510). Further adjustments for QOL in Model 2 slightly increased the strength of the association (B = 3.146, 95% CI: 2.13 to 4.157). In the fully adjusted Model 3, accounting for PSS, the association remained significant (B = 2.643, 95% CI: 1.758 to 3.528). These findings indicate that higher EDII scores are strongly linked to increased respiratory symptoms, as measured by WURSS, even after controlling for other variables. These findings highlight the importance of dietary interventions to reduce the inflammatory burden, which could improve quality of life and respiratory health. These findings highlight the importance of dietary interventions to reduce the inflammatory burden, which could improve quality of life and respiratory health.

4.0 DISCUSSIONS

4.1 Anthropometric measures

This study provides significant insights into the associations between pro-inflammatory and anti-inflammatory dietary patterns with anthropometric measures, perceived stress, quality of life (QOL), respiratory infection symptoms, and physical activity among adults in Klang Valley. The findings highlight the profound role of dietary patterns in influencing both physical and mental health outcomes, as well as their interconnections with lifestyle and immunity. These results emphasize the importance of adopting anti-inflammatory dietary practices as a means of improving health outcomes and reducing disease risk.

The relationship between dietary patterns and anthropometric measures, particularly body mass index (BMI), emerged as a key finding in this study. A higher intake of pro-inflammatory foods, including processed meats, refined sugars, and saturated fats, was significantly associated with increased BMI as shown in other studies (Grosso et al. 2022). These findings align with previous research that demonstrates the role of pro-inflammatory diets in promoting weight gain and obesity through mechanisms such as chronic low-grade inflammation and hormonal dysregulation (Deng et al. 2024). Chronic inflammation can impair insulin and leptin sensitivity, leading to increased fat storage and metabolic dysfunction, further contributing to obesity (Perez-Araluce et al. 2022).

Conversely, participants with higher consumption of anti-inflammatory foods, characterized by fruits, vegetables, whole grains, and healthy fats such as omega-3 fatty acids, exhibited lower BMI values. Anti-inflammatory foods are rich in antioxidants and bioactive compounds that help reduce oxidative stress and systemic inflammation, thereby promoting better metabolic health (Zhang & Tsao 2016). These findings emphasize the need for targeted dietary interventions to address obesity, which remains a significant public health concern in Malaysia. Given the established link between obesity and chronic diseases, such as cardiovascular disease and type 2 diabetes, promoting anti-inflammatory dietary patterns is a crucial strategy for disease prevention and weight management (Bastianon et al. 2020). Although anti-inflammatory scores are generally expected to be inversely related to adiposity, this study observed a positive correlation between anti-inflammatory score and BMI. This unexpected finding may reflect reverse causation, whereby individuals with higher BMI adopt healthier eating patterns in response to weight concerns, or residual confounding not captured in the present cross-sectional analysis.

4.2 Stress and quality of life (QOL)

This study also highlights the association between dietary patterns, perceived stress levels, and QOL, which are critical determinants of both mental and physical health. Participants who consumed more pro-inflammatory foods reported higher stress levels, as reflected in their Perceived Stress Scale (PSS) scores. Pro-inflammatory diets are known to disrupt hormonal balance, particularly cortisol regulation, which can exacerbate stress responses (Vasconcelos et al. 2016). Furthermore, stress itself can influence dietary choices, with individuals under stress often resorting to unhealthy, high-calorie foods as a coping mechanism (Masih et al. 2017). This bidirectional relationship between stress and pro-inflammatory dietary patterns underscores the cyclical nature of these factors, further exacerbating inflammation and health risks.

On the other hand, anti-inflammatory diets demonstrated protective effects, reducing perceived stress levels and enhancing QOL. Foods rich in antioxidants, polyphenols, and essential nutrients support neurochemical balance, reduce oxidative stress, and enhance psychological well-being (Winiarska-Mieczan et al. 2023). Improved QOL scores among participants consuming anti-inflammatory diets highlight the positive impact of these dietary patterns on emotional and physical health. This is particularly significant as QOL encompasses not only physical health but also emotional stability, social relationships, and overall life satisfaction. These findings suggest that promoting anti-inflammatory diets could serve as a dual strategy for improving mental health and physical well-being.

