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UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF ENGINEERING
SCHOOL OF COMPUTING
SEMESTER 2/20212022

SECI 2143 - Probability & Statistical Data Analysis
SECTION 02

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PROJECT 1: A Study On Obesity Among Teenagers

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1.0 Introduction

Overweight and obesity among adolescents is a major public health problem that has been growing rapidly within the past few years. Obesity is a severe medical condition where excess fat is stored within the body which will cause the bodyweight of the individual to increase. Individuals can determine whether they are overweight or obese by measuring their Body Mass Index (BMI). BMI can be calculated by dividing weight (kilograms) with height (meters) squared. Those who have BMI greater than 30 can be identified as overweight or obese. The accumulated fat in the body will bring many detrimental effects to the health of the individual. For obese teenagers, they are more likely to have health consequences like high blood pressure, diabetes and heart diseases than their peers and will mostly remain obese in their adulthood. After learning more about this health concern and its negative effects, we are more aware of the importance of living a healthy lifestyle as well as wanting to investigate the deeper relationship between teenagers' lifestyles and obesity. Hence, we carried out a survey on the topic titled “A Study On Obesity Among Teenagers” and analyzed the collected data.

2.0 Methodology

Our group decided to use a survey method to collect our data. Respondents for our study are randomly selected teenagers and mainly students from Universiti Teknologi Malaysia (UTM). First, we prepared a Google Form that contains questions related to our study. Then the link of the Google Form is shared with our targeted respondents via WhatsApp groups and Telegram groups that have teenagers or UTM students. The data collected is then used to construct different graphical representations. Coding through R Studio can help us to create the graphical representation and we could follow up with the data analysis.

The table below shows the data collected, levels of data measurement and graphical representation used in this study

Data collected	Answers	Levels of Data Measurement	Graphical representation
Gender	Male/Female	Nominal	Pie Chart
Age	Metric Value	Ratio	Bar Chart
Height	Metric Value	Ratio	Histogram, Box Plot
Weight	Metric Value	Ratio	Histogram, Box Plot
BMI Classification	Underweight / Normal / Overweight / Obese / Extreme Obese	Ordinal	Pie Chart, Scatterplot
Rating of importance to maintain a healthy BMI	1(not important)/2/3/4/5(very important)	Ordinal	Frequency Distribution
Ways to control BMI	Physical Exercise / Dieting with Plan / Seek Medical Help / Directly Not Eating / No Awareness of BMI Control	Nominal	Pie Chart
Time spent on exercise in a week	0/1/2/3/4/5	Interval	Box Plot
Total monthly food expenses	Below RM300 / RM301-RM500 / RM500-RM800 / Above	Ordinal	Pie Chart

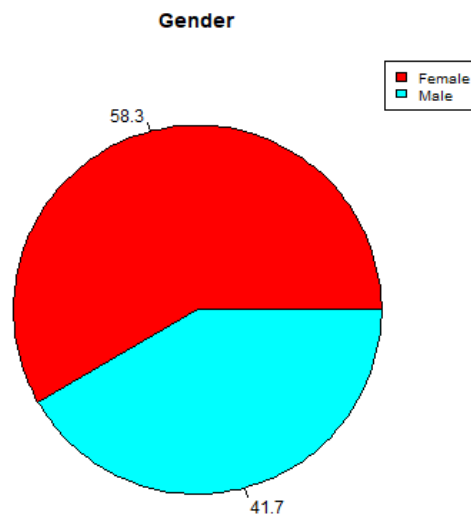
	RM800		
Number of meals in one day	0/1/2/3/4/5/6	Ratio	Frequency Distribution
Number of times eating unhealthy food in a week (McDonald, potato chips, dessert etc)	Never or Rarely / 1-2 times / 3-4times / 5 or more times	Ordinal	Pie Chart
Favorite type of food in the food pyramid	Bread, Cereals,Grains / Fruits and Vegetables / Milk,Cheese,Dairy / Meat and Fish / Snacks,Sweet,Fried Foods,Dessert	Nominal	Pie Chart
Main cause of obesity	Genes / Drugs /Unhealthy Eating Habits / Lack of Exercise / Stress / Environment	Nominal	Frequency Distribution, Pie Chart
Medical check up in a year	0/1/2/3/4	Ratio	Frequency Distribution
Rate the seriousness of public health problem in Malaysia	1(not serious)/2/3/4/5(very serious)	Ordinal	Frequency Distribution

3.0 Data analysis and result

This survey aims to determine the level of health awareness among teenagers in Malaysia. We had set several questions in our questionnaire to collect the data for further analysis. Our questions included the respondent's general information, which are gender, age, weight, and other habits of the respondent.

