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Lifestyle Factors and Selected Parameters for Cardiometabolic Health: A Predictive Study among Malaysian University Staff

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Abstract:

Objective: This study aimed to determine the prevalence of cardiometabolic risk factors and their associated factors (personal, behavioral, and environmental) among Universiti Malaysia Terengganu (UMT) staff.

Material and Methods: A cross-sectional study using quota sampling was adopted, involving 317 respondents. The Working Characteristics, the Occupational Sitting and Physical Activity Questionnaire (OSPAQ), the International Physical Activity Questionnaire (IPAQ), and Dietary Practices in Malay were self-administered, while the health status examination was assessed by medical staff. Descriptive analysis and Multiple Linear Regression were employed.

Results: In the predominantly Malay sample (97.5%), the prevalence of overweight or obesity, raised blood glucose, blood pressure, and total cholesterol among UMT staff was 62.4%, 7.3%, 21.1%, and 70% respectively. The hour of computer usage (environmental factor) was a significantly associated factor for diastolic blood pressure (p-value=0.042, β=0.622, 95% confidence interval (CI)=0.023, 1.221).

Conclusion: High rates of obesity and cardiometabolic risks were found among UMT staff, and computer usage hours were significantly linked to diastolic blood pressure. These findings highlight the need for targeted interventions addressing personal, behavioral, and environmental factors, since these findings may extend to similar sedentary working populations.

Keywords: cardiometabolic health, dietary practices, occupational sitting, University staff, working characteristics

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Introduction

Cardiovascular disease (CVD) remains the leading cause of death globally in both developed and developing countries, accounting for an estimated 17.9 million deaths each year[1]. In Malaysia, CVD is the top cause of death, responsible for 20.79% of fatalities in government hospitals and 23.09% in private hospitals in 2022[2]. Key risk factors for CVD in Malaysia, including hypertension, hypercholesterolemia, and obesity, have been on the rise, with prevalence rates reaching 29.2%, 33.3%, and 54.4%, respectively, in 2023[3].

Lifestyle is crucial to overall health and well-being, especially among working adults. It encompasses various elements, including personal factors such as knowledge and attitudes towards a healthy lifestyle, environmental factors such as social norms and working characteristics, and behavioural factors including physical activity and diet, all of which can significantly influence cardiometabolic health[4,5]. The modern workplace has undergone substantial changes that impact various aspects of employee well-being. These changes are particularly relevant to the university staff population, due to the high demands associated with academic roles and their sedentary work environments[6]. University settings involve diverse roles, each with its own set of challenges and requirements. This environmental factor can result in unfavourable behaviour. For instance, academic staff often work long hours on cognitive tasks like research, teaching, and administrative duties, resulting in extended inactivity. Likewise, administrative and support staff often face desk-bound responsibilities that restrict physical activity during the day.

Research has indicated that university staff spend a considerable amount of their workday sitting, with a high prevalence of sedentary behaviour and physical inactivity. For instance, university staff in the USA reported spending about 75% of their workday seated, often taking infrequent breaks from sitting[7]. While in Malaysia, it was reported that university staff spend an average of 7.6±2.4 hours sitting each day8. These sedentary behaviours have been associated with negative health effects, such as obesity, cardiovascular diseases, and musculoskeletal disorders[9,10].

Alongside sedentary behaviour, dietary habits among university staff significantly influence cardiometabolic health. The demanding nature of academic and administrative roles often leads to convenient, unhealthy food choices, especially when combined with the limited availability of nutritious options on campus[6,11]. Studies have shown that a significant proportion (more than 50%) of university staff in Portugal, the USA, and South Africa have poor dietary habits, and they identified workload, lack of time, and healthy food options as the barriers to healthy eating[6,12,13]. In Malaysia, university staff (66%) were found to have an excessive salt intake[14].

A country's health status is a vital foundation for its development, and a healthier, more productive population stands to benefit from improvements in overall health and well-being. According to Social Cognitive Theory, there is a dynamic interplay between personal, environmental, and behavioural factors[15]. It has been widely used to understand the motivations behind specific health behaviours, and has played a key role in shaping interventions to promote behaviour change. By understanding the synergistic effects of these factors on cardiometabolic health, a healthier workforce within university settings can be fostered. Despite numerous studies investigating the relationship between lifestyle factors and cardiometabolic diseases in recent years[16–18], the strength and consistency of such associations in diverse populations, particularly within Malaysian university settings, remain unclear. There is limited research considering the effect of working environment factors on cardiometabolic health. A gap exists in understanding how lifestyle factors like diet, physical activity, personal factors, and working characteristics affect cardiometabolic health outcomes within this demographic. Gaining insight into these effects can aid in designing workplace interventions, which would positively impact overall health and help prevent cardiovascular risk factors. As such, this study aimed to determine the prevalence of cardiometabolic risk factors and their associated factors (personal, behavioural, and environmental) among UMT staff.

Material and Methods

Study design and sample selection

This study adopted a cross-sectional study design and was conducted among both academic and non-academic university staff at UMT. To ensure that staff from different functional groups were adequately represented in the sample, quota sampling was adopted to recruit the subjects from 17 selected departments in UMT, by considering the requirement of having a minimum staff size of 30 or above in each department. Ethical approval was obtained from the UMT Human Research Ethics Committee (UMT/JKEPM/2023/163).

