Comparison of Adherence to Healthy Eating and Physical Activity across Sociodemographic Characteristics among Malaysian Adults

Norfatini Mansor., Normah Jusoh*

Faculty of Sport Sciences and Coaching, Universiti Pendidikan Sultan Idris, 35900 Tanjung Malim, Perak, Malaysia

***Corresponding Author**

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ABSTRACT

Health is a significant social issue impacting individuals, cultures, and nations. The aim of the study was to compare an adherence to healthy eating and physical activity across sociodemographic characteristics among Malaysian adults. A total of 422 healthy male and female adults without dietary and physical activity restrictions participated in this study. They completed the Motiva. diaf questionnaire to acquire the data of level of adherence to healthy eating and physical activity. This study employed Chi-square tests to compare unrelated groups and dependent variables, assessing the differences across sociodemographic factors. Results showed significant differences ($P<0.05$) in adherence to healthy eating and physical activity among Malaysian adults in terms of ethnicity, marital status, educational level, employment status, average monthly income, and Body Mass Index. On the other hand, the results showed no significant difference ($P>0.05$) in adherence to healthy eating and physical activity across genders and residential areas. The research reveals disparities in the health habits of Malaysian adults, particularly with regard to healthy eating and physical activity adherence, emphasizing the need for increased public participation in recommended physical activity and healthy eating.

Keywords: adherence, healthy eating, physical activity, socio-demography, Body Mass Index

INTRODUCTION

Health is vital and is seen as a major social issue for a nation. This issue may have an impact on a person, a culture, or even an entire nation. The phrase "healthy lifestyle" may be seen practically everywhere these days, including on television and social media platforms. According to Alkabas and collegues healthy lifestyle is one of the health-related activities that have an impact on future health [1]. Furthermore, nutrition, exercise, stress levels, personality, and behavior are parts of the aspects which influence one's health. In fact, James, Lawrence, and O'Connor stated that, most of studies on healthy lifestyles usually focus on the efficacy of intervention programs that encourage healthy eating and/or exercise to achieve weight loss or manage chronic conditions [2]. Therefore, healthy eating habits and physical activity have a noteworthy influence on an individual.

Regular physical activity is essential for maintaining health, promoting longevity, and supporting weight management [3]. Although the World Health Organization recommends at least 150–300 minutes of moderate-intensity or 75–150 minutes of vigorous-intensity activity weekly [4], many populations, including Malaysians, fall short of these guidelines. National data indicate a 24.6% prevalence of physical inactivity among Malaysian adults, with variations observed across ethnic groups, income levels, and health status [5]. These patterns suggest that sociodemographic factors may significantly shape participation in physical activity.

Dietary behavior show similar challenges. Despite clear guidance provided through the Malaysian Dietary Guidelines and the Malaysian Food Pyramid to promote balanced and varied eating patterns [6], fruit and vegetable intake among Malaysian adults remains below recommendations [8]. Given Malaysia's diverse food culture and the influence of modern food marketing, dietary behavior continues to be a public health concern linked to rising rates of noncommunicable diseases (NCDs) [7,9].

Thus, Malaysia has implemented numerous initiatives, such ad the National Strategic Plan for Noncommunicable Diseases, Malaysian Healthy Plate and physical activity campaigns in order to encourage healthier lifestyles [6,10,11]. However, persistent gaps in awareness, motivation, and behavior indicate that these efforts may not be equally effective across different populations. Factors such as time constraints, lack of motivation, physical discomfort, and convenience barriers have been shown to impede both healthy eating and physical activity [13, 15].

Understanding how adherence to healthy behaviors varies across sociodemographic groups is therefore essential for strengthening health promotion strategies. Identifying which groups are least likely to engage in healthy eating or physical activity can help tailor targeted, evidence-based interventions and inform more equitable public health policies. Thus, this study aimed to compare adherence to healthy eating and physical activity across sociodemographic characteristics among Malaysian adults.

MATERIALS AND METHODS

Participants

The participants were selected based on stratified random sampling method. Inclusion criteria of the participants include healthy male and female adults aged between 18-60 years old without dietary and physical activity restrictions. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the Universiti Pendidikan Sultan Idris (protocol number: 2022-0535-01).

