ASSOCIATION OF DIETARY INTAKE AND LIFESTYLE WITH BODY MASS INDEX AND BODY FAT PERCENTAGE AMONG UNIVERSITY TUNKU ABDUL RAHMAN (UTAR), KAMPAR STUDENT

By

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ABSTRACT

ASSOCIATION OF DIETARY INTAKE AND LIFESTYLE WITH BODY MASS INDEX AND BODY FAT PERCENTAGE AMONG UNIVERSITY TUNKU ABDUL RAHMAN (UTAR), KAMPAR STUDENTS

Teo Lim Ang

Globalization and modernization have unfortunately resulted in unhealthy dietary patterns and a unhealthy lifestyle among Malaysians, leading to high levels of obesity and body fat. Thus, this research aimed to investigate the association between lifestyle, dietary intake with body mass index and body fat percentage among students in the Kampar campus of Universiti Tunku Abdul Rahman (UTAR). A convenience sampling method was employed to select the participants for a cross-sectional study that was conducted among 165 UTAR students. The study involved a guided self-administered online questionnaire and physical measurements. SPSS software was utilized to analyze the data. Pearson's Chi-Square test was employed to examine the association between dietary intake, lifestyle, body mass index, and body fat percentage of the respondents. It also used to identify the association between body mass index and body fat percentage. The present study found that there was a significant association between body mass index and body fat percentage ($p<0.001$). Regarding lifestyle, there was significant association between lifestyle with

body mass index ($p=0.002$) and body fat percentage ($p<0.001$). For dietary intake with BMI, a significant association of BMI with vegetable ($p<0.001$), fruits ($p<0.001$), nuts ($p<0.001$), red meat ($p<0.001$), processed food consumption ($p<0.011$), breakfast consumption ($p=0.008$), type of bread consumed ($p<0.001$) and frequency ($p=0.042$), type of milk consumption ($p=0.004$) was found. In terms of dietary intake with body fat percentage, there was a significant association between body fat percentage with vegetable ($p<0.001$), fruits consumption ($p<0.001$), red meat consumption ($p<0.001$), processed food consumption ($p<0.001$), type of bread consumed ($p=0.008$), type of milk consumption ($p=0.004$) and type of spread used in sandwich ($p<0.001$). Overall, the findings indicated that a healthy lifestyle and good dietary intake may produce a good BMI and body fat outcome.

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DECLARATION

I hereby declare that this final year project report is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

TEO LIM ANG

APPROVAL SHEET

This final year project report entitled "**ASSOCIATION OF DIETARY INTAKE AND LIFESTYLE WITH BMI AND BODY FAT PERCENTAGE AMONG UNIVERSITY TUNKU ABDUL RAHMAN (UTAR), KAMPAR STUDENT**" was prepared by TEO LIM ANG and submitted as partial fulfilment of the requirements for the degree of Bachelor of Science (Hons) Dietetics at Universiti Tunku Abdul Rahman.

Approved by:

Ms. Fiona Lim Wei Ting Date: 5th June 2023

Supervisor

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Date: 30th March 2023

PERMISSION SHEET

It is hereby certified that **TEO LIM ANG** (ID No: **20ADB04135**) has completed this final year project report entitled "ASSOCIATION OF DIETARY INTAKE AND LIFESTYLE WITH BMI AND BODY FAT PERCENTAGE AMONG UNIVERSITY TUNKU ABDUL RAHMAN (UTAR), KAMPAR STUDENT" under the supervision of Ms. Fiona Lim Wei Ting from the Department of Allied Health Sciences, Faculty of Science.

I hereby give permission to the University to upload the softcopy of my final year project report in pdf format into the UTAR Institutional Repository, which may be made accessible to the UTAR community and public.

Yours truly,

(TEO LIM ANG)

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LIST OF ABBREVIATION

BFP	Body fat percentage
BIA	Bioelectrical impedance analysis
BMI	Body mass index
DALYs	Disability-adjusted life years
FAS	Faculty of Arts and Social Science
FBF	Faculty of Business and Finance
FEGT	Faculty of Engineering and Green Technology
FFQ	Food Frequency Questionnaire
FICT	Faculty of Information and Communication Technology
FSC	Faculty of Science
ICS	Institute of Chinese Studies
IIUM	International Islamic University Malaysia
LTPA	lecture time physical activity
MUFA	Monounsaturated fatty acids
NEFA	Non esterified fatty acids
NWO	Normal weight obesity
PA	Physical activity
PUFA	Polyunsaturated fatty acids
SLIQ	Simple Lifestyle Indicator Questionnaire
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya

UPM	Universiti Putra Malaysia
USM	Universiti Sains Malaysia
UTAR	Universiti Tunku Abdul Rahman
UTM	Universiti of Technology Malaysia

CHAPTER 1

INTRODUCTION

1.1 Research background

Malaysia is a prime example of rapidly developing country that has undergone significant demographic and socioeconomic changes since gaining independence in 1957. The economy has shifted from primary and secondary sectors to tertiary sector, resulting in rapid industrialization and changes in employment patterns. Besides, the globalization has led to the integration of the domestic economy with the international economy, resulting in improved absorption of labour, higher incomes, and overall prosperity. Hence, this scenario has affected the dietary intake and lifestyle changes. For examples, it has brought about changes in dietary patterns, as direct foreign investment in food processing and retailing, along with global food advertising and local promotion, have shifted consumption away from traditional local staples towards highly processed, often imported food and food with high sugar content (Goh et al., 2020).

Aside from the changes in dietary intake, the healthy lifestyle also affected. While globalization has increased employment opportunities, higher incomes, and overall prosperity, it has also resulted in greater effort and responsibility from the people, lead to busy and stressful life. This distress can take a toll on their mental and physical health. In this case, sedentary lifestyle widespread all around the world. According to Park et al. (2020), insufficient physical activity

is practised by 31% of people worldwide who are more or equal to 15 years old. A poor level of physical exercise engagement may be influenced by busy working and household duties (WHO, 2002). In addition, environmental variables brought on by modernisation and urbanisation may also contribute to physical inactivity. Examples of factors that may deter physical activity include heavy traffic, violence, and air pollution. Moreover, some unhealthy lifestyles such as smoking and drinking alcohol have increased in worldwide due to the elevated of stress nowadays. In this case, people may try to "self-medicate" by smoking or drinking to reduce their depressive symptoms, which also brings many adverse effects (AlQuaiz et al., 2021).

In fact, both unbalanced diet and unhealthy lifestyles are the contributing factors to the development of high body mass index (BMI) and high body fat level. According to CDC (2021), a person BMI is within the range of 25 to <30 considered as overweight, whereas BMI is 30 or higher considered as obesity. National Health and Morbidity Survey (2019) had demonstrated that there are 50.1 % of Malaysian adult were overweight or obesity. In fact, obesity impairs nearly every aspect of health, including reproductive, respiratory, memory, and emotional functions. Obesity also play an important role in raising the risk of many fatal and disabling conditions, such as diabetes, heart disease, and various malignancies (Fruh, 2017). For examples, there are more non-esterified fatty acids (NEFA), glycerol hormones, cytokines, proinflammatory agents, and other substances in an obese person who contribute to the development of insulin resistance. The onset of diabetes is accompanied by insulin resistance and a decline in cell function. Besides, obesity reduces life expectancy and

quality of life while also raising personal, societal, and international healthcare expenses. Hence, this issue should be taken seriously and struggle to find a solution as it bring adverse effect.

BMI measures excess weight rather than excess body fat, although it serves as a substitute for measuring body fatness, however, the result can be influenced by elements like age, sex, race, and muscular mass. Moreover, BMI does not indicate how fat is distributed among people or make a distinction between excess fat, muscle mass, or bone mass. Thus, the body fat percentage is measured by using BIA to obtain a more accurate result (Dehghan and Merchant, 2008).

As mentioned above, there is a connection between dietary intake, lifestyle with obesity and high fat adiposity. Thus, a healthy dietary intake and lifestyle should be practised. According to the WHO in 1946, the term “Health” is defined as a complete condition of physical, mental, and social well-being and does not just refer to the absence of sickness (WHO, 2022). A healthy and balanced diet should be rich in vitamins, minerals and antioxidants while also include adequate amount of carbohydrate, protein and healthy fat. In this case, it is recommended to consume nutrients dense food with adequate number of fruits and vegetables. Based on CDC (2016), at least 1½ to 2 cups per day of fruit and 2 to 3 cups per day of vegetables were suggested for daily consumption. They are high in fiber and packed with nutrients like vitamins and minerals that could speed the metabolism and help to lose abdominal fat. It is also suggested

to consists of several different protein-rich foods, such as seafood, lean meat and poultry, eggs, legumes (beans and peas), soy products, nuts, and seeds. On the other hands, highly processed food, red and processed meat, trans fat, added sugar and salt should be limited as they are the major contributor that led to increased risk of Noncommunicable disease (NCDs) (CDC, 2019).

On the other hand, healthy lifestyle should be concerned not only physical but also mentally health. Firstly, increase physical activity is the main concern. WHO (2022) had suggested that adults should engage in at least 150–300 minutes of moderate–intensity activity, or 75–150 minutes of vigorous–intensity activity throughout the week. In fact, it has been demonstrated that regular exercise helps control and prevent noncommunicable diseases like diabetes, heart disease, stroke, and several malignancies. Moreover, it lowers blood pressure, supports a healthy body weight, and enhances mental health, wellbeing, and quality of life (WHO, 2022). Besides, obtaining enough sleep, avoiding substances abuse, avoid smoking and alcohol consumption and increase the awareness of mental health is the actions to achieve healthy lifestyle.

Taken together, lifestyle and diet are two crucial factors that affect individual's body composition even their quality of life. According to Foster-Schubert et al. (2011), diet and lifestyle intervention have significant effect on weight loss and greater body composition. Thus, it is important to maintain a healthy lifestyle and balanced diet to achieve normal BMI and body fat level.

1.2 Problem statements

There are several similar studies that have been done in Malaysia. Recent studies demonstrated the association between dietary intake and BMI without examine the association between lifestyle with BMI (Abdul et al., 2015; Lee and Wan Muda, 2019; Yang et al., 2017). Similarly, some studies have assessed the association between lifestyle and BMI without examined the association between dietary intake with BMI (Zulfarina et al., 2022; Chen et al., 2019; Alias et al., 2022). Meanwhile, some studies also examined the association of both dietary intake and lifestyle with BMI in a target population. (Radhika et al., 2018; Iannotti and Wang, 2013; Zaki and R Youness, 2022; Chen Yun, Ahmad and Soo Quee, 2018; Almoraie et al., 2023) However, majority of the research were conducted in foreign countries included Puducherry, United State and Egypt, which shows that limited relevant studies were conducted in Malaysia. Based on the studies mentioned above, they focused only on the BMI whereas there was limited study examined the body fat percentage. It is important to determine the body fat since it can provide more accurate result of body fat compared to BMI which measures weight rather than body fat. Fauzy, Ali and Jaafar (2020) conducted a study in IIUM Kuantan Campus indicated that majority of students practised unhealthy lifestyles and had bad eating habits. In contrast, study conducted by Omar et al. (2015) in Ungku Omar's Residential College demonstrated that students had a satisfactory level of a balanced diet and physical activity. There are inconsistent findings in term of the dietary and lifestyle practiced in different university students. Therefore, the purpose of this

study is to investigate the relationship between dietary intake and lifestyle, with BMI and body fat levels in UTAR Kampar students.

1.3 Research Objectives

1.3.1 General Objective

The general objective of this research is to investigate the association between dietary intake and lifestyle with BMI and body fat percentage among UTAR Kampar student.

1.3.2 Specific Objectives

The specific objectives are as follows:

i. To assess the BMI and body fat percentage among UTAR Kampar students.
ii. To assess the dietary and lifestyle practice among UTAR Kampar students.
iii. To identify the association between BMI and body fat percentage among UTAR Kampar students.
iv. To identify the association between lifestyle and BMI among UTAR Kampar students.
v. To identify the association between lifestyle and body fat percentage among UTAR Kampar students.
vi. To identify the association between dietary intake and BMI among UTAR Kampar students.

vii. To identify the association between dietary intake and body fat percentage among UTAR Kampar students.

1.4 Significance of Study

The study was conducted to provide general information on the association between dietary, lifestyle change with BMI and body fat percentage among UTAR students in the Kampar campus. Furthermore, the information obtained from this study will help those students increase awareness and provide a chance for them to comprehend more information about the relationship between dietary, lifestyle with BMI and body fat percentage. Thus, they have the opportunity to practice healthy dietary intake and lifestyle. Nonetheless, this study can provide insight for future researchers to further research on the relevant topic and the future nutrition promotion initiatives can be designed with the provided information by public health authorities.

1.5 Null and Alternative Hypothesis

Null Hypothesis:

$H_0$1: There is no association between BMI and body fat percentage.

H_o2: There is no association between lifestyle with BMI among UTAR Kampar students.

H_o3: There is no association between lifestyle with body fat percentage among UTAR Kampar students.

H_o4: There is no association between dietary intake with BMI among UTAR Kampar students.

H_o5: There is no association between dietary intake with body fat percentage among UTAR Kampar students.

Alternative Hypothesis:

$H_1 1$: There is association between BMI and body fat percentage.

$H_1 2$: There is association between lifestyle with BMI among UTAR Kampar students.

$H_1 3$: There is association between lifestyle with body fat percentage among UTAR Kampar students.

$H_1 4$: There is association between dietary intake with BMI among UTAR Kampar students.