Respondent demography

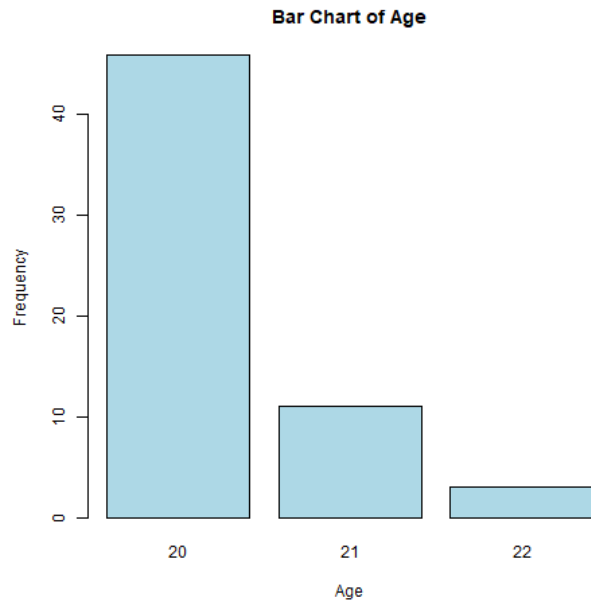
1. Respondent's gender



Pie Chart 1: Gender

From the pie chart above, most respondents are female (58.3%) and 41.7% of respondents are male.

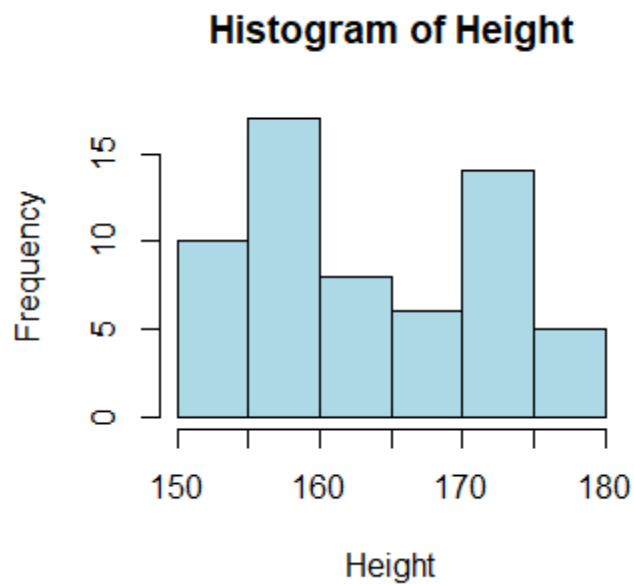
2. Respondent's age



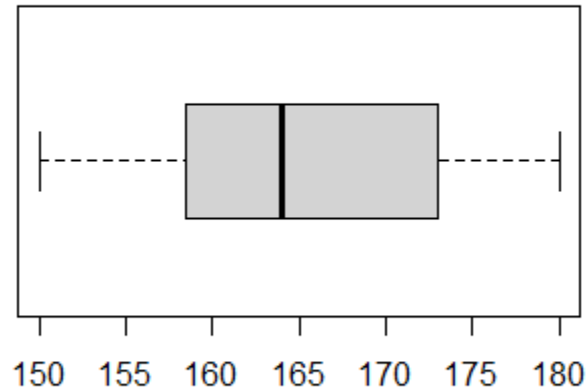
Bar Chart 1: Age

The age of most respondents is 20 years old (76.7%) in the survey, followed by 18.3% of respondents are 21 years old, and roughly 5% of respondents are 22 years old.