The sample size was calculated using the following equation:

$n = Z^2 P q / d^2$

n is the minimum sample size

Z = 1.96 corresponding to 95% confidence interval

P = expected prevalence based on previous research

q = 1-P

d = margin of error of precision

The sample size was determined based on statistics from previous study on healthy diet and physical activity adherence in Spain which had 50.98% compliance [12].

n = (1.96 x 1.96) x 0.51 x (1-0.51) / (0.05 x 0.05)

= 384

Considering 10% drop out of study participants, the sample size for this study were 422.

Research Design

A cross-sectional quantitative survey was used in this study. This study compared the dependent variables across some selected independent variables. No manipulation of independent variables involved in this study.

Instruments

The Motiva. Diaf questionnaire with cronbach's alpha .802, was used to evaluate healthy eating and physical activity adherence [12]. The questionnaires had been adapted and translated to Malay version which consists of 13 items, with 8 statements regarding healthy eating and 5 statements on physical activity adherence. All items were given a dichtomous response of "Yes" or "No." The questionnaire also contained inquiries about the

sociodemographic details of the participants, including age, weight, height, gender, ethnicity, religion, marital status, education status, health status, employment status, average household income, and residence place.

Procedure

The data collection was conducted in a face-to-face setting. The participants completed the questionnaire, which was administered in a distraction-free and convenient environment. Before the survey began, the participants' consent was obtained. The participants were informed of the study's objective, the study's voluntary nature, and that all responses will be kept anonymity and confidentiality. The participants were given verbal instructions on how to complete the questionnaire before they began. The session lasted approximately 15 minutes.

Statistical Analysis

The Statistical Package for Social Science (SPSS) version 29 (IBM Corporation, USA) was used to analyze the data. The demographic data, as well as adherence to healthy behaviour, were reported using mean, standard deviation, frequency, and percentage. The Chi-square test was employed to evaluate the difference between adherence to healthy eating and physical activity across sociodemographic factors. The significant level was set at $P<0.05$.

RESULTS

A total of 422 participants were volunteered in this study. The participants demographic characteristics is shown in Table 1.

Table 1. Demographic variables

Variables		Frequency (N)	Percentage (%)	Mean±Standard Deviation
Gender	Male	212	50.2	
	Female	210	49.8	
Age (years)	Male	-	-	25±7.23
	Female	-	-	28.3±10.1
Weight (kg)	Male	-	-	70.9±15.4
	Female	-	-	60.1±15.5
Height (cm)	Male	-	-	171.4±6.7
	Female	-	-	158.3±5.9
BMI (kg/m^2)	Male	-	-	24.2±4.9
	Female	-	-	23.9±6.0
Ethnicity	Malay	295	69.9	
	Chinese	65	15.4	
	Indian	35	8.3	
	Others	27	8.4	

Marital status	Single	312	73.9	
	Married	106	25.1	
	Widow/widower	4	0.9	
Educational level	Foundation	68	16.1	
	Undergraduate	330	78.2	
	Postgraduate	24	5.7	
Employment status	Self-employed	45	10.7	
	Government	74	17.5	
	Private	75	17.8	
	None	228	54.0	
Average monthly income	Less than RM4360	126	29.9	
	RM4360-RM9619	55	13.0	
	More than RM9619	4	0.9	
Residential area	Rural	143	33.9	
	Urban	279	66.1	
Classification of BMI	Underweight	46	10.9	
	Normal	160	37.9	
	Overweight	62	14.7	
	Pre-obese	99	23.5	
	Obese	55	13.0	

Adherence to healthy eating and physical activity based on gender

Table 2 shows the result of adherence level between genders. There was no significant different between males and females for adherence to healthy eating and physical activity. However, among the questions that were asked, male participants showed highest adherence to walking at least 30 minutes per day (89.6%), while female participants adhere most to daily water intake (90.5%). Interestingly, both male and female participants showed less adherence to daily consumption of milk and dairy products and weekly consumption of legumes, whereby those who answered YES were below 60% for these two items.