$H_1 5$: There is association between dietary intake with body fat percentage among UTAR Kampar students.

CHAPTER 2

LITERATURE REVIEW

2.1 BMI and Body fat percentage

The body mass index (BMI) is widely used as a measure of adult anthropometric characteristics to classify individuals into groups based on their height and weight. These groups are categorized as underweight (BMI less than 18.5), normal (BMI between 18.5 and 24.9), overweight (BMI between 25.0 and 29.9), and obese (BMI of 30.0 or higher) (CDC, 2019). It is generally considered to be an indicator of an individual's level of fatness and is often employed as a risk factor for predicting the onset or progression of various health issues. Furthermore, the BMI is often used to inform public health policies. Due to its widespread use in defining specific categories of body mass as potential health concerns, the BMI has proven to be a valuable tool in population-based studies. However, it is becoming more and more obvious that BMI is a rather poor predictor of body fat percentage. Since the BMI does not distinguish between body lean mass and body fat mass, a person can have a high BMI while also having relatively low-fat mass, and vice versa (Nuttall, 2015). The body fat percentages were valuable in understanding the differences between fat and muscle mass, and they were relatively easy to obtain through various methods. In this situation, body fat percentages which measured by bioelectrical impedance analysis (BIA) could obtained more accurate results of individuals body fat (Dehghan and Merchant, 2008). Gallagher et al. (2000)

categorized the body fat percentage into low, normal, high, and very high as shown in table 2.1.

Table 2.1 Body fat percentage results

Gender	Age	Low (-)	Normal (0)	High (+)	Very High (++)
Female	**20-39**	<21	21-32.9	33-38.9	≥ 39
	40-59	<23	23-33.9	34-39.9	≥ 40
	60-79	<24	24-35.9	36-41.9	≥ 42
Male	**20-39**	<8	8-19.9	20-24.9	≥ 25
	40-59	<11	11-21.9	22-27.9	≥ 28
	60-79	<13	13-24.9	25-29.9	≥ 30

(Gallagher et al., 2000)

2.2 High BMI and body fat percentage among university students

2.2.1 Global high BMI burden of disease

According to World Health Organization, there were around 1 billion people worldwide suffer from obesity. In Malaysia, there were 50.1% of adults were overweight or obese (NHNS, 2019). Excessive body weight is a significant health concern, and it poses a risk factor for numerous non-communicable diseases (NCDs). Obesity is linked with a greater likelihood of experiencing morbidity, disability, and mortality. A study conducted by Dai et al. (2020) had reported that high BMI is a significant factor in the burden of disease worldwide.

It noticed that the number of disability-adjusted life years (DALYs) and fatalities worldwide associated with high BMI grew significantly between 1990 to 2017. A survey was completed by 97 overweight and obese individuals. Yet, it indicated that high BMI was significantly impact the expenses to society that associated to health (Hecker et al., 2022). Furthermore, Seidell and Halberstadt (2015) found that obesity is plausible to characteristic as a public health catastrophe that significantly worsens people's health and quality of life while also significantly increasing the cost of national health care.

2.2.2 High BMI prevalence in university students

A growing number of university students are experiencing an obesity epidemic. As evidence, Wan Mohamed Radzi et al. (2019) found that nearly 37.5% of university students in Malaysia were overweight or obese. Likewise, Pitil and Ghazali (2022) also reported a high prevalence (39.07%) of overweight and obese among 2 public university students in Sarawak. Similarly, Peltzer and Pengpid (2017) collected data from university students in eight ASEAN countries and found that 24.2% of male and 9.3% of female students had general obesity. Among those countries. Malaysian university students showed a high occurrence of general obesity. This finding was consistent with the literature from other countries. Previous study revealed that about 33% of Philippine university students were obese which higher than the Philippine obesity prevalence of 31.1% (Bulusan and Ramos, 2019). Besides, Peltzer et al. (2014) demonstrated that about 22% of university students were overweight and obese among 22 universities students in different countries. Likewise, Kela and

Nkengbeza (2022) also reported that about 58.2% of university students in Namibia was overweight or obese, which may contribute high risk of several obesity related disease.

2.2.3 Body Fat percentage in university student

Body fat percentage is an essential indicator of overall health and fitness, measuring the amount of fat in the body relative to total body weight. High levels of body fat can increase the risk of several health problems, including heart disease, diabetes, and certain cancers (Etchison et al., 2011). University students, like many young adults, may be particularly vulnerable to unhealthy body fat levels due to a sedentary lifestyle, poor dietary habits, and high stress levels (Anuradha, Priyadharshini and Patil, 2021). Examining the average body fat percentage of university students can provide valuable insights into the overall health and well-being of this population, highlighting areas for lifestyle habit improvements. A cross-sectional study conducted by Nuñez-Leyva et al. (2022) gathered data on 2,048 students from a private institution in Lima, Peru, which revealed that the majority (61.1%) of students had a high level of body fat. Christianus et al. (2022) also found high mean body fat percentages of 33.72% and 21.59% among female and male university students, respectively. Furthermore, Savegnago Mialich et al. (2014) discovered that most university students in Chile had a normal BMI, but high body fat mass levels. Similarly, Nogueira et al. (2021) found that 48.3% of university students had high, average, or low body fat percentage, with 22.4% having very bad body fat percentage, which means the body fat level was higher than 39% and 25% in females and

males, respectively. Additionally, Maitiniyazi et al. (2021) revealed a significant proportion of female (40.1%) and male (25.5%) university students with normal weight obesity (NWO), a condition in which an individual has a normal BMI but excess body fat.

2.3 Dietary intake and lifestyle practice in university student

University life is a crucial time for the establishment of eating and lifestyle habits that may have a long-term impact on the emergence of obesity and related chronic disorders. In this case, there are several studies conducted in Malaysia indicates the dietary intake and lifestyle among university students. As evidence, Wan Zakaria et al. (2021) and Cheema et al. (2021) indicated that majority of the university students were practising poor eating habit. Besides, several studies demonstrated that university students in Malaysia had practising unhealthy lifestyle (Al-Naggar, Bobryshev and Mohd Noor, 2013; Zakaria and Abidin, 2014; Anuradha, Priyadharshini and Patil, 2021). Meanwhile, a study conducted in International Islamic University Malaysia (IIUM) Kuantan campus found that most of the participants were practise poor dietary habit and unhealthy lifestyle. (Omar et al., 2015). This finding was consistent with the literature from other countries. Research conducted among university students from University Brunei Darussalam (UBD), demonstrated that poor dietary intake and unhealthy lifestyle were practiced although the majority had good nutrition knowledge. (Chen Yun, Ahmad and Soo Quee, 2018). In Jordan, the research found that the student at Hashemite University had unhealthy dietary and lifestyle habits (Al-Awwad et al., 2021). Another studiy conducted at

Universidad Iberoamericana del Ecuador indicated that 70.2% of participants partially inadequate in eating habit and 60.6% of participants had inadequate physical activity (Ordoñez-Araque, JARAMILLO and GÁLVEZ, 2021). Overall, the findings demonstrated that university students having poor dietary intake and unhealthy lifestyle which should be taken seriously as it may brought many adverse effects on health.

2.4 Association between dietary intake and BMI, fat adiposity

2.4.1 Association between dietary intake and BMI

Numerous studies have reported a positive correlation between dietary intake and body mass index (BMI), both in local and international studies. In Malaysia, a previous study demonstrate that obese adolescents consumed more calories than overweight, healthy, and thin adolescents. Compared to normal and overweight adolescent, they consumed 14% and 12% more energy, respectively. (Palaniveloo et al., 2021), Similar findings from a study by Abdul Majid et al. (2016) showed that obese adolescents used 15.8% more energy than teenagers of normal weight. Besides, obese adolescent also consumed more dietary fat (85.2 grams/day) and carbohydrates (290.6 grams/day). These findings were consistent with the literature from other countries In Puducherry, research found out that high calorie and protein intake was associated with increased BMI among the dental students (Radhika et al., 2018**).** Another study conducted by Shatwan and Almoraie (2022) found that low intakes of protein, MUFA, PUFA, and omega-3 fatty acids was linked to a higher risk of obesity. Furthermore, a cross-sectional study conducted in the German population found a significant

association between BMI and higher consumption of animal protein in both genders, as well as lower consumption of polysaccharides in males (Moon et al., 2021). Hence, we could observe that dietary intake had significant impact on BMI.

2.4.2 Association between dietary intake and body fat percentage

Currently, there were limited research which examined the association between dietary intake and body fat percentage, and it is noteworthy that most of the prior research has been conducted in foreign countries. One such study conducted by Ayusari et al. (2019) revealed a correlation between fat consumption and body composition, where the consumption of polyunsaturated fatty acids (PUFAs) and total cholesterol was found to be negatively associated with total fat mass. Similarly, a cross-sectional study carried out in an Indian population by Bowen et al. (2015) showed that there was a positive correlation between the proportion of energy obtained from protein and total body fat. Aragon et al. (2017) demonstrated that low energy, low fat, and low carbohydrate intake were significantly associated with lower body fat percentages. Furthermore, Soltero and Palacios (2011) suggested that high consumption of sweetened drinks and low consumption of fruits, vegetables, and fiber were associated with increased body fat percentage. In a study performed by Ilesanmi-Oyelere et al. (2020) found that a dietary pattern that included oily fish, sports drinks, and seafood was negatively associated with total body fat percentage. In essence, consumption of these foods was found to be associated with lower levels of total body fat percentage.

2.5 Association between lifestyle with BMI, body fat percentage.

Excess weight or obesity is a global public health concern, and it has been linked to various health issues, such as diabetes, cardiovascular disease, and certain cancers. While genetic and physiological factors play a role in an individual's weight status, lifestyle factors such as physical activity, alcohol consumption, smoking and stress are also known to contribute significantly to obesity and body fat percentage.

2.5.1 Physical activity with BMI and body fat percentage.

Several studies conducted in Malaysia have demonstrated that physical inactive linked to higher BMI. (Chan et al., 2017; Zulfarina et al., 2022; Abidin, Zaibidi and Zulkepli, 2014). These findings were consistent with the literature from other countries. In Spain, the research found out that lecture time physical activity (LTPA) was inversely related to BMI in older adults. (Cárdenas Fuentes et al., 2018). A similar result was obtained by a study on the relationship between BMI and physical activity participation rate, discovering that the willingness to engage in physical exercise decreases while the rate of engagement in physical activity increases with group weight (Wu and He, 2022). Apart from that, a study conducted among medical college freshmen in China reported that BMI and physical fitness level have non-linear correlations with one another. Students who were underweight, overweight, or obese performed worse on the physical fitness index than students who were of a normal weight (Chen et al., 2020).

Meanwhile, a local study reported that both BMI and fat adiposity having correlation with physical activity. In this case, the increased in physical activity will lower the BMI and body fat percentage, while muscle mass will rise (HW, PL and AF, 2020). This finding was consistent with the literature from other countries. In UK, research found that the physical activity was inversely related to body fat percentage and BMI. The finding indicated that those who were more active had lower body fat percentages than individuals with the same BMI. (Bradbury et al., 2017). Another research showed that there is an attenuation from declining adiposity and an increase in physical activity (Ahmadi et al., 2022). Moreover, Specht, Heitmann and Larsen (2022) demonstrated that physical activity (PA) may prevent gain in adiposity, specifically in the abdominal region based on Danish MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) cohort. Overall, the results had shown that physical activity was associate with BMI and fat adiposity.

2.5.2 Smoking with BMI and fat adiposity

Piirtola et al. (2018) indicated that smoking was linked to lower BMI, and when an individual quits smoking, their BMI tends to increase. However, the overall impact of smoking and subsequent cessation on weight gain is negligible, as it typically results in an average increase of no more than 0.7 kg/m^2. Similar finding was performed by Nawawi et al. (2020) and Sun et al. (2019), which also demonstrated that ceasing smoking associated with a higher risk of obesity. Meanwhile, (Terry et al., 2020) found that both current and former smokers have a greater volume of adipose tissue especially in abdominal region

compared to non-smoker. Apart from that, Dos Santos Gouveia et al. (2020) also found that smoking habit led to increased body fat.

2.5.3 Alcohol with BMI and fat adiposity

There are several studies had investigated the association between alcohol and BMI, fat adiposity. According to Booranasuksakul et al. (2019), alcohol intake and BMI were positively correlated in university students from Eastern Thailand. Similar results obtained from a study conducted in Korean, discovered that the amount of alcohol consumed each occasion influenced abdominal obesity in middle-aged, normal-weight adults, which also have impacted obesity-related health risks (Park, Park and Hwang, 2017). Another research reported that heavy drinkers of alcohol had higher risks of being overweight, overweight/obese, than non-drinkers or moderate drinkers of alcohol (Golzarand, Salari-Moghaddam and Mirmiran, 2020). Meanwhile, some studies had demonstrated that higher alcohol consumption had higher levels of BMI and body fat percentage than non-drinkers and lighter drinkers (Wannamethee, Shaper and Whincup, 2005; Liangpunsakul, Crabb and Qi, 2010). However, another study conducted in UK revealed that popular adiposity measures including BMI, WC, BFP and WHR do not rise in correlation with alcohol intake (Inan-Eroglu et al., 2022). Taken together, the relationship between alcohol with BMI and fat adiposity remain unclear.