3. Respondent's height



Histogram 1: Height



Boxplot 1: Height

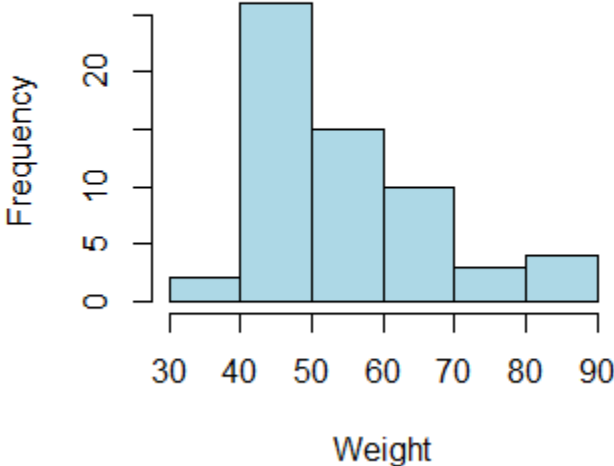
	Minimum value	First Quartile, Q1	Median, Q2	Third Quartile, Q3	Maximum Value	IQR	Mean	Outliers
Height (cm)	150	158.25	164	173	180	14.75	164.717	None

Table 1: The minimum, Q1, Q2, Q3, maximum value, interquartile range, mean and outliers of respondent's height

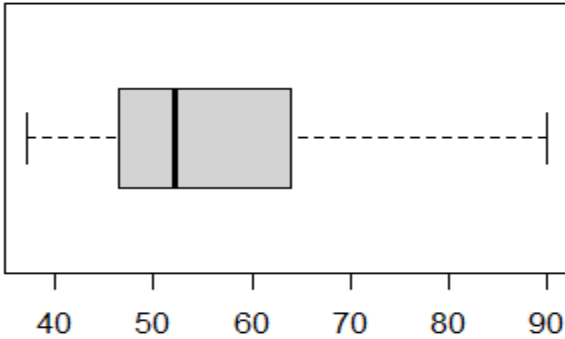
We can see that the median, first quartile, and third quartile are all in the range of 155 cm to 175 cm, and there are no outliers in the boxplot. The data above can be used to determine the average height of teenagers in Malaysia since the data was obtained from students, as mentioned above. To better understand their health condition, they had to calculate their relative BMI to determine whether they have a healthy body mass index (BMI).

4. Respondent's weight

Histogram of Weight



Histogram 2: Weight



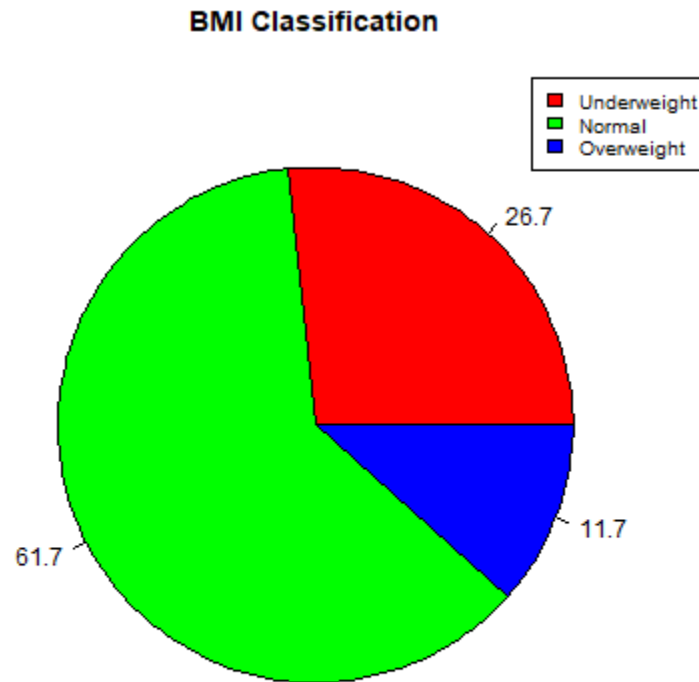
Boxplot 2: Weight

	Minimum value	First Quartile, Q1	Median, Q2	Third Quartile, Q3	Maximum Value	IQR	Mean	Outliers
Weight (kg)	37	46.25	52.25	64	90	17.75	56.247	None

Table 2: The minimum, Q1, Q2, Q3, maximum value, Interquartile range, mean and outliers of respondent's weight

The data obtained from the weight graph show that the weight of most respondents is between 40 to 90 kg. Respondents that weigh above 80 kg and below 40 kg are the minority. Most of the respondents weighed around 40 kg to 50 kg. The box plot shows the median, first quartile, and third quartile lie in between the range of 45 kg to 65 kg, with a median of roughly 53 kg, and there are no outliers in the boxplot.