Table 2. Adherence to healthy eating and physical activity based on gender

Item		Gender		
	Male (n,%)	Female (n,%)	Chi-square value	P value
Item 1	(153, 72.2)	(154, 73.3)	0.072	0.788

Item 2	(166, 78.3)	(151, 71.9)	2.310	0.129
Item 3	(153, 72.2)	(147, 70.0)	0.242	0.623
Item 4	(121, 57.1)	(113, 53.8)	0.456	0.500
Item 5	(157, 74.1)	(163, 77.6)	0.730	0.393
Item 6	(170, 80.2)	(173, 82.4)	0.333	0.564
Item 7	(121, 57.1)	(114, 54.3)	0.333	0.564
Item 8	(183, 86.3)	(190, 90.5)	1.775	0.183
Item 9	(190, 89.6)	(185, 88.1)	0.249	0.618
Item 10	(173, 81.6)	(175, 83.3)	0.218	0.640
Item 11	(179, 84.4)	(178, 84.8)	0.009	0.926
Item 12	(176, 83.0)	(169, 80.5)	0.457	0.499
Item 13	(166, 78.3)	(164, 78.1)	0.003	0.959

*Value of significant is set at P<0.05

Adherence to healthy eating and physical activity based on ethnicity

Table 3 demonstrates that there was a significant difference between ethnicity for adherence to item 3 which is the daily consumption of vegetables, raw or cooked without fat, $\chi 2$ (3, N = 422) = 11.55, P = .009 in which Indian (91.4%) showed the most adherence. Similarly, the differences between ethnicity for item 6 which is on adherence to weekly consumption of meat low in fat, with no visible fat and with no skin on fowl or a quarter of chicken or rabbit was also significant, $\chi 2$ (3, N =422) = 9.25, P = .026. In addition, there was a significant difference between ethnicity for item 7 on the adherence to weekly consumption of legumes, $\chi 2$ (3, N =422) = 9.08, P = .028 in which Indian (74.3%) was the most likely to adhere. Likewise, the comparison between ethnicity for item 9 on adherence to walking at least 30 minutes per day was also significant, $\chi 2$ (3, N =422) = 8.51, P = .037.

Table 3. Adherence to healthy eating and physical activity based on ethnicity

Item			Ethnicity			
	Malay (n,%)	Chinese (n,%)	Indian (n,%)	Others (n,%)	Chi-square value	P value
Item 1	(206, 69.8)	(55, 84.6)	(24, 68.6)	(22, 81.5)	7.231	0.065
Item 2	(218, 73.9)	(45, 69.2)	(32, 91.4)	(22, 81.5)	7.007	0.072
Item 3	(197, 66.8)	(51, 78.5)	(32, 91.4)	(20, 74.1)	11.547	0.009*
Item 4	(166, 56.3)	(37, 56.9)	(17, 48.6)	(14,51.9)	0.950	0.813
Item 5	(232, 78.6)	(42, 64.6)	(26, 74.3)	(20, 74.1)	5.826	0.120
Item 6	(247, 83.7)	(49, 75.4)	(23, 65.7)	(24, 88.9)	9.248	0.026*

Item 7	(152, 51.5)	(42, 64.6)	(26, 74.3)	(15, 55.6)	9.077	0.028*
Item 8	(263, 89.2)	(55, 84.6)	(28, 80.0)	(27, 100.0)	7.016	0.071
Item 9	(268, 90.8)	(51, 78.5)	(32, 91.4)	(24, 88.9)	8.512	0.037*
Item 10	(246, 83.4)	(49, 75.4)	(29, 82.9)	(24, 88.9)	3.202	0.361
Item 11	(254, 86.1)	(49, 75.4)	(30, 85.7)	(24, 88.9)	5.161	0.160
Item 12	(242, 82.0)	(53, 81.5)	(25, 71.4)	(25, 92.6)	4.645	0.200
Item 13	(237, 80.3)	(44, 67.7)	(27, 77.1)	(22, 81.5)	5.195	0.158

*Value of significant is set at P<0.05

Adherence to healthy eating and physical activity based on marital status

Table 4 shows the result of healthy eating and physical activity adherence comparison based on marital status. There was a significant difference between marital status for adherence to item 7 on weekly consumption of legumes, $\chi 2$ (2, N =422) = 9.49, P = .009 in which widow/widower (75.0%) showed the most adhere. Likewise, the comparison between marital status for item 10 on adherence to using the stairs instead of elevator or escalator was also significant, $\chi 2$ (2, N =422) = 6.92, P = .031, in which singles (84.9%) were the most likely to adhere compared to married individuals.