4.3 Respiratory infection physical activity

Another important finding of this study was the association between predefined EDII categories and upper respiratory symptom severity, as measured by WURSS-21. According to the validated WURSS scoring system, higher total scores indicate more severe symptoms and greater functional impairment. Interestingly, participants in the low EDII group demonstrated higher median WURSS scores compared to those in the high EDII group

This unexpected pattern may reflect the cross-sectional nature of the study, potential reverse causation, reporting bias, or unmeasured confounding factors such as environmental exposure or recent acute illness episodes. It is possible that individuals experiencing respiratory symptoms may have temporarily modified their dietary behaviors, leading to lower EDII scores at the time of assessment.

Therefore, although correlation analyses showed positive associations between EDII and WURSS scores, the categorical comparison across predefined EDII groups suggests a complex and potentially non-linear relationship that warrants further longitudinal investigation. Future studies incorporating inflammatory biomarkers and prospective follow-up designs are needed to clarify the directionality and underlying mechanisms of this association.

4.4 Quality of life implication for public health

Quality of life was a central focus of this study, as it reflects the cumulative impact of physical health, emotional well-being, and social relationships on an individual's overall life satisfaction. Participants with higher scores on the Empirical Dietary Inflammatory Index (EDII), indicative of pro-inflammatory dietary patterns, reported lower QOL. Pro-inflammatory diets are associated with increased inflammation, fatigue, and psychological distress, which collectively diminish physical and emotional well-being (Haß et al. 2019). In contrast, participants with lower EDII scores, representing anti-inflammatory dietary patterns, reported significantly better QOL scores. Anti-inflammatory diets, rich in essential nutrients and antioxidants, not only enhance physical health but also promote emotional resilience and cognitive function (Yu et al. 2024). These findings underscore the importance of dietary interventions in improving QOL, particularly among populations at risk of inflammation-related health conditions. Addressing dietary patterns could lead to substantial improvements in overall well-being and life satisfaction. The findings of this study carry significant implications for public health policies and interventions. The associations between pro-inflammatory diets and negative health outcomes—including increased BMI, higher stress levels, poorer QOL, and more severe respiratory symptoms—highlight the urgent need for promoting anti-inflammatory dietary patterns. Public health campaigns should focus on educating the population about the benefits of consuming fruits, vegetables, whole grains, and healthy fats, while reducing the intake of processed and inflammatory foods. Additionally, the link between stress and dietary habits underscores the importance of integrating stress management strategies into nutritional education (Seyidoglu & Aydin 2025). Stress management programs, coupled with nutrition education, could help individuals make healthier dietary choices and improve their overall health outcomes (Kaipainen 2014). Targeted interventions, particularly for high-risk groups, such as individuals with high stress levels or poor dietary habits, could yield significant health benefits.