5. Respondent's BMI classification



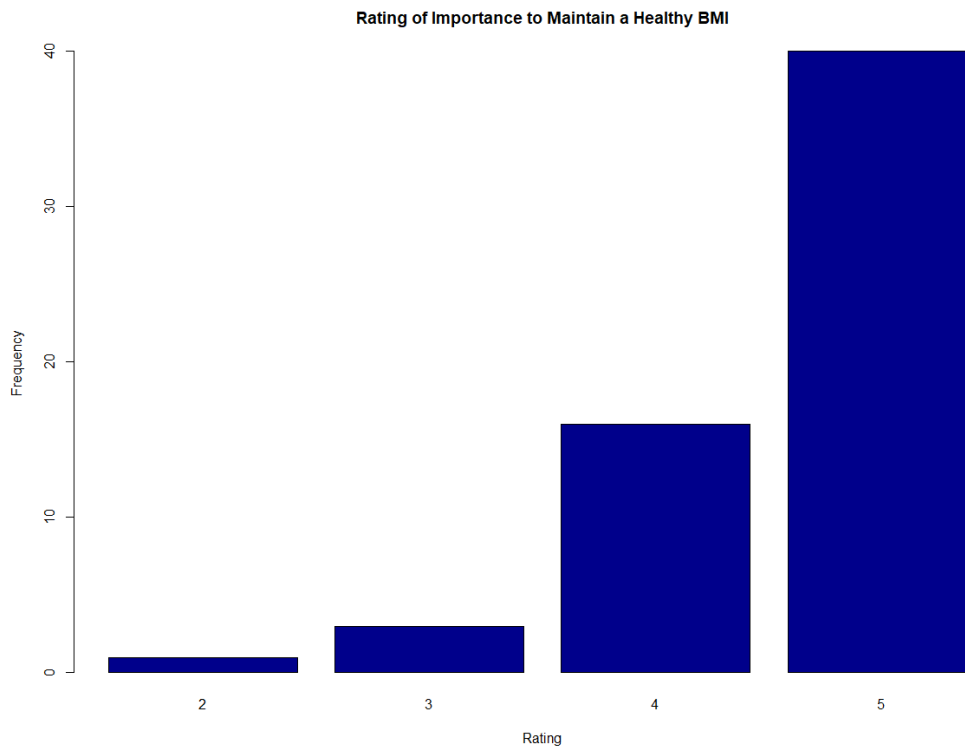
Pie chart 2: BMI Classification

The Body Mass Index (BMI) was calculated by using the formula: $BMI = \frac{kg}{m^2}$. From the pie chart of BMI, we can see that most of the respondents have a normal BMI (61.7%), which is within the range of 18.5 to 24.9, followed by those who are still slightly underweight with a BMI of less than 18.5 (26.7%). There are a small amount of respondents that have an overweight BMI between 25 to 29.9 (11.7%). In short, the data shows that an average teenager in Malaysia has a healthy BMI, but there are still a number of individuals who are underweight, and very few who are classified as overweight.