Adherence to healthy eating and physical activity based on level of education

There was a significant difference between educational level for item 13 on adherence to moving every 30 minutes while being sedentary, $\chi 2$ (2, N =422) = 7.84, P = .020, whereby postgraduate participants (95.8%) showed the most adhere (Table 5).

Table 4. Adherence to healthy eating and physical activity based on marital status

Item		Marital status			
	Single (n,%)	Married (n,%)	Widow/widower (n,%)	Chi-square value	P value
Item 1	(225, 72.1)	(78, 73.6)	(4, 100.0)	1.599	0.450
Item 2	(232, 74.4)	(82, 77.4)	(3, 75.0)	0.381	0.827
Item 3	(214, 68.6)	(83, 78.3)	(3, 75.0)	3.661	0.160
Item 4	(167, 53.5)	(64, 60.4)	(3, 75.0)	2.128	0.345
Item 5	(229, 73.4)	(87, 82.1)	(4, 100.0)	4.538	0.103
Item 6	(248, 79.5)	(91, 85.8)	(4, 100.0)	3.035	0.219
Item 7	(160, 51.3)	(72, 67.9)	(3, 75.0)	9.491	0.009*
Item 8	(274, 87.8)	(95, 89.6)	(4, 100.0)	0.781	0.677
Item 9	(277, 88.8)	(95, 89.6)	(3, 75.0)	0.841	0.657

Item 10	(265, 84.9)	(81, 76.4)	(2, 50.0)	6.916	0.031*
Item 11	(265, 84.9)	(89, 84.0)	(3, 75.0)	0.343	0.842
Item 12	(261, 83.7)	(80, 75.5)	(4, 100.0)	4.452	0.108
Item 13	(237, 76.0)	(89, 84.0)	(4,100.0)	4.097	0.129

*Value of significant is set at P<0.05

Table 5. Adherence to healthy eating and physical activity based on educational level

Item		Educational level			
	Foundation (n,%)	Undergraduate (n,%)	Postgraduate (n,%)	Chi-square value	P value
Item 1	(53, 77.9)	(240, 72.7)	(14, 58.3)	3.441	0.179
Item 2	(48, 70.6)	(251, 76.1)	(18, 75.0)	0.904	0.636
Item 3	(44, 64.7)	(235, 71.2)	(21, 87.5)	4.496	0.106
Item 4	(40, 58.8)	(184, 55.8)	(10, 41.7)	2.172	0.338
Item 5	(48, 70.6)	(254, 77.0)	(18, 75.0)	1.262	0.532
Item 6	(55, 80.9)	(272, 82.4)	(16, 66.7)	3.659	0.160
Item 7	(42, 61.8)	(181, 54.8)	(12, 50.0)	1.426	0.490
Item 8	(60, 88.2)	(291, 88.2)	(22, 91.7)	0.267	0.875
Item 9	(65, 95.6)	(288, 87.3)	(22, 91.7)	4.141	0.126
Item 10	(54, 79.4)	(274, 83.0)	(20, 83.3)	0.524	0.770
Item 11	(55, 80.9)	(281, 85.2)	(21, 87.5)	0.953	0.621
Item 12	(59, 86.8)	(270, 81.8)	(16, 66.7)	4.808	0.090
Item 13	(58, 85.3)	(249, 75.5)	(23, 95.8)	7.844	0.020*

*Value of significant is set at P<0.05

Adherence to healthy eating and physical activity based on employment status

Table 6 shows that there was a significant difference between employment status for item 3 on adherence to daily consumption of vegetables, raw or cooked without fat, $\chi 2$ (3, N =422) = 11.22, P = .011, in which participants in government sector (85.1%) showed the most adhere. In addition, the comparison between employment status for item 7 on adherence to weekly consumption of legumes was also significant, $\chi 2$ (3, N =422) = 11.13, P = .011.