Using the formula by Yamane19, the desired sample size was 329 to achieve a 95% confidence level and a 5% margin of error, given that the population of UMT staff is 1856. Due to time constraints in the project timeline and limited availability of the Pusat Kesihatan Universiti (PKU) staff for continuing health examinations, the total sample recruited from the selected departments and final evaluable data was n=317. This sample size remains within a 5% margin of error based on the finite population correction factor20.

The inclusion criteria of the participants were Malaysian UMT staff aged 18 years and above, able to understand, read, and write in Malay. Pregnant women at the time of recruitment and staff with physical disabilities or deformities were excluded from this study.

Data Collection Procedures

Dependent variables

The dependent variables included waist-to-height ratio, Body Mass Index (BMI), total cholesterol, fasting blood glucose, and blood pressure. A health status examination was administered by the medical team members from Pusat Kesihatan Universiti, UMT. Height was measured using a portable stadiometer (SECA, Germany), while the weight of the respondent was measured using a weighing scale (Tanita, Japan). BMI was calculated by dividing body weight by the square of height (kg/m^2) and categorised based on World Health Organization (WHO) guidelines[21,22]. The waist circumference of the respondents was measured using anthropometric tape, and the waist-to-height ratio was calculated by dividing waist circumference by height. Total cholesterol and fasting blood glucose were measured using CardioChek® PA Analyzer with blood samples obtained via fingerstick. Blood pressure was assessed using the Omron Japan Model HEM-907. The participants were required to fast for at least 6 hours before the assessments.

Overall, raised total cholesterol was defined as known hypercholesterolaemia and raised total cholesterol amongst those not known to have hypercholesterolaemia, with a total cholesterol of ≥5.2 mmol/L. Overall, raised blood glucose was defined as known diabetes and raised blood glucose amongst those not known to have diabetes, with a fasting blood glucose of ≥7.0 mmol/L[23]. Overall, raised blood pressure was defined as known hypertension and raised blood pressure amongst those not known to have hypertension, with a systolic blood pressure measurement of ≥140mmHg or diastolic blood pressure of ≥90mmHg[24].

Independent variables

The data for the independent variables, including personal factors (knowledge of the Healthy Plate Concept), environmental factors (functional area, computer usage, overtime hours, working hours, and occupational sitting minutes), and behavioural factors (total Metabolic Equivalent of Task (MET)-minutes, practice of the Healthy

Plate Concept, consumption of fruits, vegetables, plain water, and sugar-sweetened beverages), were collected using self-administered questionnaires in Malay. The questionnaires consisted of four sections, which were Section A: Sociodemographic Profiles, Section B: Working Characteristics and Occupational Sitting (OSPAQ-M), Section C: Exercise (IPAQ-M), and Section D: Dietary Practices questionnaires adapted from National Health and Morbidity Survey 2019[25]. In Section D, knowledge of the Healthy Plate Concept was assessed with the question: "Have you ever heard or learned about the Malaysian Healthy Plate/'Suku Suku Separuh' concept?" and participants responded either "yes" or "no". A response of "yes" was considered as having basic knowledge or awareness of the concept, while a "no" response indicated a lack of such awareness. The practice of the Healthy Plate Concept was assessed by asking participants about whether and how frequently they incorporated the concept into daily meals. Response options included "yes, every day", "yes, sometimes", and "not at all". The validity of the questionnaires was determined through face validity based on expert review, and they were adopted from established questionnaires used in national health surveys.

For occupational sitting, questions were derived from the Occupational Sitting and Physical Activities Questionnaire (OSPAQ). The OSPAQ demonstrated good reliability as tested in the office workplace setting, indicated by the intraclass correlation coefficients (ICCs) for minutes spent sitting (0.66), standing (0.83), and walking (0.77)[26]. The translated scales also exhibited adequate internal consistency (α=0.72) when pre-tested in a similar local working population[27]. The test-retest reliability data for the IPAQ-M also indicated that all the activities demonstrated reasonably acceptable reliability, ranging from p-value=0.55 to p-value=0.71 in the Malaysian population[28]. The scoring and interpretation of the OSPAQ-M were based on Chau et al. (2012), while for the IPAQ-M, they were based on Craig et al. (2003)but diverse physical activity measures in use prevent international comparisons. The International Physical Activity Questionnaire (IPAQ).

Confounding variables

The confounding variables, including age, gender, educational level, household income, and personal medical history, were self-reported via the questionnaires. The education level of the respondents was categorized into secondary education or tertiary education. The household income of respondents was categorized into the bottom 40% income group (B40), the middle 40% income group (M40), and the top 20% income group (T20)[31]. Personal medical history was categorized into two groups: no medical history and with medical history.

Statistical analysis

Data analysis of this study was done using the IBM Statistical Package for the Social Sciences (SPSS) software version 23.0, applying parametric tests. A descriptive test was used to analyse the sociodemographic profile, working characteristics, diet practice, exercise, and cardiometabolic health among the respondents. Continuous variables were presented as mean and standard deviation, while categorical variables were shown as frequency and percentage. Multiple linear regression was conducted to determine the significant associated factors (personal, behavioural, and environmental) influencing the cardiometabolic health of UMT staff. The first model of multiple linear regression was a basic model involving all the independent variables. The second model was adjusted for age, while the third model was further adjusted for gender, educational level, household income, and personal medical history. The assumptions for multiple linear regression, including linearity, normality, homoscedasticity, and multicollinearity, were tested. Linearity and homoscedasticity were confirmed through an examination of scatterplots of residuals against predicted values. The residuals were found to be approximately normally distributed. Multicollinearity was assessed using the Variance Inflation Factor (VIF), with all values below 2, indicating that there were no multicollinearity issues. Meeting these assumptions supports the robustness of the regression model. The significance level was p-value<0.05.