2.5.4 Stress with BMI and fat adiposity

There were numerous studies investigated the association between stress, body mass index (BMI), and fat adiposity. Study by Mohd-Sidik, Lekhraj and Foo (2021) indicated that BMI was significantly and inversely correlated with perceived stress among Malaysian adults. Besides, the research performed by Tan and Leung (2020) demonstrated that perceived stress quintiles are negatively correlated with obesity among Chinese population. Apart from that, Hossain, Bhuiya and Ali (2022) found that there was a correlation between obesity and DAS disorders (depression, anxiety, stress) where the DAS disorders lead to the increased risk of obese among 2 university students in Bangladesh. Meanwhile, Patel et al. (2019) indicated that there was a correlation between body fat percentage and stress, where individual who experience more stress are at a greater risk of accumulating greater levels of body fat. Lopuszanska-Dawid et al. (2022) also demonstrated that there is a direct correlation between Social Readjustment Rating Scale (SRRS) and Body Fat Percentage (BFP) among Polish adults.

CHAPTER 3

METHODOLOGY

3.1 Study design

A descriptive, cross-sectional research design was employed in this study to examine the association between dietary intake, lifestyle with BMI and fat adiposity. The research was conducted from 25 November 2023 to 12 December 2023. Convenience sampling was chosen as the sampling method for participants selection due to time, resource, and manpower limitations. Convenience sampling allowed the researcher to reach the intended population more effectively.

3.2 Study location

This study was conducted at Kampar campus of University Tunku Abdul Rahman (UTAR).

3.3 Ethnical approval

This research study had received ethical approval from UTAR Scientific and Ethical Review Committee before data collection (Appendix A). The study's objective and the confidentiality of the respondents' data were explained to participants. The participants' consent was obtained prior to data collection, and

their participation was entirely voluntary. The complete confidentiality of the data was guaranteed to all study participants.

3.4 Inclusion criteria & Exclusion criteria

The inclusion criteria for this study must be Malaysian citizens who aged between 18-25 and was undergraduate UTAR Kampar students. Both genders and all races were eligible to participate in this study. Any subject who was currently diagnosed systemic disease, follow a certain specific diet and who was disable would be excluded from the study.

3.5 Sample size

The Cochran formula was applied to estimate the required sample size.

$$n= \frac{Z^2pq}{e^2}$$

The equation above was used to calculate the sample size; where n = sample size, Z= Z-value at the desired confidence level; p= estimated proportion in the population; q= 1-p; e= desired level of precision (Cochran, 1977).

A 95% confidence level with an 8% precision was established. The z-value, calculated from the z-tables, was found to be 1.96. The estimated proportion of overweight and obese in Malaysia was 51%. Thus, p=0.51

$$n = \frac{Z^2 pq}{e^2}$$

$$n = \frac{1.96^2(0.51)(1-0.51)}{0.08^2}$$

$$n = 150$$

Account for a 10% dropout rate:

$$n = 150 \times 110\%$$

$$\approx 165$$

The sample size was initially calculated to be 150. However, considering the possibility of non-response and to minimize errors during data collection, the sample size was increased by 10%. As a result, the final sample size consisted of 165 participants.

A total of 200 students were given the questionnaire; 186 of them consented, completed it, and helped with the recording of their anthropometric measurements physically, yielding a response rate of 93%.

3.6 Questionnaires development

The survey questionnaire utilized in this study was adopted from Godwin et al. (2008) and Rothenberg et al. (2021), which are included in Appendix B. Since the validity of both questionnaires had been established by prior researchers, no pilot test was conducted in this study.

It comprised four sections that consisted of 36 questions. Section A: sociodemographic questionnaire, Section B: Anthropometry data, Section C: Simple Lifestyle Indicator Questionnaire and Section D: Short 15-Item Food Frequency Questionnaire.

3.6.1 Section A: Sociodemographic questionnaire

A total of 4 questions on sociodemographic characteristics were included in Section A. The questions included gender, age, ethnicity, and faculty. The sociodemographic data was gathered using multiple-choice and fill-in-the-blank questions.

3.6.2 Section B: Anthropometry data

A total of 4 questions on anthropometry data were included in Section B. These questions will be conducted manually by stadiometer, bioelectrical independent analysis (BIA) to assess body mass index(BMI) and body fat percentage. The questions included weight, height, BMI, body fat percentage. The anthropometry data was gathered using multiple-choice and fill-in-the-blank questions.

3.6.3 Section C: Simple Lifestyle Indicator Questionnaire (SLIQ)

A total of 12 questions adopted from Godwin et al. (2008) about lifestyle was included in Section C. The SLIQ was developed as a brief, guided self-administered questionnaire to assess 5 components such as diet, exercise,

alcohol intake, smoking, and psychosocial stress and to offer a single summary score. There were 3 questions measured the diet. Another three questions measured the frequency of exercise (light, moderate and vigorous). Moreover, there had 3 questions indicated the alcohol intake. Two questions determined whether have current smoking or smoking history. Lastly, there was one question that measured the psychosocial stress. The data was gathered using multiple-choice, fill-in-the-blank and linear scale (1-6 indicate very stressful to not at all stressful) questions.

According to the scoring guild. In diet section, a multiple-choice question was used from 0 (less than once per week) to 5 (more than two time per day). the combination score of Q1,Q2 and Q3 will translate to category values ranging from zero to two, with 0 denoting a diet score 0-5, one denoting a diet score 6-10, and two denoting a diet score 11 -15. In exercise section, the category values also ranging from zero to two, with 0 denoting only having light exercise, 1 denoting having any moderate activity, and two denoting having any vigorous activity. In terms of alcohol section, the category score will be obtained from the raw score combined from wine, beer and spirits intake. It also range from zero to two, with 0 denoting alcohol drinks 14 or more, one denoting alcohol drink 8 to 13, and two denoting alcohol drinks 0 to 7. For smoking section, the category values also ranging from zero to two, with 0 denoting the respondent is current smoker, one denoting respondent was ex-smoker, two denoting the respondents was non-smoker. For stress section, there was 0 (very stressful) to 6 (not at all stressful) to indicate the respondent stress level. The category data also ranging from zero to two, with 0 denoting stress level 1 or 2, 1 denoting the

stress level 3 to 4, two denoting the stress level 5 to 6. On a scale from 0 to 10, the category scores were added to get the total score, which was then divided into three categories: unhealthy (scoring 0-4), intermediate (score 5-7), and healthy (score 10 and above). This grading was shown in table 3.2 that had been validated by other study (Godwin et al., 2008). Hence, higher score indicated healthier lifestyle.

3.6.4 Section D: Short 15-Item Food Frequency Questionnaire

Section D of the survey included a total of 15 questions, which were adapted from Rothenberg et al. (2021). Questions 1, 2, 3, 7 and 11 pertained to the frequency consumption of vegetables, fruits, nuts, sweets, and dairy products, and responses were summarized as once a day or more often, a few times a week and once a week or less often. Question 4, 5, 6 pertained to the frequency consumption of fish, red meat and white meat, and responses were summarized as three times a week or more often, once or twice a week and a few times a month or less often. Question 8 asked about the frequency of breakfast consumption and was dichotomized into daily (every day/almost daily) or not daily (a few times a week/once a week). Question 9 asking about whether bread typically consumed daily or not, while Question 10 inquired about the type of bread consumed for those who ate daily, classified as white bread, whole wheat/crispbread, or a combination of two. Question 12 pertained to the type of milk consumed and was classified as full fat (3%), reduced fat (1.5%), or low-fat (≤0.5%) milk. Question 13 asked about the type of sandwich spread and was categorized as butter (>75% fat), margarine with plant sterols, or margarine (30-

70% fat). Question 14 asked about the type of cooking fat used and was classified as butter/margarine (60-80%), liquid margarine made with seed and plant oils, or vegetable oil. Finally, Question 15 asked about salt intake and was dichotomized into two options: never (never/never) and yes (yes often/always).

3.7 Statistical analyse

Prior to data analysis, a screening procedure was implemented where responses that did not meet the inclusion criteria such as those from non-UTAR Kampar students, vegetarians and with missing data were excluded. For responses that were unclear, the participants were contacted via Microsoft Teams for clarification. After the screening process, 165 out of 186 respondents were deemed eligible for the study, which met the minimum sample size requirement.

Data were then analysed using IBM Statistical Package for the Social Science (SPSS) version 26.0. Descriptive statistic was used to present the sociodemographic data, anthropometry data, lifestyle practise and dietary intake among UTAR Kampar students. All variables were expressed as frequency (n) and percentage (%) as they were all categorical data. Meanwhile, the statistical method of Pearson's Chi-Square test ($\chi 2$) was used to analyse the correlation between dietary intake and body mass index (BMI; association between dietary intake and body fat percentage; association between lifestyle with BMI and association between lifestyle and body fat percentage. Fisher's exact tests were used when appropriate, that is, whenever 20% of the expected cell frequencies

were ≤5 parametric. For each test, $p < 0.05$ was applied to indicated statistically significant. All data was illustrated in tabular form.

Chapter 4

RESULTS

4.1 Sociodemographic Characteristics of Respondents

The sociodemographic characteristics of respondents were presented in Table 4.1. Majority of respondents were Chinese (90.9%) and aged between 20 to 21 years old (57.6%). Meanwhile, there is a near-even distribution of males (n=82, 49.7%) and females (n=83, 50.3%) in this study, with only a slight variation of one person between the two genders. Regarding the faculty, majority of the respondents were from Faculty of Science (38.8%), subsequently followed by Faculty of Business and Finance (33.3%), Faculty of Arts and Social Science (11.5%), Faculty of Information and Communication Technology (9.7%), Faculty of Engineering and Green Technology (3.6%), while respondents from Institute of Chinese Studies contributed the least portion in the study (3%).

Table 4.1: Sociodemographic characteristics of respondents (n=165)

Demographic characteristics	Distribution	N(%)
Gender	Male	82 (49.7%)
	Female	83 (50.3%)
Age	18-19	54 (32.7%)
	20-21	95 (57.6%)
	22-23	16 (9.7%)
Ethnicity	Chinese	150 (90.9%)
	Malay	7 (4.2%)
	Indian	8 (4.9%)
Faculty	FAS	19 (11.5%)
	FBF	55 (33.3%)
	FEGT	6 (3.6%)
	FICT	16 (9.7%)
	FSC	64 (38.8%)
	ICS	5 (3%)

4.2 Anthropometry measurement

The anthropometry variables of the respondents were tabulated in Table 4.2, which revealed that the majority of respondents (62.4%) had a BMI that fell within the normal range, followed by those who were classified as overweight (18.2%), underweight (11.5%), and obese (7.9%). Furthermore, analysis of the data also indicated that more than half of the respondents had normal levels (62.4%) of percentage of body fat, while 11.5%, 20%, and 6.1% of the respondents had low, high, and very high levels of percentage of body fat, respectively.

Table 4.2 Anthropometry variables

Anthropometry variables	**Distribution**	**N(%)**
Body Mass Index (BMI)	Underweight (Below 18.5 kg/m2)	19 (11.5%)
	Normal (18.5 -24.9 kg/m2)	103(62.4%)
	Overweight (25.0-29.9 kg/m2)	30 (18.2%)
	Obese (Above 30kg/m2)	13 (7.9%)
Percentage of Body fat(PBF)	Low	19 (11.5%)
	Normal	103 (62.4%)
	High	33 (20%)
	Very High	10 (6.1%)

4.3 Lifestyle and Dietary Intake

4.3.1 Lifestyle Practices among UTAR Kampar students

The lifestyle practice of the respondents was tabulated in Table 4.3. Individual score was generated after adding up each of the scores obtained from five components including diet, exercise, alcohol intake, smoking, and psychosocial stress. With a maximum score of 10, the lifestyle of the respondents was categorized into three levels: Unhealthy (0-4), Intermediate (5-7) and Healthy (8-10). The finding revealed that majority (44.2%) of the respondent had intermediate lifestyle followed by unhealthy lifestyle (36.4%), while respondents had healthy lifestyle (19.4%) contributed the least portion in the study.

Table 4.3 Lifestyle practice among UTAR Kampar student

Variables	Distribution	n(%)
Lifestyle	Unhealthy	60 (36.4%)
	Intermediate	73 (44.2%)
	Heathy	32 (19.4%)

Notes: n= number of respondents that answered the related option

4.3.2 Dietary Intake among UTAR Kampar students

The dietary intake of the respondents was tabulated in Table 4.4. Majority of respondents consume vegetables and fruits once a day or more often, which is 54% and 44.2% respectively. Besides, there are 55.8% of the respondents consume nuts just once a week or less often. Moreover, 46.1% of respondents reported eating fish or shellfish a few times a month or less often. In term of red meat and white meat consumption, there are 45.5% and 61.8% of respondents reported that they consume 3 times a week or more often. Additionally, 36.4% of the respondents reported consuming these foods once a week or less often. Furthermore, about one-third of the respondents (66.1%) claimed that they eat breakfast daily and have consumed bread. In this case, about half of them consume white bread (49.5%). Apart from that, majority of the respondents consume milk, sour milk, and yogurt once a week or less often (40%), while about half of the respondents (49.1%) consume skimmed milk. For spread using on sandwich, 35.8% of respondents used margarine about 30-70% fat, followed by 32.7% of respondents used margarine with plant sterols, while respondents who used butter (31.5%) contributed the least portion of the study. In term of cooking fat, more than half of the respondents (56.4%) used vegetable oil instead of butter and margarine with 60 to 80% of fat (29.7%) in cooking session. There were almost all the respondents claimed that they often add salt to their food.