Table 6. Adherence to healthy eating and physical activity based on employment status

Item	Employment status					
	None (n,%)	Self-employed	Government	Private (n,%)	Chi-square	P value

		(n,%)	(n,%)		value	
Item 1	(164, 71.9)	(34, 75.6)	(53, 71.6)	(56, 74.7)	0.443	0.931
Item 2	(171, 75.0)	(35, 77.8)	(61, 82.4)	(50, 66.7)	5.156	0.161
Item 3	(149, 65.4)	(32, 71.1)	(63, 85.1)	(56, 74.7)	11.224	0.011*
Item 4	(117, 51.3)	(23, 51.1)	(47, 63.5)	(47, 62.7)	5.449	0.142
Item 5	(167, 73.2)	(35, 77.8)	(60, 81.1)	(58, 77.3)	2.130	0.546
Item 6	(181, 79.4)	(38, 84.4)	(65, 87.8)	(59, 78.7)	3.262	0.353
Item 7	(111, 48.7)	(28, 62.2)	(51, 68.9)	(45, 60.0)	11.126	0.011*
Item 8	(200, 87.7)	(42, 93.3)	(70, 94.6)	(61, 81.3)	7.586	0.055
Item 9	(203, 89.0)	(41, 91.1)	(66, 89.2)	(65, 86.7)	0.610	0.894
Item 10	(192, 84.2)	(35, 77.8)	(64, 86.5)	(57, 76.0)	4.159	0.245
Item 11	(197, 86.4)	(39, 86.7)	(63, 85.1)	(58, 77.3)	3.772	0.287
Item 12	(190, 83.3)	(39, 86.7)	(57, 77.0)	(59, 78.7)	2.697	0.441
Item 13	(179, 78.5)	(31, 68.9)	(63, 85.1)	(57, 76.0)	4.602	0.203

*Value of significant is set at P<0.05

Adherence to healthy eating and physical activity based on average monthly income

Table 7 demonstrates that there was a significant difference between average monthly income for item 3 on adherence to daily consumption of vegetables, raw or cooked without fat, $\chi 2$ (3, N =422) = 11.45, P = .010, as well as item 7 on adherence to weekly consumption of legumes, $\chi 2$ (3, N =422) = 12.10, P = .007 in which participants with average monthly income of RM4360-RM9619 (69.1%) showed the most adhere.

Table 7. Adherence to healthy eating and physical activity based on average monthly income

Item	Average monthly income					
	None (n,%)	Less than RM4360 (low) (n,%)	RM4360-RM9619 (moderate) (n,%)	More than RM9619 (high) (n,%)	Chi-square value	P value
Item 1	(172, 72.6)	(96, 76.2)	(37, 67.3)	(2, 50.0)	2.633	0.452
Item 2	(179, 75.5)	(92, 73.0)	(45, 81.8)	(1, 25.0)	7.016	0.071
Item 3	(154, 65.0)	(96, 76.2)	(47, 85.5)	(3, 75.0)	11.453	0.010*
Item 4	(123, 51.9)	(73, 57.9)	(37, 67.3)	(1, 25.0)	6.139	0.105
Item 5	(174, 73.4)	(101, 80.2)	(43, 78.2)	(2, 50.0)	3.663	0.300

Item 6	(189, 79.7)	(107, 84.9)	(44, 80.0)	(3, 75.0)	1.627	0.653
Item 7	(115, 48.5)	(80, 63.5)	(38, 69.1)	(2, 50.0)	12.096	0.007*
Item 8	(209, 88.2)	(111, 88.1)	(0, 90.9)	(3,75.0)	1.059	0.787
Item 9	(211, 89.0)	(117, 92.9)	(44, 80.0)	(3, 75.0)	7.180	0.066
Item 10	(197, 83.1)	(103, 81.7)	(46, 83.6)	(2, 50.0)	3.083	0.379
Item 11	(205, 86.5)	(103, 81.7)	(46, 83.6)	(3, 75.0)	1.765	0.623
Item 12	(197, 83.1)	(105, 83.3)	(40, 72.7)	(3, 75.0)	3.635	0.304
Item 13	(182, 76.8)	(101, 80.2)	(45, 81.8)	(2, 50.0)	2.847	0.416

*Value of significant is set at P<0.05

Adherence to healthy eating and physical activity based on residential area

There was no significant difference based on residential area for all item on adherence to healthy eating and physical activity (Table 8). However, among the questions that were asked, the rural participants showed highest adherence to walking at least 30 minutes per day (90.2%), while urban participants most adherence to daily water intake (89.2%). Interestingly, both rural and urban participants showed less adherence to daily consumption of milk and dairy products and weekly consumption of legumes, whereby those who answered YES were below 60% for these two items.