4.5 Prevalence of consuming a healthy diet among Malaysian adults overall comment

Results illustrate the frequency of consumption of both pro-inflammatory and anti-inflammatory food groups by gender. The prevalence of consuming a healthy diet, defined by higher intake of anti-inflammatory foods, was observed across the participants. Among these foods, the consumption of leafy green vegetables, dark yellow vegetables, fruit juice, oily fish, coffee, tea, and limited alcohol intake were analyzed. A total of 20.1% of Malaysian participants in this study consumed leafy green vegetables 7 or more times per week, while 49.1% consumed them 1–3 times per week, indicating a moderate level of healthy food consumption. Similarly, 62% of participants consumed fruit juice and oily fish more than twice per week, representing a relatively high prevalence of anti-inflammatory food intake. These findings align with the MANS 2014 report, which found that 43.2% of Malaysian adults consumed leafy green vegetables daily, and 29.4% consumed marine fish daily. However, MANS 2014 also reported that 55.9% of adults consumed sugar daily, suggesting that unhealthy dietary habits persist despite the intake of beneficial foods (Kasim et al. 2018). This study highlights a mixed dietary pattern among Malaysian adults, where anti-inflammatory food consumption is evident, yet certain unhealthy dietary habits remain prevalent. While efforts to promote consistent healthy food consumption are crucial, the high intake of sugar and processed foods, as reported in MANS 2014, raises concerns about overall dietary quality. The association between pro-inflammatory diets, stress, respiratory health, and quality of life (QOL) suggests the need for targeted public health interventions. Strategies focusing on reducing unhealthy food intake and promoting anti-inflammatory dietary patterns could lead to better long-term health outcomes and improved QOL among Malaysian adults (Kasim et al. 2018).

The findings of this study highlight significant associations between inflammatory diets, respiratory infections, and quality of life, shedding light on the complex interplay of dietary patterns, stress levels, and lifestyle factors with respiratory health. Results showed that participants with higher consumption of pro-inflammatory diets, such as red and processed meats, exhibited a higher frequency of respiratory symptoms and poorer quality of life. Conversely, individuals adhering to anti-inflammatory diets, characterized by fruits, vegetables, and whole grains, demonstrated improved respiratory health outcomes and better quality of life. The data also revealed that stress levels, as measured by the Perceived Stress Scale (PSS-10), played a critical role in influencing dietary habits and respiratory health. Participants with higher stress levels were more likely to consume pro-inflammatory foods, which further exacerbated their respiratory symptoms. These findings align with prior studies, such as those by (Wawrzyniak-Gramacka et al. 2021), which emphasized the negative correlation between high stress levels and healthy dietary patterns. Lifestyle factors, including physical activity assessed using the Global Physical Activity Questionnaire (GPAQ), also emerged as significant contributors. Individuals engaging in regular physical activity reported better respiratory health and reduced inflammation, consistent with findings from (Bull et al. 2009), which highlighted the protective role of physical activity in mitigating inflammation and improving overall quality of life. These results underscore the importance of targeted interventions to address dietary patterns, stress management, and lifestyle modifications. Public health strategies should focus on promoting anti-inflammatory diets, enhancing physical activity, and implementing stress-reduction programs to improve respiratory health and overall well-being. Educational tools that simplify the concept of pro-inflammatory and anti-inflammatory diets can play a crucial role in raising awareness and motivating individuals to adopt healthier dietary and lifestyle habits

(Muñoz & Costa 2013). This study contributes to the growing body of evidence supporting the role of diet, stress, and lifestyle factors in respiratory health. Similar to previous research, such as (Wawrzyniak-Gramacka et al. 2021), which highlighted the use of visual aids and simplified communication for public education, this study emphasizes the need for accessible and comprehensive public health resources. These findings have significant implications for healthcare professionals, including dietitians, nutritionists, and public health educators, in designing effective interventions to reduce the risk of respiratory infections and improve quality of life in the Malaysian population.

CONCLUSION

This study provides evidence that dietary inflammatory potential is significantly associated with anthropometric measures, perceived stress, physical activity, and quality of life among adults in Klang Valley, Malaysia. Higher EDII scores were consistently linked to increased BMI, higher stress levels, lower physical activity, and poorer overall quality of life, even after adjustment for confounding variables. Although differences in upper respiratory symptom severity were observed across EDII categories, interpretation of this relationship requires caution due to the cross-sectional nature of the study. According to the standardized WURSS-21 scoring system, higher scores indicate greater symptom severity. Variations observed across EDII groups suggest a complex and potentially bidirectional interaction between diet and respiratory health that warrants further investigation Overall, these findings emphasize the importance of promoting anti-inflammatory dietary patterns alongside stress management and physical activity as part of comprehensive public health strategies. Future longitudinal studies incorporating inflammatory biomarkers are needed to clarify causal mechanisms and strengthen the evidence base.