Table 4.4 Dietary Intake among UTAR Kampar students

Question	Categorized	n(%)
1. How often do you eat vegetables?	Once a day or more often	89 (54%)
	A few times a week	55 (33.3%)
	Once a week or less often	21 (12.7%)
2. How often do you eat fruit and/or berries?	Once a day or more often	73 (44.2%)
	A few times a week	49 (29.7%)
	Once a week or less often	43 (26.1%)
3. How often do you eat nuts	Once a day or more often	32 (19.4%)
	A few times a week	41(24.8%)
	Once a week or less often	92 (55.8%)
4. How often do you eat fish or shellfish?	Three times a week or more often	15 (9.1%)
	Once or twice a week	74 (44.8%)
	A few times a month or less often	76 (46.1%)
5. How often do you eat red meat?	Three times a week or more often	75 (45.5%)
	Once or twice a week	39 (23.6%)
	A few times a month or less often	51 (30.9%)
6. How often do you eat white meat?	Three times a week or more often	102 (61.8%)
	Once or twice a week	47 (28.5%)
	A few times a month or less often	16 (9.7%)
7. How often do you eat buns/cakes, chocolate/sweets, crisps or soda/juice?	Once a day or more often	54 (32.7%)
	A few times a week	51 (30.9%)
	Once a week or less often	60 (36.4%)
8. How often do you eat breakfast?	Everyday	109 (66.1%)
	Not everyday	56 (33.9%)
9. Do you eat bread	No	56 (33.9%)
	Yes	109 (66.1%)

10. What type(s) of bread do you eat?	White bread	54 (49.5%)
	Whole wheat bread/crispbread	38 (23%)
	Combinations of above	17 (10.3%)
11. How often do you drink/eat milk, sour milk and/or yoghurt?	Once a day or more often	57 (34.5%)
	A few times a week	42 (25.5%)
	Once a week or less often	66 (40%)
12. What type of milk, sour milk and/or yoghurt do you usually drink/eat?	Full fat (3%)	46 (27.9%)
	Semi-skimmed/reduced fat (1.5%)	38 (23%)
	Skimmed/low-fat/non-fat (<0.5%)	81 (49.1%)
13. What kind of spread do you usually use on sandwiches?	Butter (>75% fat)	52 (31.5%)
	Margarine with plant sterols	54 (32.7%)
	Margarine (30–70% fat)	59 (35.8%)
14. What kind of fat do you usually use for cooking at home?	Butter/margarine (60–80%)	49 (29.7%)
	Margarine made with seed and plant oils/liquid	23 (13.9%)
	Vegetable oil	93 (56.4%)
15. Do you usually add salt to your food?	No/yes sometimes	19 (11.5%)
	Yes, often/always	146 (88.5%)

Notes: n= number of respondents that answered the related option

4.4 Association between BMI and Body fat percentage

Table 4.5 presents the results of the analysis examining the association between Body Mass Index (BMI) and body fat percentage. The statistical analysis revealed a significant association between the two variables, with a p-value of less than 0.05.

Table 4.5 Association between BMI and body fat percentage

BMI	BFP			Total	X^2
	Low	Normal	High		p-value
Underweight	1 (5.3%)	10 (52.6%)	8 (42.1%)	19	28.331
Normal	7 (6.8%)	79 (76.7%)	17 (16.5%)	103	p<0.001
Owerweight/ Obese	11 (25,6%)	14 (32.6%)	18 (41.9%)	43	
Total	19	103	43	165	

p-value < 0.05 is significant. BMI: Body Mass Index

BFP: Body fat percentage

4.5 Association between lifestyle with BMI and Body fat percentage

4.5.1 Association between lifestyle with BMI

Table 4.6 presents the results of the analysis examining the association between lifestyle and Body Mass Index (BMI). The statistical analysis revealed a significant association between the two variables, with a p-value of less than 0.05. There were 87.5% of the respondents with normal BMI had healthy lifestyle.

Table 4.6 Associated between lifestyle and BMI.

Lifestyle	BMI			Total	X^2 p-value
	Underweight	Normal	Overweight / Obese		
Unhealthy	12 (20%)	25 (41.67%)	23 (38.33%)	60	
Intermediate	7 (9.6%)	50 (68.5%)	16 (21.9%)	73	21.673 p=0.002
Healthy	0 (0%)	28 (87.5%)	4 (12.5%)	32	
Total	19	103	43	165	

p-value < 0.05 is significant. BMI: Body Mass Index

4.5.2 Association between lifestyle and body fat percentage

Table 4.7 presents the results of the analysis examining the association between lifestyle and body fat percentage. The statistical analysis revealed a significant association between the two variables, with a p-value of less than 0.05. There was 87.5% of the respondents with normal body fat percentage had healthy lifestyle.

Table 4.7 Association between lifestyle and body fat percentage

Lifestyle	BFP			Total	X^2
	Low	Normal	High		p-value
Unhealthy	8 (13.3%)	28 (46.67%)	24 (40%)	60	16.216 p<0.001
Intermediate	10 (13.7%)	47 (64.38%)	16 (21.92%)	73	
Healthy	1 (3.13%)	28 (87.5%)	3 (9.38%)	32	
Total	19	103	43	165	

p-value < 0.05 is significant. BFP: Body Fat Percentage

4.6 Association between dietary intake with BMI and body fat percentage

4.6.1 Association between dietary intake and BMI

Table 4.8 presents the outcomes of an investigation that examined the link between dietary intake and BMI. The results revealed that no significant association was observed between BMI and the intake of fish, white meat, type of spread used on sandwich, daily bread consumption, type of fat used in cooking, and salt intake. Conversely, there was a significant association between BMI and the consumption of vegetables ($p<0.001$), fruits ($p<0.001$), nuts ($p<0.001$), red meat ($p<0.001$), processed food ($p<0.011$), breakfast intake ($p=0.008$), type of bread consumed ($p<0.001$), frequency ($p=0.042$), and type of milk consumed ($p=0.004$).

Table 4.8 Association between dietary intake and BMI

Question	Categorized	BMI			X^2 p-value
		Under weight	Normal	Over weight/ Obese	
1. How often do you eat vegetables?	Once a day or more often	8 (9%)	75 (84.27%)	6 (1.12%)	20.684 p<0.001
	A few times a week	6 (10.9%)	25 (45.46%)	24 (43.64%)	
	Once a week or less often	5 (23.81%)	3 (14.29%)	13 (61.9%)	
2. How often do you eat fruit and/or berries?	Once a day or more often	5 (6.85%)	59 (80.82%)	9 (12.33%)	24.540 p<0.001
	A few times a week	9 (18.37%)	27 (55.1%)	13 (26.53%)	
	Once a week or less often	5 (11.63%)	17 (39.54%)	21 (48.84%)	
3. How often do you eat nuts	Once a day or more often	2 (6.25%)	30 (93.75%)	0 (0%)	31.677 p<0.001
	A few times a week	3 (7.32%)	31 (75.61%)	7 (17.07%)	
	Once a week or less often	14 (15.22%)	42 (45.65%)	36 (39.13%)	
4. How often do you eat fish or shellfish?	Three times a week or more often	1 (6.7%)	11 (73.3%)	3 (20%)	1.859 p=0.780
	Once or twice a week	11 (14.9%)	43 (58.1%)	20 (27%)	
	A few times a month or less often	7 (9.2%)	49 (64.5%)	20 (26.3%)	
5. How often do you eat red meat?	Three times a week or more often	13 (17.3%)	35 (46.7%)	27 (36%)	17.152 p<0.001
	Once or twice a week	3 (7.7%)	26 (66.7%)	10 (25.6%)	
	A few times a month or less often	3 (5.9%)	42 (82.4%)	6 (11.8%)	

6. How often do you eat white meat?	Three times a week or more often	12 (11.8%)	62 (60.8%)	28 (27.5%)	
	Once or twice a week	5 (10.6%)	29 (61.7 %)	13 (27.7%)	1.771
	A few times a month or less often	2 (12.5%)	12 (75%)	2 (12.5%)	p=0.790
7. How often do you eat buns/cakes, chocolate/sweets, crisps or soda/juice?	Once a day or more often	11 (20.4%)	24 (44.4%)	19 (35.2%)	
	A few times a week	5 (9.8%)	34 (66.7%)	12 (23.5%)	12.772
	Once a week or less often	3 (5%)	45 (75%)	12 (20%)	p=0.011
8. How often do you eat breakfast?	Daily	11 (10.1%)	77 (70.6%)	21 (19.3%)	9.729
	Not daily	8 (14.3%)	26 (46.4%)	22 (39.3 %)	p=0.008
9. Do you eat bread daily	No	3 (6.4%)	38 (67.9%)	15 (26.8%)	3.210
	Yes	16 (14.7%)	65 (59.6%)	28 (25.7%)	p=0.201
10. What type(s) of bread do you eat?	White bread	11 (20.4%)	21 (38.9%)	22 (40.7%)	
	Whole wheat bread/crispbread	4 (10.5%)	30 (79%)	4 (10.5%)	22.616
	Combinations of above	0 (0%)	15 (88.2%)	2 (11.7%)	p<0.001
11. How often do you drink/eat milk, sour milk and/or yoghurt?	Once a day or more often	5 (8.8%)	42 (73.7%)	10 (17.5%)	
	A few times a week	5 (11.9%)	29 (69%)	8 (19%)	9.760
	Once a week or less often	9 (13.6%)	32 (48.5%)	25 (37.9%)	P=0.042

12 What type of milk, sour milk and/or yoghurt do you usually drink/eat?	Full fat (3%)	5 (10.9%)	20 (43.5%)	21 (45.7%)	15.218 p=0.003
	Reduced fat (1.5%)	7 (18.4%)	23 (60.5%)	8 (21.1%)	
	Low fat (<0.5%)	7 (8.6%)	60 (74.1%)	14 (17.3%)	
13. What kind of spread do you usually use on sandwiches?	Butter (>75% fat)	8 (15.4%)	25 (48.1%)	19 (36.5%)	7.958 p=0.093
	Margarine with plant sterols	7 (13%)	35 (64.8%)	12 (22.2%)	
	Margarine (30–70% fat)	4 (6.8%)	43 (72.9%)	12 (20.3%)	
14. What kind of fat do you usually use for cooking at home?	Butter/margarine (60–80%)	7 (14.3%)	22 (44.9%)	20 (40.8%)	10.037 p=0.064
	Margarine made with seed and plant oils/liquid	3 (13%)	15 (65.2%)	5 (21.7%)	
	Vegetable oil	9 (9.7%)	66 (71%)	18 (19.4%)	
15. Do you usually add salt to your food?	Never	0 (0%)	14 (73.7%)	5 (26.3%)	2.754 p=0.293
	Yes	19 (13%)	89 (61%)	38 (26%)	

4.6.2 Association between dietary intake and body fat percentage.

Table 4.9 presented the outcomes of an investigation that examined the link between dietary intake and body fat percentage. The results revealed that no significant association was observed between body fat percentage and the nut, fish intake, white meat intake, breakfast consumption, daily bread consumption, frequency of dairy consumption, type of cooking oil and salt intake. Conversely,

there was a significant association between body fat percentage with vegetable ($p<0.001$), fruits consumption ($p<0.001$), red meat consumption ($p<0.001$), processed food consumption ($p<0.001$), type of bread consumed ($p=0.008$), type of milk consumption ($p=0.004$) and type of spread used in sandwich ($p<0.001$).

Table 4.9 Association between dietary intake and Body Fat Percentage

Question	Categorized	PBF			X^2
		Low	Normal	High	p-value
1. How often do you eat vegetables?	Once a day or more often	6 (6.74%)	73 (82%)	10 (11.24%)	16.959 p<0.001
	A few times a week	10 (18.18%)	21 (38.18%)	24 (43.64%)	
	Once a week or less often	3 (14.29%)	9 (42.86%)	9 (42.86%)	
2. How often do you eat fruit and/or berries?	Once a day or more often	4 (5.5%)	58 (79.5%)	11 (15.1%)	17.648 p<0.001
	A few times a week	9 (18.4%)	25 (51%)	15 (30.6%)	
	Once a week or less often	6 (14%)	20 (46.5%)	17 (39.5%)	
3. How often do you eat nuts	Once a day or more often	5 (15.6%)	22 (68.8%)	5 (15.6%)	6.818 p=0.140
	A few times a week	4 (9.8%)	30 (73.2%)	7 (17.1%)	
	Once a week or less often	10 (10.9%)	51 (55.4%)	31 (33.7%)	
4. How often do you eat fish or shellfish?	Three times a week or more often	1 (6.7%)	10 (66.7%)	4 (26.7%)	2.237 p=0.706
	Once or twice a week	8 (10.8%)	50 (67.6%)	16 (21.6%)	