Results

Table 1 presents the sociodemographic profile of the respondents. The majority of respondents (57.7%) were female; 42.3% were male. The mean age of the respondent was 40 years old. Most of the respondents (97.5%) were Malay, 1.9% were Chinese, and one respondent was from another ethnic group. Most of them (76.7%) were married. For education, the majority of the respondents held a Bachelor's degree (27.8%), followed by 25.9% with a diploma, 19.6% with either SRP, PMR, or SPM qualifications, 19.2% with a PhD, and 7.6% with a Master's degree. Regarding household monthly income, 46.4% of respondents were in the M40 category, 37.5% in the B40 category, and 16.1% in the T20 category. Most respondents (58.0%) were supporting staff, 21.5% of them were in the group of management and professionals (non-academic), and 20.5% of them were in the group of management and professionals (academic).

The working characteristics of respondents are shown in Table 2. Most (79.5%) worked in support, service, and administrative areas, while 20.5% worked in academic areas. Out of 317 respondents, 96.2% used computers for work, with only 3.8% not using computers. The average computer usage per workday was 6.64±2.44 hours. The respondents worked 5 days a week, with an average total working hour of 43 and 5 hours of overtime per week. During their workday, the respondents spent an average of 276 minutes sitting, 82 minutes standing, 93 minutes walking, and 36 minutes of heavy labour.

Table 3 presents the cardiometabolic health of respondents. The mean waist-to-height ratio was 0.53. The mean BMI of the respondents was 27.08 kg/m^2, which was classified as overweight. Most of the respondents were overweight (41.3%), and 21.1% of them were obese. One-third (35.0%) of the respondents had normal BMI, while 2.5% were underweight. The prevalence of overall raised total cholesterol was 70.0%, with a mean total cholesterol level of 5.70 mmol/L. The prevalence of overall raised blood glucose was 7.3%, with a mean fasting blood glucose of 5.75 mmol/L. The overall prevalence of raised blood pressure was 21.1%, with a mean systolic blood pressure of 123.17 mmHg and diastolic blood pressure of 79.79 mmHg.

Table 1 Sociodemographic profile of the respondents

Characteristics	Respondents (n=317)	
	n (%)	Mean±S.D.
Age (years)		40.05±7.99
Gender		
Female	183 (57.7)	
Male	134 (42.3)	
Marital status		
Married	243 (76.7)	
Single/Divorced/Single mother	74 (23.3)	
Ethic		
Malay	309 (97.5)	
Chinese	6 (1.9)	
Other	2 (0.6)	
Educational level		
Bachelor's degree	88 (27.8)	
Diploma	82 (25.9)	
SRP/PMR/SPM	62 (19.6)	
Ph.D.	61 (19.2)	
Master's degree	24 (7.6)	
Household median income categories[a]		
M40	147 (46.4)	
B40	119 (37.5)	
T20	51 (16.1)	
Group of service		
Supporting staff	184 (58.0)	
Management and professionals (non-academic)	68 (21.5)	
Management and professionals (academic)	65 (20.5)	

[a]Department of Statistics Malaysia (2017); Osman et al. (2020), S.D.=standard deviation, B40=Household income<RM4360 (USD 997), M40=Household income ranged RM 4360-RM9619 (USD 997-USD2201), T20=Household income >RM9619 (USD 2201)

Table 2 Working characteristics of the respondents

Characteristics	Respondents (n=317)	
	n (%)	Mean±S.D.
Functional area		
Support, service and administrative	252 (79.5)	
Academic	65 (20.5)	
Computer usage		
Yes	305 (96.2)	
No	12 (3.8)	
Computer usage (hour/day)		6.64±2.44
Overtime work (hour/week)		4.43±7.83
Working hour/week		42.89±12.64
Working day/week		5.29±0.91
Work activities (minutes/day)		
Sitting		276.63±129.77
Standing		82.74±54.61
Walking		93.00±60.02
Heavy labour		36.80±53.92

S.D.=standard deviation

Table 3 Cardiometabolic health of the respondents

Characteristics	Respondents (n=317)	
	n (%)	Mean±S.D.
Waist circumference		85.13±12.81
Waist-to-height Ratio		0.53±0.08
BMI (kg/m^2)		27.08±5.36
BMI classification (WHO)[a]		
Underweight (<18.5)	8 (2.5)	
Normal (18.5-24.9)	111 (35.0)	
Overweight (25.0-29.9)	131 (41.3)	
Obese (≥30.0)	67 (21.1)	
Total cholesterol (mmol/L)[b]		5.70±1.51
Known hypercholesterolemia	2 (0.6)	
Overall raised total cholesterol	222 (70.0)	
Fasting blood glucose (mmol/L)[c]		5.75±1.21
Known diabetes	13 (4.1)	
Overall raised blood glucose	23 (7.3)	
Blood Pressure (mmHg)[d]		
Systolic blood pressure (mmHg)		123.17±17.46
Diastolic blood pressure (mmHg)		79.79±11.83
Known Hypertension	21 (6.6)	
Overall raised blood pressure	67 (21.1)	