Table 8. Adherence to healthy eating and physical activity based on residential area

Item	Residential area			
	Rural (n,%)	Urban (n,%)	Chi-square value	P value
Item 1	(105, 73.4)	(202, 72.4)	0.050	0.823
Item 2	(110, 76.9)	(207, 74.2)	0.377	0.539
Item 3	(103, 72.0)	(197, 70.6)	0.093	0.761
Item 4	(83, 58.0)	(151, 54.1)	0.588	0.443
Item 5	(103, 72.0)	(217, 77.8)	1.705	0.192
Item 6	(116, 81.1)	(227, 81.4)	0.004	0.952
Item 7	(77, 53.8)	(158, 56.6)	0.297	0.586
Item 8	(124, 86.7)	(249, 89.2)	0.592	0.442
Item 9	(129, 90.2)	(246, 88.2)	0.397	0.529
Item 10	(119, 83.2)	(229, 82.1)	0.085	0.771
Item 11	(126, 88.1)	(231, 82.8)	2.051	0.152

Item 12	(121, 84.6)	(224, 80.3)	1.188	0.276
Item 13	(110, 76.9)	(220, 78.9)	0.207	0.649

*Value of significant is set at P<0.05

Adherence to healthy eating and physical activity based on classification of BMI

Table 9 illustrates that there was a significant difference between classification of BMI for item 3 on adherence to daily consumption of vegetables, raw or cooked without fat, $\chi 2$ (4, N =422) = 9.74, p = .045 in which participants in overweight category (82.3%) showed the most adhere.

Table 9. Adherence to healthy eating and physical activity based on BMI classifications

Item	BMI						
	Underweight (n,%)	Normal (n,%)	Overweight (n,%)	Pre-obese (n,%)	Obese (n,%)	Chi-square value	P value
Item 1	(35, 76.1)	(112, 70.0)	(48, 77.4)	(73, 73.7)	(39, 70.9)	1.693	0.792
Item 2	(36, 78.3)	(117, 73.1)	(50, 80.6)	(71, 71.7)	(43, 78.2)	2.485	0.647
Item 3	(31, 67.4)	(114, 71.3)	(51, 82.3)	(61, 61.6)	(43, 78.2)	9.740	0.045*
Item 4	(26, 56.5)	(89, 55.6)	(40, 64.5)	(52, 52.5)	(27, 49.1)	3.329	0.504
Item 5	(34, 73.9)	(118, 73.8)	(53, 85.5)	(73, 73.7)	(42, 76.4)	3.868	0.424
Item 6	(35, 76.1)	(129, 80.6)	(54, 87.1)	(81, 81.8)	(44, 80.0)	2.317	0.678
Item 7	(26, 56.5)	(83, 51.9)	(40, 64.5)	(51, 51.5)	(35, 63.6)	5.020	0.285
Item 8	(41, 89.1)	(146, 91.3)	(54, 87.1)	(83, 83.8)	(49, 89.1)	3.426	0.489
Item 9	(41, 89.1)	(142, 88.8)	(56, 90.3)	(90, 90.9)	(46, 83.6)	2.078	0.722
Item 10	(39, 84.8)	(126, 78.8)	(54, 87.1)	(84, 84.8)	(45, 81.8)	3.023	0.554
Item 11	(35, 76.1)	(132, 82.5)	(55, 88.7)	(91, 91.9)	(44, 80.0)	8.867	0.065
Item 12	(33, 71.7)	(132, 82.5)	(55, 88.7)	(82, 82.8)	(43, 78.2)	5.711	0.222
Item 13	(31, 67.4)	(126, 78.8)	(51, 82.3)	(77, 77.8)	(45, 81.8)	4.212	0.378

*Value of significant is set at P<0.05

DISCUSSION

Overall, the results showed significant differences in adherence to healthy eating and physical activity among Malaysian adults based on ethnicity, marital status, educational level, employment status, average monthly income, and BMI. Meanwhile. no significant difference was found genders and residential areas.