	A few times a month or less often	10 (13.2%)	43 (56.6%)	23 (30.3%)	
5. How often do you eat red meat?	Three times a week or more often	13 (17.3%)	34 (45.3%)	28 (37.3%)	17.176 p<0.001
	Once or twice a week	3 (7.7%)	31 (79.5%)	5 (12.8%)	
	A few times a month or less often	3 (5.9%)	38 (74.5%)	10 (19.6%)	
6. How often do you eat white meat?	Three times a week or more often	13 (12.7%)	56 (54.9%)	33 (32.4%)	8.321 p=0.069
	Once or twice a week	6 (12.8%)	34 (72.3 %)	7 (14.9%)	
	A few times a month or less often	0 (0%)	13 (81.3%)	3 (18.8%)	
7. How often do you eat buns/cakes, chocolate/sweets, crisps or soda/juice?	Once a day or more often	4 (7.4%)	21 (38.9%)	29 (53.7%)	37.294 p<0.001
	A few times a week	3 (5.9%)	41 (80.4%)	7 (13.7%)	
	Once a week or less often	12 (20%)	41 (68.3%)	7 (11.7%)	
8. How often do you eat breakfast?	Daily	14 (12.8%)	71 (65.1%)	24 (22 %)	2.789 p=0.269
	Not daily	5 (8.9%)	32 (57.1%)	19 (33.9 %)	
9. Do you eat bread daily	No	6 (10.7%)	37 (66.1%)	13 (23.2%)	0.491 p=0.782
	Yes	13 (11.9%)	66 (60.6%)	30 (27.5%)	
10. What type(s) of	White bread	10 (18.9%)	24 (45.3%)	19 (35.8%)	13.098

bread do you eat?	Whole wheat bread/crispbread	1 (2.6%)	31 (81.6%)	6 (15.8%)	p=0.008
	Combinations of above	2 (11.8%)	11 (64.7%)	4 (23.5%)	
11. How often do you drink/eat milk, sour milk and/or yoghurt?	Once a day or more often	5 (8.8%)	41 (71.9%)	11 (19.3%)	3.548 p=0.476
	A few times a week	5 (11.9%)	25 (59.5%)	12 (28.6%)	
	Once a week or less often	9 (13.6%)	37 (56.1%)	20 (30.3%)	
12 What type of milk, sour milk and/or yoghurt do you usually drink/eat?	Full fat (3%)	7 (15.2%)	22 (47.8%)	17 (37%)	15.192 p=0.004
	Reduced fat (1.5%)	3 (7.9%)	20 (52.6%)	15 (39.5%)	
	Low-fat/ (<0.5%)	9 (11.1%)	61 (75.3%)	11 (13.6%)	
13. What kind of spread do you usually use on sandwiches?	Butter (>75% fat)	7 (13.5%)	20 (38.5%)	25 (48.1%)	28.339 p<0.001
	Margarine with plant sterols	7 (13%)	33 (61.1%)	14 (25.9%)	
	Margarine (30–70% fat)	5 (8.5%)	50 (84.7%)	4 (6.8%)	
14. What kind of fat do you usually use for cooking at home?	Butter/margarine (60–80%)	7 (14.3%)	27 (55.1%)	15 (30.6%)	3.701 p=0.445
	Margarine made with seed and plant oils/liquid	2 (8.7%)	18 (78.3%)	3 (13 %)	
	Vegetable oil	10 (10.8%)	58 (62.4%)	25 (26.9%)	
15. Do you usually add salt to your food?	Never	2 (10.5%)	11 (57.9%)	6 (31.6%)	0.466 p=0.874
	Yes	17 (11.6%)	92 (63%)	37 (25.3%)	

Chapter 5

DISCUSSION

5.1 BMI and Body Fat Percentages among UTAR students.

The findings of the current research suggest that a majority of the participants (62.4%) had a normal body mass index (BMI). This finding is consistent with studies conducted among five universities in Malaysia (UM, UPM, USM, UKM, UTM), which indicated that more than half of the students (54.5%) were within the normal weight range (Wan Mohamed Radzi et al., 2019). Similar observations have been reported in other countries, such as Bangladesh, where a study found that the majority of students (67.2%) had a normal BMI (Mohammad et al., 2019). Notably, the majority of respondents in the present study were from the Faculty of Science, which has a good nutrition-based knowledge. Akkartal and Gezer (2019) have previously demonstrated that a high level of knowledge regarding nutrition is associated with a decrease in body mass index.

Regarding body fat percentage, the present study indicated that most of the respondents (62.4%) were within the normal level. In contrast, a study by Nuñez-Leyva et al. (2022) revealed that 61.1% of men and 50.5% of women from a private university located in Lima, Peru, had a high body fat percentage. The differences observed in the results could be due to variations in knowledge, health awareness, and environmental factors (Akkartal and Gezer, 2019; Brehm and D'Alessio, 2019; Oostenbach et al., 2019).

5.2 Lifestyle practices among UTAR students.

Maintaining a healthy lifestyle can yield a multitude of benefits for an individual's overall well-being. Consistently engaging in physical activity and consuming a well-balanced diet have been demonstrated to notably decrease the likelihood of developing chronic conditions, such as cardiovascular disease, cerebrovascular disease, diabetes, and various forms of cancer. Furthermore, adopting a healthy lifestyle can lead to increased energy levels, decreased fatigue, better mental health, improved sleep quality, and enhanced longevity. However, many respondents (44.2%) in this study were found to practice an intermediate lifestyle, while the healthy lifestyle practice contributed the least portion (19.4%). This finding is consistent with a study by Barnes and Brownwell (2017), which indicated that most students practiced an intermediate lifestyle. In contrast, other studies have demonstrated even poorer lifestyle practices among university students (Al-Naggar, Bobryshev, and Mohd Noor, 2013; Alsayed, Bano, and Alnajjar, 2019; Aljehani et al., 2022; Müller, El-Ansari, and El Ansari, 2022).

Several possible explanations exist to justify why UTAR students may struggle to achieve a healthy lifestyle. University students often have demanding schedules filled with classes, assignments, exams, and extracurricular activities, which leave little time for exercise, healthy meal preparation, and self-care. Moreover, university can be a stressful environment with academic pressure, social stressors, and financial worries, which may lead to unhealthy habits, such as overeating, smoking, and excessive alcohol consumption. Limited resources

can also serve as a barrier to healthy lifestyle practice, as many students live on a tight budget and may not have access to healthy food options (Amiri et al., 2010; Dhia Al-Deen and Ibrahim, 2012; Fathima et al., 2019).

5.3 Dietary intake among UTAR students.

The present study revealed that majority of the respondents consumed at least one serving of fruits (44.2%) and vegetables (54%) per day or more. This finding is consistent with previous studies that have shown that the majority of university students consume fruits and vegetables daily or more frequently (Schroeter and House, 2015; Dos Santos et al., 2017; Alkazemi and Salmean, 2021; Mclean-Meyinsse, 2021). For instance, Mclean-Meyinsse (2021) reported that 54% of the respondents consumed at least two servings of vegetables daily, while 61% of the respondents consumed at least one cup of fruits daily or more.

Regarding nut consumption, more than half of the respondents reported consuming nuts once a week or less. This finding is consistent with a previous study conducted in Malaysia, which indicated a low frequency of nut consumption as nuts are typically not considered main food sources in this country and are often consumed in small amounts as snacks, added to sauces, or used as ingredients in recipes (Ain, 2011).

Moreover, the study revealed that a high proportion of respondents consumed fish or shellfish monthly or less frequently (46.1%), which is consistent with the low frequency of fish intake reported in a study by Keisuke Hamazaki et al. (2015) among undergraduate students. This could be due to the high cost of fish, which may be unaffordable for many university students on tight budgets (Fathima et al., 2019).

Furthermore, the current study found that the majority of respondents consumed red meat (45.5%) and white meat (61.8%) three times a week or more. This is consistent with a similar study conducted by Rocío Ortiz-Moncada et al. (2019), which reported that a majority of university students (72.9%) consumed fresh meat more than three times a week, indicating excessive consumption. Another study by Kremmyda et al. (2008) reported that over 90% of students at the University of Alicante had a high intake of red meat.

Apart from that, the study found that 36.4% of the respondents consumed processed foods such as buns/cakes, chocolate/sweets, crisps, or soda/juice once a week or less, which considered as low intake. This finding is inconsistent with previous studies, which have shown that university students tend to consume a high amount of processed foods, particularly soft drinks (Fondevila-Gascón et al., 2022). The disparity in findings may be attributed to the fact that a majority of the respondents in the current study were from the Faculty of Science, and thus, may have a greater knowledge of nutrition that affects their food choices. Scalvedi et al. (2021) demonstrated that nutrition knowledge level was

correlated with the eating habits, as low levels of nutrition knowledge led to poor eating habits.

Additionally, the present study revealed that 66.1% of the respondents consumed breakfast daily, which is consistent with previous studies conducted by Özkaya and İsmail (2021) where 73% of students had regular breakfast. Moreover, most of the respondents (66.1%) in the current study consumed bread daily, with 49.5% of them consuming white bread. Similar findings were observed by Ilktac, Sadik, and Garipagaoglu (2021) where the majority of the respondents (87.3%) consumed white bread. The possible reason for this preference for white bread among university students could be the perception that it is more affordable due to high demand and market competition, while whole grain foods are often considered pricier (Kamar, Evans, and Hugh-Jones, 2019).

In terms of dairy consumption, the current study revealed that 40% of the respondents consumed dairy products once a week or less, and 49.1% consumed skim milk. However, Durá Travé (2008) reported that 98.6% of Spanish college students consumed dairy products daily, which is inconsistent with the current study. Nonetheless, it was found that 60% of the students consumed low-fat dairy products, which is consistent with the current study. The difference in findings may be attributed to differences in eating habits. For example, a survey conducted by Vodus Insights in 2021 in Malaysia revealed that 44% of respondents did not consume any form of milk (Statista, 2022).

Regarding spreads used in sandwiches, 35.8% of the respondents chose margarine containing 30-70% fat. More than half (56.4%) of the respondents used vegetable oil in cooking. According to Al-Khaleej (2018), palm oil is the most widely used vegetable oil, with a consumption of 2.74 million metric tons in 2016/2017. Additionally, the present study showed that the majority of respondents (88.5%) always added salt to their food. This finding is in line with Biswas et al. (2020), who reported that undergraduate students at the Bangladesh University of Health Sciences commonly consume salty processed foods and add salt to their meals.

5.4 Association between BMI and body fat percentage

The current study has identified a significant association between BMI and body fat percentage (χ^2= 28.331, p<0.001), which is consistent with previous research findings. Several studies have reported a positive association between BMI and BF% (Akmal, Huddin, and Arma, 2014; Jelena et al., 2016; Jeong et al., 2023). Similarly, a study conducted in Malaysia has indicated a strong correlation between BMI and body fat percentages in adults (Ranasinghe et al., 2013). Akindele, Phillips, and Igumbor (2016) have also identified a significant and positive statistical relationship between BF% and BMI (r=0.81, p<0.01) among Nigerian adults. Additionally, Ilman, Zuhairini, and Siddiq (2015) have demonstrated a significant association between BMI and body fat percentage in both genders at Universitas Padjadjaran in Indonesia. Furthermore, Rush, Freitas, and Plank (2009) found that the association between body fat mass and BMI varied among different populations, such as Asians, Indians, Europeans,

Maoris, and Pacific Islanders. Specifically, the study revealed that Asians and Indians had a greater body fat percentage than Europeans, Maoris, and Pacific Islanders. However, Meeuwsen, Horgan, and Elia (2010) reported a weaker correlation between BMI (less than 27 kg/m^2) and body fat percentage as the subjects' age influenced the results.

Overall, the current study's findings, along with the previous research, support the notion that BMI is positively associated with body fat percentage. The variations in this association across different populations and age groups suggest the need for further investigation and tailored interventions to address the complexities of obesity.

5.5 Association of lifestyle with BMI and body fat percentage

5.5.1 Association of lifestyle with BMI

The present study found a significant association between lifestyle and BMI (χ^2=21.673, p=0.002). Majority of the respondents (87.5%) with healthy lifestyle had normal body mass index (BMI). This result may indicate that individual who practising healthy lifestyle may lower the risk of overweight or obese. Meanwhile. Almutairi et al. (2018) found that unhealthy lifestyle factors are associated with higher BMI, whereas the findings showed that those who having healthy lifestyle had a lower BMI among King Saud University students. Besides, Mathew, Dsouza, and Saldanha (2021) reported that an unhealthy lifestyle can increase the risk of overweight and obesity among adolescents in Malaysia. Adopting a healthy lifestyle, including a balanced diet and regular

exercise, can help individuals maintain a healthy weight and reduce their BMI (National Heart, Lung, and Blood Institute, 2010). As evidence, CDC (2019) suggests that consuming a balanced diet with plenty of fruits, vegetables, and whole grains, which are low in calories but rich in nutrients, can help individuals maintain a healthy weight. In addition, engaging in physical activity can increase an individual's total energy expenditure and lead to weight maintenance or weight loss over time (Cox, 2017). Donnelly et al. (2013) conducted a study involving 141 overweight or obese men and women with a BMI of 31 kg/m^2 who participated in supervised exercise for 10 months, with a calorie-equivalent reduction of either 400 or 600 calories per day. The results showed that participants who completed the study experienced significant weight loss of 3.9 ± 0.1kg and 5.2 ± 0.4kg, depending on the level of exercise calorie-equivalent reduction. Elliot and Hamlin (2018) suggest that a combination of dietary and physical activity interventions may be more effective in promoting health improvements than focusing on only one behaviour.

Smoking and alcohol consumption are common lifestyle behaviours that have negative impacts on health and are associated with changes in BMI. Liao et al. (2016) found that moderate to heavy smokers tend to have lower BMI than non-smokers, while former smokers tend to have higher BMI. However, nicotine's appetite-suppressing effect is not a healthy way to manage weight, as smoking can lead to numerous negative health effects (Jacobs, 2019). Traversy and Chaput (2018) also found that alcohol consumption could increase the risk of obesity due to its high calorie content and potential to interfere with the body's fat-burning ability, leading to overeating and weight gain.

Studies have shown that stress is another factor that contributes to weight change (Yau and Potenza, 2013; Harding et al., 2013; Cuevas et al., 2019). The release of the hormone cortisol in response to stress can increase appetite and lead to cravings for high-fat and high-sugar foods, resulting in overeating and weight gain. Furthermore, stress can lead to emotional eating, where individuals eat in response to emotions rather than physical hunger, resulting in excessive consumption of high-calorie foods and weight gain (Cuevas et al., 2019).