[a]=World Health Organization (1998), [b]=Ministry of Health Malaysia (2017), [c]Ministry of Health Malaysia (2020), [d]=Ministry of Health Malaysia (2018), S.D.=standard deviation

Table 4 shows the result of multiple linear regression, which determined the significant associated factors of cardiometabolic health of respondents. A serving of fruits consumed by respondents was significantly associated with fasting blood glucose levels. However, this association was no longer significant after adjusting for age in Model 2 and persisted after further adjustments for gender, educational level, household income, and personal medical history in Model 3. Significant association was found between functional area and systolic blood pressure (p-value=0.010, β= -6.440, 95% confidence interval (CI)=-11.348, -1.532), diastolic pressure (p-value=0.044, β=-3.556, 95% CI=-7.011, -0.100), as well as fasting blood glucose (p-value=0.048, β=0.361, 95% CI=0.004, 0.718), after the adjustment for age in Model 2, but these association attenuated and became no longer statistically significant after adjustment for other confounders in Model 3.

A significant association was found between knowledge of the healthy plate concept and waist-to-height ratio after adjusting for age (p-value=0.026, β=0.028, 95% CI=0.003, 0.053). This association remained significant even after further adjustment for other confounding variables (p-value=0.035, β=0.027, 95% CI=0.002, 0.053), yet the size of the effects was small. After adjustment for all the confounding variables in Model 3, the association between computer usage and diastolic blood pressure was significant. One-unit higher computer usage was associated with 0.622 higher diastolic blood pressure. Results indicated that knowledge of the healthy plate concept was significantly associated with the waist-to-height ratio, while computer usage was significantly associated with diastolic blood pressure.

Discussion

According to the results, the overall prevalence of overweight and obesity among the respondents was 63.9%, with 41.1% classified as overweight and 22.8% as obese,

Table 4 Factors associated with cardiometabolic health

	Model 1, β (95% CI)	p-value	Model 2, β (95% CI)	p-value	Model 3, β (95% CI)	p-value
BMI	R^2=0.055		R^2=0.076		R^2=0.154	
Constant	24.927 (21.497, 28.356)		20.611 (15.871, 25.351)		22.540 (17.219,27.810)	
Knowledge towards Healthy Plate Concept	1.245 (−0.442, 2.933)	0.148	1.495 (−0.188, 3.178)	0.081	1.546 (−0.157, 3.249)	0.075
Functional area	0.114 (−1.432, 1.661)	0.884	−0.322 (−1.891, 1.246)	0.686	0.771 (−0.973, 2.515)	0.385
Computer usage (hour/week)	0.045 (−0.222, 0.312)	0.740	0.102 (−0.166, 0.371)	0.453	0.089 (−0.181, 0.358)	0.517
Overtime work (hour/week)	0.078 (−0.001, 0.157)	0.053	0.078 (−0.001, 0.156)	0.052	0.065 (−0.010, 0.141)	0.091
Working hour/week	0.034 (−0.022, 0.090)	0.229	0.037 (−0.018, 0.093)	0.188	0.035 (−0.018, 0.089)	0.193
Occupational sitting minutes	−0.004 (−0.010, 0.001)	0.143	−0.005 (−0.011, 0.001)	0.082	−0.004 (−0.010, 0.002)	0.154
Total Met-minutes	0.000 (0.000, 0.000)	0.176	0.000 (0.000, 0.000)	0.158	0.000 (0.000, 0.000)	0.114
Practice of Healthy Plate Concept	0.049 (−1.348, 1.445)	0.745	0.086 (−1.298, 1.470)	0.903	−0.063 (−1.403, 1.278)	0.927
Fruits consumption day/week	−0.021 (−0.358, 0.316)	0.903	−0.041 (−0.376, 0.293)	0.808	−0.023 (−0.349, 0.303)	0.890
Serving of fruits/day	−0.310 (−1.045, 0.425)	0.407	−0.213 (−0.945, 0.519)	0.567	−0.428 (−1.142, 0.285)	0.239
Vegetables consumption day/week	−0.168 (−0.469, 0.133)	0.273	−0.161 (−0.460, 0.137)	0.289	−0.180 (−0.475, 0.114)	0.230
Serving of vegetables/day	0.518 (−0.117, 1.152)	0.109	0.446 (−0.185, 1.077)	0.165	0.546 (−0.067, 1.159)	0.081
Plain water consumption	0.197 (−0.030, 0.424)	0.089	0.172 (−0.054, 0.398)	0.135	0.142 (−0.080, 0.363)	0.210
Sugar-sweetened beverage consumption	−0.035 (−0.590, 0.519)	0.900	−0.056 (−0.606, 0.493)	0.840	−0.087 (−0.617, 0.444)	0.748
Waist-to-height ratio	R^2= 0.046		R^2=0.075		R^2=0.108	
Constant	0.501 (0.450, 0.551)		0.426 (0.357, 0.496)		0.456 (0.377, 0.535)	
Knowledge towards Healthy Plate Concept	0.024 (−0.001, 0.048)	0.060	0.028 (0.003, 0.053)	0.026*	0.027 (0.002, 0.053)	0.035*
Functional area	−0.006 (−0.029, 0.016)	0.590	−0.014 (−0.037, 0.009)	0.239	−0.004 (−0.030, 0.022)	0.770
Computer usage (hour/week)	0.001 (−0.003, 0.005)	0.517	0.002 (−0.002, 0.006)	0.254	0.002 (−0.002, 0.006)	0.259
Overtime work (hour/week)	0.001 (0.000, 0.002)	0.053	0.001 (0.000, 0.002)	0.052	0.001 (0.000, 0.002)	0.074
Working hour/week	0.000 (−0.001, 0.001)	0.471	0.000 (0.000, 0.001)	0.394	0.000 (0.000, 0.001)	0.421
Occupational sitting minutes	−6.990 E-5 (0.000, 0.000)	0.104	−8.338 E-5 (0.000, 0.000)	0.051	−7.525E-5 (0.000, 0.000)	0.080
Total Met-minutes	−1.672 E-5 (0.000, 0.000)	0.256	−1.755 E-6 (0.000,0.000)	0.227	−1.813E-6 (0.000, 0.000)	0.216
Practice of Healthy Plate Concept	0.009 (−0.012, 0.029)	0.408	0.009 (−0.011, 0.029)	0.368	0.007 (−0.013, 0.027)	0.471
Fruits consumption day/week	−0.001 (−0.006, 0.004)	0.729	−0.001 (−0.006, 0.004)	0.622	−0.001(−0.006, 0.004)	0.705
Serving of fruits/day	0.004 (−0.007, 0.015)	0.454	0.006 (−0.005, 0.016)	0.289	0.004 (−0.007, 0.014)	0.501
Vegetables consumption day/week	−0.002 (−0.006, 0.002)	0.392	−0.002 (−0.006, 0.003)	0.416	−0.002 (−0.006, 0.002)	0.377
Serving of vegetables/day	0.002 (−0.007, 0.011)	0.670	0.001 (−0.008, 0.010)	0.866	0.002 (−0.008, 0.011)	0.720
Plain water consumption	0.001 (−0.003, 0.004)	0.659	0.000 (−0.003, 0.004)	0.850	0.000 (−0.003, 0.003)	0.944
Sugar-sweetened beverage consumption	0.000 (−0.008, 0.008)	0.957	0.000 (−0.008, 0.008)	0.972	0.000 (−0.008, 0.007)	0.910