Limitations

Despite its valuable findings, this study has several limitations. The cross-sectional design restricts the ability to establish causal relationships between dietary patterns, stress, physical activity, respiratory health, and QOL. Additionally, data collection relied on self-reported questionnaires, which may have introduced recall bias or social desirability bias, potentially affecting the accuracy of responses. The sample size (159 participants) was relatively small and limited to Klang Valley, which may reduce the generalizability of findings to other regions or populations. Furthermore, unmeasured confounders, such as genetic predisposition, environmental factors, and unrecorded dietary components, were not accounted for, which may have influenced the observed associations. A subset of participants (n = 28) provided self-reported height and weight, which may have introduced measurement bias. Given the cross-sectional design, reverse causation cannot be excluded; dietary choices may have been modified in response to existing weight status, which may partly explain unexpected associations observed between anti-inflammatory dietary scores and BMI.

Strengths

This study has several strengths that contribute to its scientific value and practical relevance. Firstly, it is one of the few studies in Malaysia that explores the association between inflammatory diets, stress, respiratory infections, and quality of life (QOL) in adults, addressing an important research gap. Secondly, the use of validated assessment tools—including the Empirical Dietary Inflammatory Index (EDII), Perceived Stress Scale (PSS-10), Wisconsin Upper Respiratory Symptom Survey (WURSS-21), Global Physical Activity Questionnaire (GPAQ), and QOL-36—ensures the reliability and validity of the data collected. Additionally, the study's multifactorial approach is a key strength, as it examines the interplay between dietary habits, mental health, physical activity, and immune function, providing a more holistic understanding of health outcomes. The study also employed multiple statistical methods, including correlation analysis, regression modeling, and Chi-square/Fisher's Exact tests, to account for potential confounders and strengthen the reliability of the findings. Moreover, the study's public health relevance is significant, as the findings offer actionable insights for nutrition and lifestyle interventions aimed at reducing the burden of inflammatory-related diseases and respiratory infections in Malaysia. Lastly, the study's emphasis on modifiable lifestyle factors makes it a valuable contribution to health promotion strategies, highlighting the importance of dietary modifications, stress management, and physical activity in improving overall well-being.

Suggestions

Based on the findings, several suggestions are proposed to enhance future research and improve public health interventions. Longitudinal studies should be conducted to establish causal relationships between dietary patterns, stress, respiratory infections, and QOL, providing stronger evidence for intervention strategies. Expanding the sample size and including participants from diverse regions beyond Klang Valley would improve the generalizability of findings. Future research should also incorporate biomarkers of inflammation, such as C-reactive protein (CRP) and cytokine levels, to objectively assess dietary impacts on immune function. Additionally, mixed-method approaches, integrating qualitative interviews with quantitative data, could offer deeper insights into behavioral and cultural influences on dietary choices. Collaborating with healthcare institutions and policymakers to implement nutrition education programs, stress management initiatives, and public health campaigns could amplify the study's impact. Lastly, the development of personalized dietary guidelines based on inflammatory potential could provide targeted interventions for individuals at higher risk of stress-related health issues and respiratory infections.

ACKNOWLEDGEMENT

The authors would like to Universiti Kebangsaan Malaysia for granting this research work, researchers and all the participants involved in this study.

FUNDING SOURCES

This study was supported by the IsDB scholarships program.

INFORMED CONSENT STATEMENT

Informed consent was obtained from study participants.

CLINICAL TRIAL REGISTRATION

This research does not involve any clinical trials

CONFLICT OF INTEREST

All authors declare that they do not have any conflicts of interest that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

Raw data of the findings in this study are available from the corresponding author

AUTHORS' CONTRIBUTIONS

Anas Ahmed Almaswary: Main researcher and writer of the study

Suzana Shahar: Supervision, Study Administration.

ETHICS STATEMENT

This study was reviewed and approved by the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM/PPI/111/8/ JEP-2023-211)

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