5.5.2 Association of lifestyle with body fat percentage.

The present study has revealed a significant association between lifestyle factors and body fat percentage (χ^2=16.216, p<0.001). Majority of the respondents (87.5%) with healthy lifestyle had normal body fat percentage. This result may indicate that individual who practising healthy lifestyle may lower the body fat percentage. This finding aligns with the results obtained by Ohlsson and Manjer (2020), who reported that unhealthy lifestyle behaviors are linked to a higher body fat percentage and increased risk of normal weight obesity, whereas those who practising healthy lifestyle had lower body fat percentage. Additionally, Maitiniyazi et al. (2021) found a similar association between unhealthy lifestyle and normal weight obesity, a condition characterized by having normal BMI but a high percentage of body fat.

Several lifestyle factors including physical activity, diet, alcohol consumption, smoking habits, and stress can affect body fat percentage. A case-control study involving 90 university students, categorized into normal weight, normal weight

obesity, and obesity groups, showed that the normal weight obesity group consumed the least amount of fruits, vegetables, and nuts (Amani et al., 2019). Similarly, a study conducted in New Zealand found that diet quality was positively correlated with body fat percentage (Wong et al., 2015), indicating that a healthy diet may aid in body fat management.

Zaccagni, Barbieri, and Gualdi-Russo (2014) discovered a significant negative correlation between physical exercise behavior and body fat percentages. A study conducted among Italian university students also revealed a positive correlation between physical activity, such as soccer, basketball, volleyball, and bodybuilding, and fat loss, as physical activity can aid in preserving muscle mass while losing fat.

Smoking and alcohol consumption are two common lifestyle behaviors that can negatively impact an individual's health while also being associated with body fat percentage. Chiolero et al. (2007) and Artese, Stamford, and Moffatt (2017) demonstrated that frequent smoking can increase fat accumulation and insulin resistance. A study conducted in Switzerland found that heavy smokers tend to increase body fat (Chiolero et al., 2007) There are several possible explanations for this finding. Nicotine found in cigarettes can lead to insulin resistance, anti-estrogenic effects, and increased cortisol levels, which can promote fat accumulation (Graff-Iversen et al., 2019). Additionally, smokers tend to gain weight, particularly fat mass, when they quit smoking, and heavy smokers who

are more nicotine-dependent may experience greater weight gain from previous attempts to quit (Rigotti and Clair, 2018).

In terms of alcohol consumption, Parente et al. (2022) demonstrated that higher consumption of alcohol was associated with an increase in body fat, especially in the abdominal region. Similarly, Coulson et al. (2013) discovered that individuals who consume five or more alcoholic drinks per day have a higher percentage of body fat compared to those who do not drink alcohol. Several explanations were found in previous studies (Yeomans, 2010; Shelton and Knott, 2014; Traversy and Chaput, 2018). Alcoholic drinks contain calories, and consuming large amounts of alcohol regularly can contribute to excessive caloric intake and weight gain. Additionally, alcohol can disrupt the body's metabolism of fats, leading to an increase in the storage of fat in the body, particularly in the abdominal area. Moreover, alcohol can stimulate appetite and lead to overeating or making poor food choices, which can further contribute to weight gain. Chronic heavy drinking can also lead to liver damage and impair the liver's ability to process fat, leading to further accumulation of body fat.

On the other hand, Patel et al. (2019) demonstrated that the percentage of body fat had a positive association with stress. This finding can be explained by the fact that stress may induce cortisol secretion, which may contribute to an increase in body fat, especially abdominal fat (Epel et al., 2000).

5.6 Association of dietary intake with BMI and body fat percentage

5.6.1 Frequency of vegetables and fruits associated with BMI and body fat percentage.

The present study found a significant association between the frequency of vegetable (χ^2=20.684, p<0.001), fruit intake (χ^2=24.540, p<0.001) and BMI. Majority of the respondents who reported consumed vegetables (84.27%) and fruits (80.82%) daily or more had normal BMI. This result is consistent with a study conducted by Wall et al. (2018) which demonstrated that individuals who consumed fruits and vegetables three or more times per week had a lower BMI. Similar findings have been reported in studies conducted in the United States and Canada, which suggest that increased consumption of fruits and vegetables can aid in weight management and reduce the risk of obesity (Bertoia et al., 2015; Azagba and Sharaf, 2012). Additionally, the frequency of vegetable (χ^2=16.959, p<0.001) and fruit intake (χ^2=17.648, p<0.001) was significantly associated with body fat percentage. Majority of the respondents who reported consumed vegetables (82%) and fruits (79.5%) daily or more had normal body fat percentage. This result is consistent with a study conducted by Yu et al. (2018), which found that a high level of vegetable and fruit consumption was inversely associated with body fat percentages among respondents in Atlantic Canada. Another study conducted in Pakistan demonstrated that low vegetable and fruit consumption was significantly associated with higher body fat percentages (Safdar et al., 2022).

Collectively, increasing vegetable and fruit intake may help lower BMI and body fat percentages. Fruits and vegetables have a low energy density due to their high-water content and low-fat content. Satiety research investigations have shown that a food's water content affects its energy density, satiety level, and energy intake during subsequent meals (Rolls, Ello-Martin and Tohill, 2004). Furthermore, vegetables and fruits are rich in soluble dietary fibres, which may increase post-meal satiety and lower the glycaemic index and glycaemic load of the food consumed, resulting in less energy absorption. They also contain a variety of phytochemicals that protect against the oxidative stress and subclinical inflammation caused by obesity-related conditions (Slavin and Lloyd, 2012).

5.6.2 Frequency of nuts intake associated with BMI and body fat percentage.

The present study investigated the association between the frequency of nuts intake and body mass index (BMI) (χ^2=31.677, p<0.001). Majority of the respondents (93.75) who reported consume nuts daily or more had normal BMI. This finding is consistent with previous research that suggests increased nuts consumption is associated with lower BMI and lower risk of obesity in adults (Jackson and Hu, 2014; Liu et al., 2019; Eslami, Shidfar and Dehnad, 2019). However, we did not observe a significant association between frequency of nuts intake and body fat percentage (χ^2=6.818, p=0.140). This finding is inconsistent with a previous study, which found that high frequency

consumption of nuts significantly reduced adiposity-related measurements (Garrido-Miguel et al., 2021).

As evidence, nuts are a highly nutritious food source that contain essential nutrients necessary for optimal health. Specifically, nuts are rich in protein, a fundamental component of our diet that plays a critical role in the formation and maintenance of muscles, skin, and other tissues in our bodies (Liu et al., 2019). Additionally, nuts are high in unsaturated fats, which are considered "good" fats as they promote oxidation, the process by which the body breaks down stored fat to use as fuel. This process may lead to a reduction in body fat stores and potentially help decrease body fat accumulation (Garrido-Miguel et al., 2021). Furthermore, nuts are a great source of dietary fiber, particularly viscous fiber, which can delay gastric emptying, providing a longer feeling of fullness and potentially reducing appetite (Eslami, Shidfar and Dehnad, 2019). Moreover, the protein, fiber, and unsaturated fat content in nuts can also help boost thermogenesis and resting energy expenditure. These processes refer to the body's calorie-burning activities while producing heat and at rest, respectively. By increasing both processes, nuts have the potential to help individuals burn more calories throughout the day (Liu et al., 2019). Hence, Further research is necessary to clarify the association between nuts consumption and body fat percentage.

5.6.3 Frequency of fish consumption associated with BMI and body fat percentage.

The current study investigated the association between frequency of fish consumption and BMI as well as body fat percentage. Interestingly, the study did not find any significant association between fish consumption and BMI (χ^2=1.859, p=0.780). and body fat percentage (χ^2=2,.337, p=0.706). This finding is consistent with the study conducted by Jakobsen et al. (2013) which reported no relationship between fish consumption and weight gain in European adults. Furthermore, Winnicki et al. (2002) found that a high fish diet was linked to lower levels of leptin in the bloodstream irrespective of an individual's body fat levels and BMI. Leptin is a hormone that regulates appetite and metabolism and is secreted by adipose tissue. These results suggest that fish consumption may not have a direct impact on body weight and fat percentage but may have indirect effects on hormones and metabolism. Further studies are warranted to explore the potential mechanisms underlying the relationship between fish consumption and weight-related variables.

5.6.4 Frequency of red meat consumption associated with BMI and body fat percentage.

The present study has demonstrated a significant association between the frequency of red meat consumption and BMI (χ^2=17.152, p<0.001). Majority of the respondents (82.4%) who reported consume meat few times a month or less had normal BMI. This finding is in line with previous studies, which suggest a positive correlation between high red meat consumption and obesity

(Xu, Yin, and Tong, 2007; Wang and Beydoun, 2009; Rouhani et al., 2014). On the other hand, the present study has also revealed that there is significant association between the frequency of red meat consumption and body fat percentage (χ^2=17.176, p<0.001). Majority of the respondents (74.5%) who reported consume meat few times a month or less had normal body fat percentage. These findings are consistent with a study conducted by Willmann et al. (2019), which found that reduced red meat consumption can lead to a decrease in body fat mass. This may be attributed to the high calorie and saturated fat content of red meat. Frequent consumption of red meat can contribute to an excess of calories beyond the body's energy requirements, leading to weight gain and a subsequent increase in BMI and body fat percentage over time. Moreover, the consumption of saturated fat has been associated with the development of various health issues, including obesity and heart disease (Rouhani et al., 2014).

5.6.5 Frequency of white meat consumption associated with BMI and body fat percentage.

The present study reported that the frequency of white meat consumption was not significantly associated with BMI (χ^2=1.771, p=0.790) and body fat percentage (χ^2=8.321, p=0.069). However, this finding was comparable with Maskarinec et al (2006) and Khodayari et al (2022), as it revealed a strong positive connection between consumption of white meat and overall obesity. Besides, Kim (2017) found that higher chicken consumption was associated with higher body fat percentage in a group of young adults. In fact, white meat

is a leaner source of protein, with a lower fat content. Hence, A possible explanation is that the cooking methods used for white meat, such as frying or grilling, may add excess calories and unhealthy fats to the food, which can contribute to weight gain and increased body fat. Additionally, the added fats, sauces, or toppings that are commonly used to enhance the flavor of white meat dishes can also increase the calorie content and potentially lead to weight gain (Kim, 2017). Therefore, further studies are necessary to confirm the association between white meat consumption with BMI and body fat percentage.

5.6.6 Frequency of processed food consumption associated with BMI and body fat percentage.

The present study demonstrated that the frequency of processed food consumption, including bun/cake, chocolate/sweets, crisps, and soda/juice, was significantly associated with BMI (χ^2=12.772, p=0.011) and body fat percentage (χ^2=37.294, p<0.001). Majority of the respondents who reported consume meat weekly or less had normal BMI (75%) and body fat percentage (80.4%). These findings were consistent with prior research, such as Barnes et al. (2015) and Murakami and Livingstone (2016), which also revealed a significant relationship between snack consumption frequency and BMI in young adults and the increased risk of overweight in US adults, respectively. Moreover, Costa et al. (2017) indicated a positive correlation between the consumption of processed foods, such as sweets, soda, and crisps, and elevated body fat percentages.

The high intake of processed snacks containing excess calories may contribute to increased BMI and body fat percentages. Frequent consumption of these snacks can lead to a caloric surplus, which the body may store as fat, leading to an increase in BMI and body fat percentage (Singh S et al., 2021). According to the CDC (2022), chocolates, sweets, and soda/juice are high in added sugars. Regular consumption of these snacks may cause a surge in blood sugar levels, prompting the body to release insulin. Prolonged insulin spikes can lead to insulin resistance, which is linked to obesity and an increase in body fat (Costa et al, 2017).

5.6.7 Breakfast consumption associated with BMI and body fat percentage.

The present study reported that the breakfast consumption was significantly associated with BMI (χ^2=37.294, p=0.008). Majority of the respondents (70.6%) who reported consume breakfast daily had normal BMI. Consistent finding was observed among Kuwaiti adolescents, demonstrated that breakfast intake less than five times per week is linked to a higher risk of obesity and being overweight (Aldwairji, 2018). On the other hand, present study revealed that there was no significant association between breakfast consumption with body fat percentage (χ^2=2.789, p=0.269). However, this finding was inconsistent with previous study, which showed that there were significant association between breakfast consumption and body fat percentages (Li et al., 2011).

Several credible explanations exist that could explain this phenomenon. For instance, daily breakfast consumption may lead to increased physical activity, as people who eat breakfast tend to have more energy and feel more motivated to be active throughout the day, resulted in the decreased of BMI and body fat percentages (Li et al., 2011). Besides, daily breakfast consumption can help to reduce overall energy intake by reducing hunger and preventing overeating later in the day. On the other hand, skipping breakfast can lead to increased hunger and a greater likelihood of overeating later in the day, which can contribute to a higher BMI. Nurul-Fadhilah et al. (2013) indicated that eating breakfast can help to kickstart the metabolism and regulate blood sugar levels. This can help to improve the body's ability to burn calories and prevent the storage of excess fat. Therefore, further studies are necessary to confirm the association between breakfast consumption and body fat percentages.