Table 4 (continued)

	Model 1, β (95% CI)	p-value	Model 2, β (95% CI)	p-value	Model 3, β (95% CI)	p-value
Fasting Blood Glucose	R=0.050		R^2=0.055		R^2=0.101	
Constant	5.369 (4.595, 6.143)		4.861 (3.783, 5.940)		5.394 (4.171, 6.617)	
Knowledge towards Healthy Plate Concept	0.114 (−0.266, 0.495)	0.555	0.144 (−0.239, 0.527)	0.460	0.213 (−0.182, 0.608)	0.290
Functional area	0.412 (0.063, 0.761)	0.021*	0.361 (0.004, 0.718)	0.048*	0.352 (−0.053, 0.757)	0.088
Computer usage (hour/week)	−0.002 (−0.062, 0.059)	0.957	0.005 (−0.056, 0.066)	0.869	0.010 (−0.053, 0.073)	0.753
Overtime work (hour/week)	0.001 (−0.017, 0.019)	0.896	0.001 (−0.017, 0.019)	0.901	−0.001 (−0.018, 0.017)	0.925
Working hour/week	0.005 (−0.008, 0.017)	0.477	0.005 (−0.008, 0.018)	0.445	0.004 (−0.008, 0.017)	0.505
Occupational sitting minutes	0.000 (−0.002, 0.001)	0.468	−0.001 (−0.002, 0.001)	0.389	0.000 (−0.002, 0.001)	0.627
Total Met-minutes	2.754E-5 (0.000, 0.000)	0.224	2.697E-5 (0.000, 0.000)	0.233	2.073E-5 (0.000, 0.000)	0.360
Practice of Healthy Plate Concept	−0.025 (−0.340, 0.290)	0.876	−0.021 (−0.336, 0.294)	0.897	−0.018 (−0.329, 0.293)	0.912
Fruits consumption day/week	0.042 (−0.034, 0.118)	0.281	0.039 (−0.037, 0.115)	0.310	0.045 (−0.031, 0.120)	0.247
Serving of fruits/day	−0.169 (−0.335, −0.003)	0.046*	−0.158 (−0.325, 0.009)	0.063	−0.158 (−0.323, 0.008)	0.062
Vegetables consumption day/week	0.021 (−0.047, 0.089)	0.542	0.022 (−0.046, 0.090)	0.526	0.027 (−0.041, 0.095)	0.439
Serving of vegetables/day	0.016 (−0.127, 0.159)	0.828	0.007 (−0.136, 0.151)	0.919	0.012 (−0.130, 0.154)	0.870
Plain water consumption	−0.004 (−0.055, 0.047)	0.875	−0.007 (−0.058, 0.044)	0.788	−0.003 (−0.054, 0.049)	0.915
Sugar-sweetened beverage consumption	0.068 (−0.057, 0.193)	0.283	0.066 (−0.059, 0.191)	0.301	0.063 (−0.060, 0.186)	0.312
Total Cholesterol	R^2= 0.046		R^2= 0.052		R^2= 0.095	
Constant	5.280 (4.308, 6.251)		4.581 (3.229, 5.933)		4.089 (2.553, 5.625)	
Knowledge towards Healthy Plate Concept	0.302 (−0.176, 0.780)	0.215	0.342 (−0.138, 0.822)	0.162	0.163 (−0.333, 0.660)	0.518
Functional area	0.365 (−0.073, 0.803)	0.102	0.395 (−0.153, 0.742)	0.196	0.373 (−0.135, 0.881)	0.149
Computer usage (hour/week)	−0.027 (−0.103, 0.049)	0.483	−0.018 (−0.094, 0.059)	0.649	−0.047 (−0.125, 0.032)	0.241
Overtime work (hour/week)	−0.002 (−0.025, 0.020)	0.853	−0.002 (−0.025, 0.020)	0.847	−0.001 (−0.023, 0.021)	0.920
Working hour/week	−0.003 (−0.019, 0.013)	0.734	−0.002 (−0.018, 0.014)	0.778	−0.001 (−0.016, 0.015)	0.935
Occupational sitting minutes	7.424E-5 (−0.002, 0.002)	0.928	−5.273E-5 (−0.002, 0.002)	0.949	0.000 (−0.002, 0.001)	0.627
Total Met-minutes	−2.710E-5 (0.000, 0.000)	0.340	−2.788E-5 (0.000, 0.000)	0.325	−1.513E-5 (0.000, 0.000)	0.595
Practice of Healthy Plate Concept	0.119 (−0.277, 0.514)	0.554	0.125 (−0.270, 0.520)	0.534	0.111 (−0.280, 0.501)	0.577
Fruits consumption day/week	0.054 (−0.041, 0.150)	0.266	0.051 (−0.045, 0.146)	0.296	0.034 (−0.061, 0.129)	0.478
Serving of fruits/day	−0.017 (−0.226, 0.191)	0.869	−0.002 (−0.211, 0.207)	0.986	−0.049 (−0.257, 0.159)	0.645
Vegetables consumption day/week	0.001 (−0.084, 0.087)	0.977	0.002 (−0.083, 0.088)	0.956	−0.024 (−0.110, 0.062)	0.585
Serving of vegetables/day	−0.149 (−0.328, 0.031)	0.104	−0.160 (−0.340, 0.020)	0.081	−0.127 (−0.306, 0.052)	0.162
Plain water consumption	0.040 (−0.024, 0.105)	0.218	0.036 (−0.028, 0.101)	0.268	0.028 (−0.036, 0.093)	0.386
Sugar-sweetened beverage consumption	0.146 (−0.011, 0.303)	0.068	0.143 (−0.014, 0.299)	0.075	0.149 (−0.005, 0.304)	0.059

Table 4 (continued)