There was a significant difference in the intake of vegetables, raw or cooked without fat, depending on ethnicity, with Indians dominating the compliance. This result is supported by another study on the factors influencing fruit and vegetable intake among adult Malaysians, which discovered that Indian were most likely to meet the recommended intake of fruits and vegetables, followed by Malay, Chinese, and others [16]. The findings, however, are contradictory with research conducted by Izzah and colleagues, which found no significant differences in the participants' intake of various vegetable categories among ethnic groups [17]. The study showed that the participants liked vegetables in every category, but only the Malay favored traditional veggies above those from the other two ethnic groups. In comparison to the Malay, the Chinese and Indians eat more green and brassica vegetables. Unlike most Indian, none of the participants had eaten salad on the day of the data collection took place.

The present study shows that government employees had higher consumption of vegetables, raw or cooked without fat compared to non-working individuals, self-employed persons, and private sector workers. Similarly, the government employees consume more legumes than people who are unemployed, self-employed or work in the private sector. Fixed income and predictable meal times may be accountable for this trend. Since the government workers have a fixed salary and more financially secure, they can afford a healthy diet compared to other groups of workers. Stadlmayr et al., stated that people with higher socioeconomic status, which frequently includes government workers because of their stable jobs and benefits, have easier access to and consume more veggies [18]. Additionally, government workers are able to better arrange their meals because they have scheduled work hours, which encourages them to cook more regularly at home. In fact, findings by Ronda-Pérez and colleagues, showed that the highest intake of fruits and vegetables was found in occupations such as teachers and healthcare workers [19]. Like many government jobs, these occupations frequently have established timetables, which makes it easier to follow regular vegetable-rich eating habits.

The present study shows that the higher income group had higher consumption of vegetables, raw or cooked without fat compared to low and no income. Due to their financial stability, they may prioritize a high value on reasonably priced, wholesome veggies for easy, home-cooked meals. They may also choose fat-free veggies and frequently have access to supermarkets or fresh market. This result was supported by Huang, He, Xu, Du, and Zhao, who stated that socioeconomic status might restrict access to fresh fruits and vegetables due to limited health literacy and high costs [20]. The higher income group eating habits may have been influenced by their greater access and information. Additionally, findings by another study shows that individuals with lower income were more likely to describe price and storage as barriers to increasing their consumption of fruits and vegetables [21].

In terms of BMI, overweight individuals comply with the consumption of vegetables, whether raw or cooked without fat, perhaps because at this stage they need more vegetables or raw cooking without fat to lose weight. This finding was supported by Parisi et al., who discovered that low-income overweight or obese African-American women in Pittsburg, Pennsylvania who consumed more than 5 servings of fruits and vegetables per day were more likely to be weight resilient in maintaining weight control in an obesity risky environment than those who consumed less than 5 servings per day [22].

Compared to Malay, Chinese, and Indian and others consumed more meat that low in fat, with no visible fat and with no skin on fowl. The availability of particular lean meat varieties in nearby markets might assist in clarifying this and might have an impact on consumption trends. There may be a preference for particular animal proteins or better access to lean cuts in some areas or populations. Choi and Lee corroborated this finding, pointing out that racial and ethnic groups in the US have different food consumption habits, with variables including availability and cultural preferences playing a role [23]. Therefore, the accessibility and availability of particular meat varieties might affect how different ethnic groups consume meat.