5.6.8 Type of bread intake associated with BMI and body fat percentage.

The current study has found a significant association between type of bread consumption and BMI (χ^2=22.616, p<0.001). Majority of the respondents (79%) who reported consume whole wheat bread or crispbread had normal BMI. Whole grain bread was shown to prevent an increase in BMI. This finding is consistent with previous research, such as that conducted by Maki et al. (2019), who reported that a higher intake of whole grains has an inverse relationship with BMI among the adult population. Additionally, the present study also revealed a significant association between the type of bread consumed and body fat percentage (χ^2=13.098, p=0.008). Majority of the respondents (81.6%) who

reported consume whole wheat bread or crispbread had normal body fat percentage. This finding is consistent with study performed by McKeown et al. (2009), who reported that whole-grain sources are linked to a reduced overall body fat percentage.

Several plausible explanations exist to explain these phenomena. For example, whole grain bread has a lower glycemic index than refined grain bread, meaning that it causes a slower and more sustained rise in blood sugar levels. This can result in improved insulin sensitivity and reduced fat storage (Du et al., 2009). Furthermore, Milesi, Rangan, and Grafenauer (2022) indicated that whole grain bread is more nutrient-dense than refined grain bread, containing more vitamins, minerals, and antioxidants that can support overall health and reduce inflammation. Inflammation can contribute to obesity and other chronic health conditions, and thus reducing inflammation through the consumption of whole grain bread may promote weight loss. Additionally, whole grain bread is also a rich source of dietary fiber, which can increase satiety and reduce overall calorie intake. The fiber in whole grains slows down digestion and keeps individuals feeling full for longer, leading to a reduction in food cravings and snacking. Ultimately, this can result in a decrease in overall calorie intake, leading to weight loss and a decrease in body fat (Serra-Majem and Bautista-Castaño, 2015).

5.6.9 Frequency of dairy consumption associated with BMI and body fat percentage.

The present study has shown a significant association between the frequency of dairy consumption and BMI (χ^2=9.760, p=0.042), Majority of the respondents (78.95%) who reported consume dairy product daily or more had normal BMI. This outcome is consistent with previous research findings. Several studies have reported that consuming dairy products is associated with a lower risk of obesity (Chiang and Pan, 2021; Wang, Wu and Zhang, 2016; Feng et al., 2022). However, the present study revealed no significant association between the frequency of dairy consumption and body fat percentage (χ^2=3.548, p=0.476). This finding is inconsistent with previous studies that suggest individuals who consume more dairy products tend to have less body fat (Teegarden, 2005). Similarly, Leiu et al. (2020) found that low consumption of dairy products may contribute to higher body fat percentage and lead to vitamin D deficiency.

In fact, dairy products are a good source of high-quality protein, which can promote feelings of fullness and reduce hunger, thereby preventing overeating and contributing to weight loss or maintenance. Additionally, dairy products are a good source of calcium, which may play a role in weight regulation. Higher calcium intake has been associated with lower body weight and body fat percentage in several studies (Teegarden, 2003; Caroline et al., 2005; Sigal Eilat-Adar et al., 2007; Zhang et al., 2019). Moreover, some dairy products, such as yogurt and kefir, contain probiotics that can help promote a healthy gut microbiome, which may be associated with a lower risk of obesity and

metabolic disorders (Wang, Wu and Zhang, 2016). Taken together, high dairy consumption seems to be associated with a lower risk of obesity and lower body fat percentage. Hence, future research is needed to validate the link between dairy consumption and body fat percentage.

5.6.10 Types of milk consumption associated with BMI and body fat percentage.

The present study revealed that the types of milk consumption (full fat, reduced fat, low fat) was significantly associated with BMI ($\chi 2=15.218$, $p=0.003$). and body fat percentage ($\chi 2=15.192$, $p=0.004$). These findings are consistent with previous research conducted among adults, which demonstrated that milk-fat differences were associated with changes in BMI and adiposity (Wilkinson et al., 2021). Similarly, Alonso et al. (2009) investigated the effects of consuming either low-fat or high-fat dairy products on body weight in young adults and found that individuals who consumed high-fat dairy products had a significant increase in body weight compared to those who consumed low-fat dairy products. This result was supported by Aragon et al. (2017), who suggested that whole-fat or high-fat milk had a higher caloric content compared to low-fat or skim milk. When the body receives an excess of calories over time, it is more likely to store the extra calories as fat, which can contribute to the development of increased body fat stores and BMI.

5.6.11 Types of spread used in sandwich associated with BMI and body fat percentage.

The present study reported that the type of spread used in a sandwich was not significantly associated with BMI (χ^2=7.958, p=0.093). However, this finding was inconsistent with a previous study by Tell et al. (2022), which found that the use of butter or margarine as a sandwich spread was significantly associated with BMI. Moreover, other relevant studies have indicated a significant association between sandwich consumption and obesity (Mohammadbeigi et al., 2018). The possible reason for the lack of association in the present study could be attributed to differences in study populations, which may have different eating habits. For example, Zainuddin et al. (2023) demonstrated that sandwich consumption among university students in Malaysia contributed the least portion in the study.

On the other hand, the present study revealed that the type of spread used in a sandwich was significantly associated with body fat percentage (χ^2=28.339, p<0.001). To date, there has been no prior research that has specifically investigated the relationship between these two variables. However, this finding can be explained by Górska-Warsewicz et al. (2019), as butter has a higher fat content than margarine. Butter is made from milk or cream and contains about 80% fat, while margarine is typically made from vegetable oil and contains around 60-70% fat. Margarines with plant sterols will have a lower overall fat content compared to regular margarine due to the addition of plant sterols (Law, 2000). In this case, consuming excess fat can lead to an increase in body fat, as

fat is a high-calorie macronutrient. Consuming more calories than the body needs for energy can lead to weight gain and an increase in body fat over time. This is because when the body consumes more calories than it needs for energy, it stores the excess calories as fat in adipose tissue (Rolls, 2000).

5.6.12 Types of cooking oil associated with BMI and body fat percentage.

The present study found no significant association between the type of cooking oil and BMI (χ^2=10.037, p=0.064) or body fat percentage (χ^2=3.701, p=0.445). To date, no prior research has specifically investigated the relationship between these variables. However, Thomas, Cha and Kim (2020) demonstrated that vegetable oils such as olive oil, perilla oil, and safflower oil have anti-obesity effects. According to Górska-Warsewicz et al. (2019), the fat content in butter is higher than that in margarine. Butter is derived from milk or cream and typically contains approximately 80% fat. In contrast, margarine is commonly produced from vegetable oil and usually contains between 60-70% fat. It is worth noting that margarines containing plant sterols tend to have a lower overall fat content than regular margarine because of the added plant sterols (Law, 2000). However, Warwick (2020) demonstrated that even though butter and margarine have different ingredients, both can contain significant quantities of diverse types of fats. In this case, the consumption of excessive amounts of fat can lead to weight gain and an increased likelihood of developing obesity. Although research on the relationship between cooking oil and BMI or body fat percentage is limited, it is plausible to hypothesize that the fat content in different types of cooking oils may affect BMI and body fat percentage. Hence,

further research is required to validate the link between type of cooking oils with BMI and body fat percentage.

5.6.13 Salt intake associated with BMI and body fat percentage.

The present study reported that there was no significant association between salt intake and BMI (χ^2=2.754, p=0.293) and body fat percentage (χ^2=0.466, p=0.874). However, this finding was inconsistent with a study by Ma, He and MacGregor (2015), which revealed that increased salt consumption was significantly associated with increased body fat mass and BMI in both children and adults. The discrepancy in results could be explained by the fact that high sodium intake has been linked to increased appetite and decreased satiety, leading to overeating and weight gain over time. This effect may be due to the fact that sodium is often present in highly processed, calorie-dense foods that are low in nutrients and high in fat, sugar, and refined carbohydrates (Kang et al., 2016).

In addition, high sodium intake can lead to water retention because sodium is an electrolyte that regulates the balance of fluids in the body. When there is too much sodium in the body, it can cause the body to hold onto water, leading to bloating and weight gain. Zhang et al. (2018) suggested that high salt intake has been associated with insulin resistance, which can lead to weight gain and an increased risk of type 2 diabetes. Insulin resistance occurs when cells in the body become less responsive to the hormone insulin, which regulates blood sugar levels. This can cause the body to produce more insulin, leading to

increased fat storage and weight gain. Therefore, further studies are necessary to confirm the association between salt intake and BMI and body fat percentage.

5.7 Significance of results

Despite there are plenty of studies investigated the association between lifestyle, dietary intake with body mass index (BMI), it is critical to recognise that the BMI inability to differentiate between lean and fat mass (Arvin Raj Goonasegaran, Fatin Nabila and Nurul Shuhada Shuhada, 2012). A variety of factors such as sex, age, ethnicity, and muscle mass can influences the BMI results (Kam, 2012). Hence, this study showed that lifestyle and dietary intake can lower the risk of hyperlipidemia rather than BMI. In order to proactively prevent obesity-related diseases and the detrimental consequences associated with high body fat, it is crucial to increase the emphasis placed on promoting healthy lifestyle and dietary habits among university students. Furthermore, the findings of this study can serve as a valuable reference point for future researchers seeking to explore related topics. Additionally, public health authorities can leverage the information provided to design effective nutrition promotion initiatives in the future.

5.8 Strengths and Limitations

Regarding the strengths of the study, the Kampar campus UTAR students were subjected to a validated questionnaire to determine the association between dietary intake, lifestyle with BMI and body fat percentages. Questionnaires that have been validated are especially important to ensure that the data collected is reliable, accurate and is not influenced by measurement errors. Besides, the anthropometry data was collected through physical measurement. Physical measurements taken during anthropometry can be highly precise and accurate, which means that they can provide detailed and reliable information about an individual's body composition and health status.

Despite the strengths, the researcher acknowledged several limitations in the study. As the study was conducted using a cross-sectional methodology, the data was obtained at a singular time point, precluding the ability to establish longitudinal relationships between the variables under consideration. Furthermore, the study employed a convenience sampling technique, which may have led to selection bias, while also failing to provide equitable representation of the target population. Most participants were Chinese, and affiliated with the Faculty of Science, thereby impeding the generalizability of the findings to the broader Malaysian populace comprising various ethnic groups. Moreover, although the validated questionnaire was guided self-administer, there still a possibility that respondents experienced memory relapse and recall bias especially the short 15 FFQ, which could lead to either overreporting or underreporting of the data.

5.9 Future Recommendations

Prospective longitudinal studies may be performed to monitor a cohort of university students, tracking their dietary intake, lifestyle and their influence on Body Mass Index (BMI) and body fat percentages over an extended period. This method of study allows for the observation of changes in individual behavior and the relationship between variables over time. Besides, strata random sampling method is recommended to use instead of convenience sampling as it provides a more accurate representation of the population being studied. By dividing the population into subgroups based on relevant characteristics such as age, gender, or socioeconomic status, the sample can be selected in a way that reflects the diversity of the population. This approach ensures that the results of the study are more generalizable to the target population. To obtain a more precise measure of daily dietary intake, it is advisable to utilize a three-day food record or a comprehensive food frequency questionnaire (FFQ) that covers various food groups. These assessments are preferred as they can provide a more accurate estimation of an individual's typical dietary habits, leading to a more accurate measure of daily dietary intake.

CHAPTER 6

CONCLUSION

In conclusion, the present study explores the association between dietary intake, lifestyle with body mass index and body fat percentage among UTAR students. Based on the results, there is a significant association between BMI and body fat percentage, lifestyle with BMI, lifestyle with body fat percentage, and dietary intake with BMI among UTAR Kampar students, thus, the null hypothesis is rejected. However, there is no association between dietary intake and body fat percentage among UTAR Kampar students, thus, failed to reject the null hypothesis.

These results highlight the importance of promoting healthy dietary habits and an active lifestyle among college students. Educational interventions aimed at increasing awareness of the importance of healthy eating and physical activity could be implemented to improve the health and well-being of college students. Further research is needed to determine the most effective interventions to promote healthy lifestyle behaviors among college students.

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APPENDICES

APPENDIX A

Ethical Approval Letter

UNIVERSITI TUNKU ABDUL RAHMAN DU012(A)
Wholly owned by UTAR Education Foundation Co. No. 578227-M

Re: U/SERC/80/2023

30 March 2023

Dr Teh Lai Kuan
Head, Department of Allied Health Sciences
Faculty of Science
Universiti Tunku Abdul Rahman
Jalan Universiti, Bandar Baru Barat
31900 Kampar, Perak.

Dear Dr Teh,

Ethical Approval For Research Project/Protocol

We refer to the application for ethical approval for your students' research projects from Bachelor of Science (Honours) Dietetics programme enrolled in course UDDN3108. We are pleased to inform you that the application has been approved under Expedited Review.

The details of the research projects are as follows:

No	Research Title	Student's Name	Supervisor's Name	Approval Validity
1.	Association Between Adherence to Mediterranean Diet, Perceived Stress and Body Mass Index (BMI) Among UTAR Students	Lee Yong Khang	Ms Fiona Lim Wei Ting	30 March 2023 – 29 February 2024
2.	Eating Habits and Physical Activity Level in Relation to BMI Among University Students in Malaysia	Loh Zi Xiang		
3.	Association of Dietary Intake, Lifestyle with BMI and Fat Adiposity Among UTAR Kampar Student	Teo Lim Ang		

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

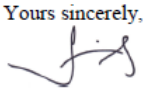
(4) Written consent be obtained from the institution(s)/company(ies) in which the physical or/and online survey will be carried out, prior to the commencement of the research.