	Model 1, β (95% CI)	p-value	Model 2, β (95% CI)	p-value	Model 3, β (95% CI)	p-value
Systolic blood pressure	R^2= 0.045		R^2=0.148		R^2=0.214	
Constant	126.100 (114.864, 137.336)		94.470 (79.639, 109.301)		95.601 (79.045, 112.157)	
Knowledge towards Healthy Plate Concept	1.025 (−4.504, 6.555)	0.715	2.855 (−2.411, 8.122)	0.287	5.132 (−0.219, 10.483)	0.060
Functional area	−3.239 (−8.306, 1.828)	0.209	−6.440 (−11.348, −1.532)	0.010*	−2.623 (−8.102, 2.857)	0.347
Computer usage (hour/week)	−0.239 (−1.114, 0.636)	0.591	0.181 (−0.658, 1.021)	0.671	0.297 (−0.549, 1.144)	0.490
Overtime work (hour/week)	0.052 (−0.208, 0.311)	0.695	0.048 (−0.198, 0.293)	0.702	−0.005 (−0.243, 0.234)	0.968
Working hour/week	−0.052 (−0.235, 0.131)	0.579	−0.030 (−0.204, 0.143)	0.732	−0.044 (−0.213, 0.124)	0.603
Occupational sitting minutes	−0.007 (−0.026, 0.012)	0.464	−0.013 (−0.031, 0.005)	0.162	−0.006 (−0.024, 0.011)	0.486
Total Met-minutes	0.001 (0.000, 0.001)	0.051	0.001 (0.000, 0.001)	0.052	0.000 (0.000, 0.001)	0.176
Practice of Healthy Plate Concept	−1.727 (−6.303, 2.848)	0.458	−1.453 (−5.784, 2.877)	0.509	−1.585 (−5.796, 2.626)	0.459
Fruits consumption day/week	0.281 (−0.824, 1.386)	0.618	0.130 (−0.917, 1.177)	0.808	0.269 (−0.756, 1.293)	0.606
Serving of fruits/day	0.509 (−1.899, 2.917)	0.678	1.219 (−1.072, 3.509)	0.296	0.948 (−1.295, 3.191)	0.406
Vegetables consumption day/week	−0.167 (−1.154, 0.819)	0.739	−0.116 (−1.050, 0.818)	0.807	0.061 (−0.865, 0.987)	0.897
Serving of vegetables/day	0.058 (−2.021, 2.136)	0.956	−0.467 (−2.441, 1.508)	0.642	−0.450 (−2.378, 1.477)	0.646
Plain water consumption	0.288 (−0.457, 1.032)	0.447	0.105 (−0.602, 0.812)	0.770	0.135 (−0.561, 0.831)	0.703
Sugar-sweetened beverage consumption	−0.533 (−2.350, 1.283)	0.564	−0.688 (−2.408, 1.031)	0.432	−0.840 (−2.506, 0.827)	0.322
Diastolic blood pressure	R^2=0.151		R^2= 0.282		R^2= 0.377	
Constant	78.673 (70.972, 86.374)		62.733 (52.291, 73.175)		68.353 (56.635, 80.072)	
Knowledge towards Healthy Plate Concept	−0.542 (−4.331, 3.248)	0.779	0.380 (−3.328, 4.088)	0.840	1.331 (−2.457, 5.118)	0.490
Functional area	−1.942 (−5.415, 1.530)	0.272	−3.556 (−7.011, −0.100)	0.044*	−2.371 (−6.249, 1.507)	0.230
Computer usage (hour/week)	0.324 (−0.276, 0.923)	0.289	0.535 (−0.055, 1.126)	0.076	0.622 (0.023, 1.221)	0.042*
Overtime work (hour/week)	0.034 (−0.144, 0.212)	0.706	0.032 (−0.141, 0.205)	0.714	0.004 (−0.164, 0.173)	0.959
Working hour/week	0.004 (−0.122, 0.129)	0.955	0.014 (−0.108, 0.137)	0.816	0.005 (−0.114, 0.124)	0.939
Occupational sitting minutes	−0.004 (−0.017, 0.009)	0.520	−0.007 (−0.020, 0.005)	0.267	−0.004 (−0.016, 0.009)	0.562
Total Met-minutes	0.000 (0.000, 0.001)	0.452	0.000 (0.000, 0.001)	0.489	6.510E-5 (0.000, 0.000)	0.764
Practice of Healthy Plate Concept	−1.340 (−4.476, 1.796)	0.401	−1.202 (−4.251, 1.847)	0.438	−1.320 (−4.300, 1.661)	0.384
Fruits consumption day/week	0.315 (−0.443, 1.072)	0.414	0.239 (−0.498, 0.976)	0.525	0.331 (−0.394, 1.056)	0.370