The Indian population consumes more legume than the Malay, Chinese, and other ethnic groups. The results were consistent with previous study that examining food intake in Malaysian culture found that Indian respondents favored legume, while Malay and Chinese respondents preferred eggs [24]. This may be attributed by **c**ultural and religious influences. The Indian society, notably Hindus and Jains, relies largely on legume as a key protein source, with traditional foods such as dal and sambar being essential to their diet. These dietary choices are encouraged by religious rituals that promote vegetarianism and plant-based protein intake. In

contrast, Malay and Chinese cuisines in Malaysia use legume to a lesser level, with rice, meats, and fish as the main components. Legume are also regarded "sattvic" (wholesome, and conducive to spiritual progress) in Indian religious philosophy, which corresponds to common eating patterns in Indian homes. Another study proved the finding, stating that the variation might be related to differences in food cultures and dietary assessment methods utilized [25]. In addition, the present study shows that widows consume more legume compared to single or married peers. This might be related to economic factors. Legume are often inexpensive and widely available, making them an acceptable nutritional option for those on tight financial constraints. Widows who are facing financial difficulties as a result of the loss of a spouse's income may choose legume as a more affordable protein source. This was corroborated by a recent study by Fiore, Castiglione, and Ferrante on legume consumption patterns, which found that legumes are a low-cost source of protein, potentially influencing dietary choices among low-income individuals [26]. However, the present study findings contradicted those of [26] who identified that married persons consumed more legume than single or widowed people.

Moreover, the higher consumption of legume among the the higher income group compared to lower income can be attributed to health consciousness. In line with the present study, a study conducted among individuals in Puerto Rico discovered that a higher intake of legumes was linked to favorable opinions regarding the taste as well as perceived health benefits [27]. This implies that the nutritional advantages of legumes make them more likely to be consumed by those who are health-conscious.

In term of adherence to physical activity, the present study shows that walking at least 30 minutes a day is also dominated by Indians. A study conducted by Cian Lian and colleagues supports this finding, showing that light exercise activities including housework, gardening, slowly strolling, bowling, fishing, or woodworking were prevalent among Indians [28]. Chinese individuals were the least likely to indicate moderate or vigorous exercise and the least likely ethnic group overall in terms of physical activity [28]. However, data from another study on Malaysian shows otherwise, which discovered that individuals of "Other" races were the least physically active, while Chinese people were the most active, with Malay and Indians lying in between [29].

The present study also indicates that single individuals considered more likely to engage in healthy physical activities like using the stairs instead of the elevator or escalator than married and widowed. The possible explanation for this is that single individuals may place greater emphasis on their own fitness. Considering they are less likely to have competing responsibilities like childcare or household management, which are more typical of married or widowed people, single individuals may place a higher priority on their own physical fitness and health. Maintaining an ideal physique and attractive appearance may be more important to single people, which encourages them to include simple physical activity like climbing stairs in their daily routine. The results are corroborated by Puciato and Rozpara, who found that single people were more likely than married people to satisfy the World Health Organization's (WHO) physical activity guidelines. Compared to 64% of married people, almost 75% of single participants complied with the suggestions [30].

In addition, this present study also indicates that post graduate students are more likely to remember to move every 30 minutes when engaging in activities like watching TV; this might be due to their increased awareness of their health and the need to exercise. Highly educated people tend to be more active while not working, whereas less educated people tend to be less active, indicating that people in developed countries with varying levels of education have varied attitudes regarding staying active [28]. People with higher levels of education may, for instance, prefer to identify physical exercise with leisure or leading healthy lifestyles, whereas others with lower levels of education would associate it with employment. In fact, education is by far the best predictor of whether or not Malaysians were physically active after controlled for other variables. In contrast to the present study, women who completed their primary education were 1.37 times more active than those with tertiary education or had no formal education at all. However, there was no significant difference in the prevalence of physical activity among men according to educational level [29].

Our study is not without limitations. Even though the sample size is large, there were some unbalanced numbers of participants according to some categories such as marital status, employment and income status. However, overall findings are deemed sufficient for statistical power. The future study might include a wider range of age and more balanced number of participants according to categories. In terms of study strengths, this present study

employed healthy individuals only, which gives new perspectives in terms of the barriers to adherence recommendations compared to diseased population such as diabetic patient, obese individuals and so forth.

CONCLUSIONS

In conclusion, there is an urgent need to develop targeted intervention programs for various sociodemographic groups in order to promote their adherence to healthy eating and physical activity. An active lifestyle for the people to meet the aims set out in the Sustainable Development Goals (SDG) 2030, it is necessary to promote health and wellbeing in order to create the active and healthy Malaysians, hence to reduce the prevalence of NCDs.

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Conflict Of Interest

The authors declare no conflict of interest.

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