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
Tel: (605) 468 8888 Fax: (605) 466 1313
Sungai Long Campus : Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor Darul Ehsan, Malaysia
Tel: (603) 9086 0288 Fax: (603) 9019 8868
Website: www.utar.edu.my

Should the students collect personal data of participants in their studies, please have the participants sign the attached Personal Data Protection Statement for records.

Thank you.

Yours sincerely,



Professor Ts Dr Faidz bin Abd Rahman
Chairman
UTAR Scientific and Ethical Review Committee

c.c Dean, Faculty of Science
Director, Institute of Postgraduate Studies and Research

APPENDIX B

QUESTIONNAIRE

1. Acknowledgment of notice *

Mark only one oval.

- ◯ I have been notified and that i hereby consented, understood and agreed to participate in this research study.
- ◯ I disagreed to participate in this research study.

2. Email *

_____

Section A : Sociodemographic characteristics

There are 4 sociodemographic questions in this section. You are required to answer all the questions. Thank you.

3. Gender *

Mark only one oval.

- ◯ Female
- ◯ Male

4. Age *

Mark only one oval.

- ◯ 18
- ◯ 19
- ◯ 20
- ◯ 21
- ◯ 22
- ◯ 23
- ◯ 24
- ◯ 25

5. **Ethnicity** *

Mark only one oval.

- Chinese
- Malay
- Indian

6. Faculty *

Mark only one oval.

- FAS
- FBF
- FEGT
- FICT
- FSC
- CFS
- ICS

Section B: Anthropometry data

Weight is measured manually by weighing scale , height is measured by stadiometer.

7. Weight *

_____

8. Height *

_____

9. Body mass index *

Classification	BMI (kg/m^2)	Risk of comorbidities
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5–24.9	Average
Overweight (preobese)	25.0–29.9	Mildly increased
Obese	≥30.0	
Class 1	30.0–34.9	Moderate
Class 11	35.0–39.9	Severe
Class 111	≥40.0	Very severe

Mark only one oval.

- ◯ Below 18.5 kg/m2
- ◯ 18.5 -24.9 kg/m2
- ◯ 25.0-29.9 kg/m2
- ◯ 30.0- 34.9 kg/m2
- ◯ 35.0-39.9 kg/m2
- ◯ Above 40 kg/m2

10. Percentage of body fat *

Gender	Age	Low (–)	Normal (0)	High (+)	Very High (++)
Female	20-39	< 21.0	21.0 - 32.9	33.0 - 38.9	≥ 39.0
	40-59	< 23.0	23.0 - 33.9	34.0 - 39.9	≥ 40.0
	60-79	< 24.0	24.0 - 35.9	36.0 - 41.9	≥ 42.0
Male	20-39	< 8.0	8.0 - 19.9	20.0 - 24.9	≥ 25.0
	40-59	< 11.0	11.0 - 21.9	22.0 - 27.9	≥ 28.0
	60-79	< 13.0	13.0 - 24.9	25.0 - 29.9	≥ 30.0

Mark only one oval.

- Low
- Normal
- High
- Very high

Simple Lifestyle Indicator Questionnaire

Diet
To answer these questions, think about your eating habits in the past year.
Indicate how often you eat the following foods. Please include all meals, snacks and eating out

11. Lettuce or green leafy salad, with or without other vegetables *

Mark only one oval.

- less than 1/week
- 1/week
- 2-3x/week
- 4-6x/week
- once/day
- 2+/day

12. Fruit: include fresh, canned or frozen, but do not include juices *

Mark only one oval.

- ◯ less than 1/week
- ◯ 1/week
- ◯ 2-3x/week
- ◯ 4-6x/week
- ◯ once/day
- ◯ 2+/day

13. High fiber cereals or whole grain breads: this includes cereal such as Raisin bran, Fruit and Fiber, cooked oatmeal, and breads which are whole wheat, multigrain, rye or pumpernickel *

Mark only one oval.

- ◯ less than 1/week
- ◯ 1/week
- ◯ 2-3x/week
- ◯ 4-6x/week
- ◯ once/day
- ◯ 2+/day

Exercise

To answer the following questions please indicate how many times per week you take part in the following activities for a duration of at least 30 minutes or more at a time

14. Light exercise, such as:
light gardening and light housework (dusting, sweeping, vacuuming)
leisurely walking (walking your dog)
bowling, fishing, carpentry, playing a musical instrument
volunteer work

Mark only one oval.

- ◯ 0/week
- ◯ 1-3x/week
- ◯ 4-7x/week
- ◯ 8 and more/week

15. Moderate exercise, for example: *
brisk walk
bicycling, skating, swimming, curling
gardening (raking, weeding, spading)
dancing, Tai Chi or moderate exercise classes

Mark only one oval.

- ◯ 0/week
- ◯ 1-3x/week
- ◯ 4-7x/week
- ◯ and more/week

16. Vigorous exercise, for example: *

running, bicycling, x-country skiing, lap swimming, aerobics
heavy yard work
weight training
soccer, basketball or other league sports

Mark only one oval.

- ◯ 0/week
- ◯ 1-3x/week
- ◯ 4-7x/week
- ◯ 8 and more/week

Alcohol

Please indicate how many drinks of the following types of alcohol you consume in an **average week**

17. Wine: _____ drinks (3-5 oz.) *

_____

18. Beer: _____ drinks (10-12 oz or 1 bottle) *

_____

19. Spirits: ____ drinks (1-1 ½ oz.) *

_____

Smoking

Please indicate your smoking habits below:

20. Are you a smoker? *

Mark only one oval.

- ◯ Yes
- ◯ No

21. If yes, how long have you been smoking?

_____

22. If no, did you ever smoke? *

Mark only one oval.

- ◯ Yes
- ◯ No

23. If yes, how many years ago did you quit?

_____

Life Stress

To answer this question please Click the number which you feel best corresponds to the level of stress in your everyday life

24. Stress level *

Mark only one oval.

Not at all stressful

1
2
3
4
5
6

Very sterssful

Section D: Short 15-Item Food Frequency Questionnaire

This section include 15 questions. It is required to

screening the risk of poor dietary patterns . You are required to answer all the questions. Thank you.

25. **How often do you eat vegetables (fresh, frozen, or cooked)?** *

Mark only one oval.

- Twice a day or more often
- Once a day

26. **How often do you eat fruit and/or berries (fresh, frozen, preserved, juice, etc.)?** *

Mark only one oval.

- ◯ Twice a day or more often
- ◯ Once a day
- ◯ A few times a week
- ◯ Once a week or less

27. **How often do you eat nuts (almonds, peanuts, hazelnuts, pistachio nuts, pine nuts, walnuts, cashews)?** *

Mark only one oval.

- ◯ Twice a day or more often
- ◯ Once a day
- ◯ A few times a week
- ◯ Once a week or less

28. **How often do you eat fish or shellfish?** *

Mark only one oval.

- ◯ Three times a week or more often
- ◯ Twice a week
- ◯ Once a week
- ◯ A few times a month or less

29. **How often do you eat red meat (beef, pork, or game)?** *

Mark only one oval.

- ◯ Three times a week or more often
- ◯ Twice a week
- ◯ Once a week
- ◯ A few times a month or less

30. **How often do you eat white meat (poultry e.g. chicken)?** *

Mark only one oval.

- ◯ Three times a week or more
- ◯ Twice a week
- ◯ Once a week
- ◯ A few times a month or less

31. **How often do you eat buns/cakes, chocolate/sweets, crisps or soda/juice?** *

Mark only one oval.

- ◯ Twice a day or more often
- ◯ Once a day
- ◯ A few times a week
- ◯ Once a week or less

32. How often do you eat breakfast? *

Mark only one oval.

- ◯ Every day
- ◯ Almost every day
- ◯ A few times a week
- ◯ Once a week or less

33. Do you eat bread daily *

Mark only one oval.

- ◯ I don't eat bread
- ◯ I eat bread

34. What type(s) of bread do you eat?

if i don't eat bread, move on

Mark only one oval.

- ◯ White bread
- ◯ Whole wheat bread (labeled as high-fiber, low fat, and low sugar)
- ◯ Crispbread
- ◯ Other: _____

35. How often do you drink/eat milk, sour milk and/or yoghurt? *

Mark only one oval.

- ◯ Twice a day or more often
- ◯ Once a day
- ◯ A few times a week
- ◯ Once a week or less

36. What type of milk, sour milk and/or yoghurt do you usually drink/eat? *

Mark only one oval.

- ◯ Whole / full fat (3%)
- ◯ Semi-skimmed / reduced fat (1.5%)
- ◯ Skimmed / low fat (0.5%) or non-fat (0.1%)

37. What kind of spread do you usually use on sandwiches? *

Mark only one oval.

- ◯ Butter
- ◯ Spread containing 75% fat
- ◯ Margarine
- ◯ Spread made with seed and plant oils containing 70% fat
- ◯ Low-fat margarine containing 30-40% fat
- ◯ Margarine with plant sterols

38. What kind of fat do you usually use for cooking at home? *

Mark only one oval.

- ◯ Butter
- ◯ Margarine containing 60-80% fat
- ◯ Cooking margarine
- ◯ Margarine made with seed and plant oils
- ◯ Liquid margarine
- ◯ Vegetable oil, e.g. rapeseed oil, olive oil, corn oil, sunflower oil

39. Do you usually add salt to your food? *

Mark only one oval.

- No
- Yes, sometimes
- Yes, often
- Yes, I always add salt before I taste the food

Appendix C

FM-IAD-005 Form

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 1	Effective Date: 3/10/2019	Page No.: 1of 1

FACULTY OF

Full Name(s) of Candidate(s)	Teo Lim Ang
ID Number(s)	20ADB04135
Programme / Course	BACHELOR OF SCIENCE (HONOURS) DIETETICS
Title of Final Year Project	ASSOCIATION OF DIETARY INTAKE AND LIFESTYLE WITH BODY MASS INDEX AND BODY FAT PERCENTAGE AMONG UNIVERSITY TUNKU ABDUL RAHMAN

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: 18 **% Similarity by source** Internet Sources: 15 % Publications: 10 % Student Papers: 0 %	
Number of individual sources listed of more than 3% similarity: 0	
Parameters of originality required and limits approved by UTAR are as follows: (i) **Overall similarity index is 20% and below, and** (ii) **Matching of individual sources listed must be less than 3% each, and** (iii) **Matching texts in continuous block must not exceed 8 words** ***Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.***	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Fiona

Signature of Supervisor
Name: Fiona Lim Wei Ting

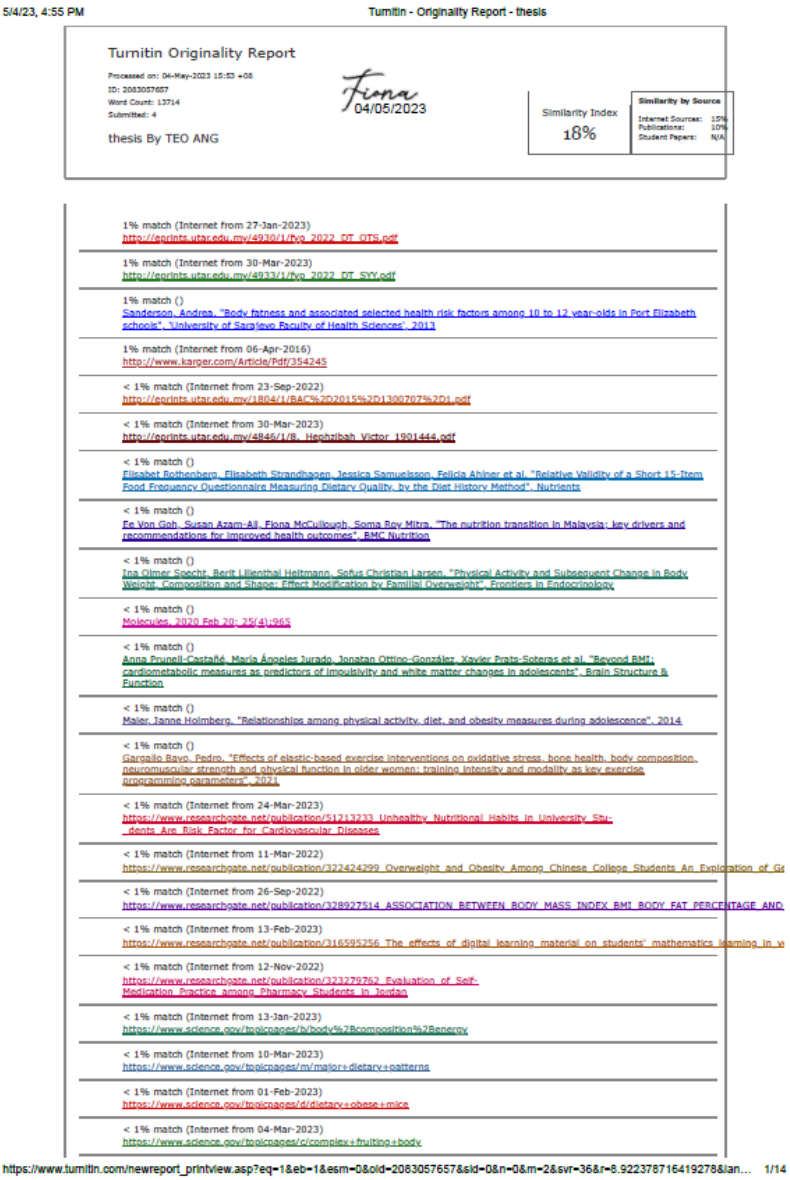
Date: 04/05/2023

Signature of Co-Supervisor
Name: _____

Date: _____

Appendix D

Summary page of the Turnitin Originality Report



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