Serving of fruits/day	−0.915 (−2.565, 0.735)	0.276	−0.557 (−2.170, 1.055)	0.497	−0.686 (−2.274, 0.901)	0.396
Vegetables consumption day/week	0.154 (−0.522, 0.830)	0.654	0.180 (−0.477, 0.837)	0.590	0.258 (−0.397, 0.914)	0.438
Serving of vegetables/day	0.649 (−0.776, 2.073)	0.371	0.384 (−1.006, 1.774)	0.587	0.428 (−0.936, 1.793)	0.537
Plain water consumption	0.090 (−0.420, 0.601)	0.727	−0.002 (−0.500, 0.496)	0.994	0.006 (−0.487, 0.499)	0.981
Sugar-sweetened beverage consumption	−0.473 (−1.717, 0.772)	0.456	−0.551 (−1.761, 0.660)	0.371	−0.620 (−1.799, 0.560)	0.302

*Significant at p-value<0.05, Model 1=Basic model with all the independent variables, Model 2=Adjusted for age, Model 3=Additionally adjusted for gender, educational level, household income and personal medical history based on the WHO classification of BMI. These findings are alarming as there is an increased trend of overweight and obesity issues in Malaysia[25]. The prevalence found in this study is slightly higher than the 2019 NHMS report, which indicated that 30.4% of Malaysian adults were overweight and 19.7% were obese[25]. The higher rates in this study may be attributed to the higher mean age of respondents compared to NHMS data, as aging reduces resting metabolic rate, leading to fewer calories burned at rest. This decline, often linked to muscle loss and increased visceral fat, is associated with insulin resistance and metabolic syndrome, both contributing to obesity[34].

Obesity is closely associated with overall cardiometabolic health. When there is weight gain and increased body fat, excess fat in the body can disrupt normal cholesterol metabolism, affecting cholesterol absorption, synthesis, and lipoprotein processing, leading to the accumulation of cholesterol in the liver[34]. The high prevalence of obesity in this sample may be associated with the elevated prevalence of raised total cholesterol among UMT staff, nearly double that reported in the 2019 NHMS data. This result aligns with a study in Poland (n=850) where 65.9% of university employees had elevated total cholesterol35.

In addition, prolonged sedentary time is linked to metabolic dysregulation, including increased low-density lipoprotein cholesterol (LDL-c) and glucose level, which are risk factors for cardiovascular disease. Sedentary behaviour among UMT staff may also be a contributing factor to the high rates of obesity and raised total cholesterol among them. Results showed that UMT staff spent nearly 7 hours on computers and 5 hours sitting while working, reflecting sedentary practices. This aligns with an Australian study where university office workers sit an average of 7.5 hours daily on their working days[36]. Sedentary behaviour among university staff members could be explained by the nature of their work, such as meetings, phone calls, and computer work.

Cardiometabolic health is influenced by personal, environmental, and behavioural factors. Computer usage, an environmental factor, is a significant associated factor of diastolic blood pressure with a positive β-coefficient. However, computer usage was significantly associated with diastolic blood pressure only in the fully adjusted Model 3. This means that the relationship was not obvious until other factors like gender, education level, income, and personal medical history were taken into account. These factors may have influenced both computer usage and blood pressure, making it harder to see the link in the earlier models. For example, individuals with higher education or income might spend more time on the computer for work, but they may also have better access to healthcare or healthier lifestyles that help control blood pressure. Without adjusting for these factors, the true relationship between computer use and blood pressure may be hidden. After adjusting for them, the connection between longer computer use and higher diastolic blood pressure became clearer. This shows how important it is to consider personal and health background when studying how sedentary behaviours like screen time affect heart health.

Increased computer use may elevate blood pressure due to prolonged sitting, which promotes a sedentary lifestyle and reduces cardiovascular efficiency. Prolonged sitting can impair blood circulation due to reduced muscle activity, leading to reduced peripheral blood flow and lower shear stress on endothelial cells[37]. This can result in endothelial dysfunction, potentially contributing to long-term cardiovascular problems. The findings of this study are partially consistent with previous studies. A 26-year cohort study in China found that computer usage, fast food, soft drinks, sugared beverages, and salty snacks were linked to hypertension[38]. However, our study found no significant association between dietary habits and blood pressure. Additionally, Trudel et al. (2020) found that, after accounting for sociodemographic factors, lifestyle-related risks, diabetes, family history of cardiovascular disease, job stress, and long working hours were associated with a higher prevalence of both masked and sustained hypertension. This highlights the impact of environmental factors on blood pressure.

In contrast, this study found that knowledge of the Healthy Plate Concept was significantly associated with the waist-to-height ratio, yet the effect size was small. This may suggest that knowledge alone does not always result in behavioural change. Although individuals may understand the healthy plate concept, they might not consistently apply it in their daily routines, potentially due to certain cultural factors in Malaysia. Since most UMT staff are Malay, the cultural practice of communal eating may pose a challenge. Meals are often shared with family and friends, influencing food choices, as individuals may prefer dishes commonly enjoyed within their social groups. Moreover, traditional Malay cuisine, often rich in calories, fats, refined carbohydrates, and sugars[40], may contribute to unfavourable cardiometabolic outcomes. These findings highlight the complex relationship between nutritional knowledge, cultural practices, and dietary behaviours, emphasizing that knowledge alone is insufficient without practical implementation and cultural awareness for meaningful health improvements. Future studies should consider incorporating more robust and objective measures of dietary practice to better capture the translation of knowledge into action.

Overall, our findings revealed that personal factors, such as knowledge, and environmental factors, such as computer usage, were significantly associated with certain cardiometabolic health outcomes. Previous research also highlights the role of behavioural factors in shaping cardiometabolic health, illustrating the interaction between personal, environmental, and behavioural influences, consistent with the Social Cognitive Theory. This underscores the need for a comprehensive approach that combines education on healthy behaviours, improved environmental conditions, and addresses broader social determinants to effectively manage and enhance cardiometabolic health outcomes.

This study enhances our understanding of the current lifestyle behaviours of university staff and the associated factors of their cardiometabolic health through surveys and health assessments. However, there are several limitations: First, the use of quota sampling may introduce sampling bias since it does not rely on random selection, potentially oversimplifying population diversity. To address this, we carefully defined quotas by selecting departments with at least 30 staff members, and considered various characteristics like age, gender, and functional area to ensure a diverse sample. Additionally, self-administered questionnaires could lead to recall bias, as participants might not accurately recall their practices related to OSPAQ, physical activity, and dietary habits. Despite this, the questionnaires used in the study have demonstrated strong reliability and validity. This study utilized the finger-prick method for blood sample collection instead of venous blood draw due to budget constraints. As a result, only limited biochemical parameters could be assessed. While total cholesterol was measured, a complete lipid profile was not available, and glycated haemoglobin (HbA1c) was also not included. These limitations may have contributed to an underestimation of the true prevalence of impaired cardiometabolic health among participants. Additionally, due to logistical and resource limitations, resting heart rate, a well-established proxy for cardiorespiratory fitness, was not measured. As a result, we were unable to examine potential associations between cardiorespiratory fitness and the dependent variables in this study.

Conclusion

The study found that environmental factors (e.g., computer usage) were associated with blood pressure, while personal factors (e.g., knowledge of the Healthy Plate Concept) were linked to the waist-to-height ratio. These findings highlight the influence of both occupational environments and individual health knowledge on cardiometabolic outcomes. Significant health issues among UMT staff, including high rates of overweight, obesity, raised cholesterol, and sedentary behavior, mirror the challenges faced by employees in other sedentary occupations. These combined factors elevate the risk of cardiometabolic diseases, emphasizing the need for comprehensive workplace health initiatives in multiethnic groups. Addressing these challenges requires promoting healthier diets, encouraging regular physical activity, and creating work environments that minimize prolonged sitting. Targeted interventions addressing both behaviour and environmental factors can help reduce the burden of cardiometabolic diseases and enhance employee well-being. Future research should also explore the effects of work characteristics on lifestyle behaviours and their combined impact on cardiometabolic health.

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Conflict of interest

There are no potential conflicts of interest to declare.

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