6. Rating of importance to maintain a healthy BMI

Rating	Frequency
1	0
2	1
3	3
4	16
5	40

Table 3: Rating of importance to maintain a healthy BMI



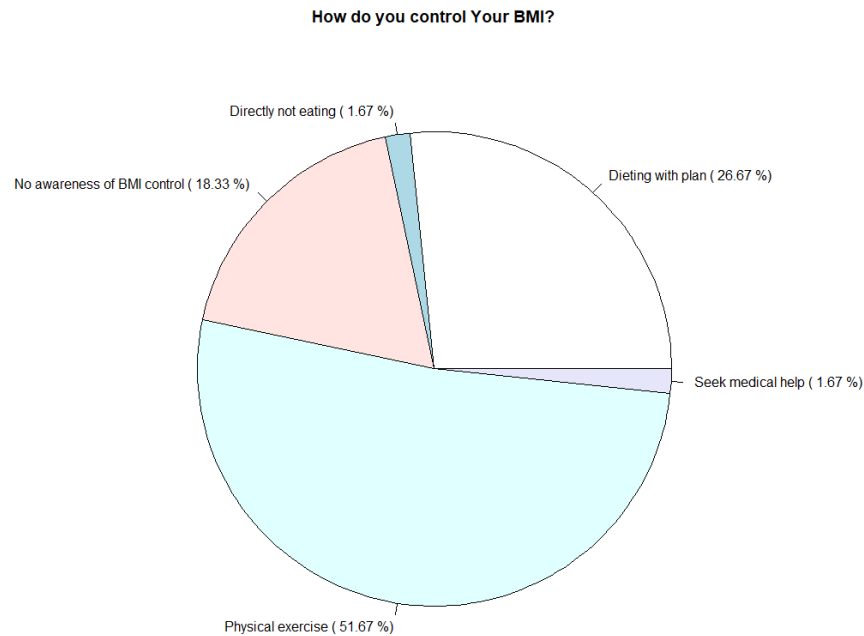
Bar Chart 2: Rating of importance to maintain a healthy BMI

Based on the bar chart above, the rating of importance to maintain a healthy BMI by 60 respondents is clearly shown. The mode for this bar chart is 5, which most of the respondents agree with it is important for humans to maintain a healthy BMI. Meanwhile, there is only 1 respondent partially agrees with this statement, which is 1.67%. Hence, based on the 40 respondents (66.67%) who strongly agree with the statement, and 0 respondents who disagree with the statement, it is important for us to maintain a healthy BMI.

7. How do respondent control their BMI?

Way	Frequency
Physical Exercise	31 (51.67%)
Dieting with plan	16 (26.67%)
Seek medical help	1 (1.67%)
Directly not eating	1 (1.67%)
No awareness of BMI control	11 (18.33%)

Table 4: How do you control your BMI?

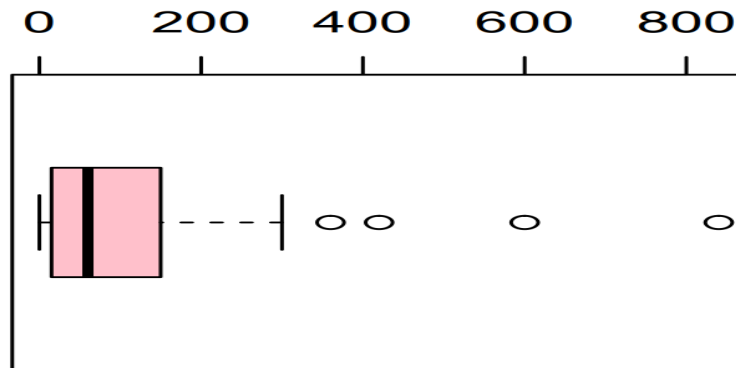


Pie Chart 3: How do you control your BMI?

Pie Chart above shows how the respondents control their BMI. There are 5 answers for respondents to choose which are doing physical exercise, dieting with a plan, seeking for medical help, directly not eating, and having no awareness of BMI control. Based on the pie chart above, 31 respondents (51.67%), which is most of the respondents are doing physical exercise to control their BMI. The second most respondents do in order to control their BMI is by dieting with a plan. Besides, 11 respondents (18.33%) do not have awareness of BMI control, and 1 of them (1.67%) directly do not eat to control their BMI.

8. Exercise time spent in a week

Exercise time spent in a week (in mins)



Boxplot 3: Time spent on exercise in a week (in minutes)

	Minimum value	First Quartile, Q1	Median, Q2	Third Quartile, Q3	Maximum Value	IQR	Mean	Outliers
Time Spending (mins)	0	15	60	150	840	135	114.42	360,420, 600,840

Table 5: The minimum, Q1, Q2, Q3, maximum value, Interquartile range, mean and outliers of time spent on exercise

The table shows the minimum, Q1, Q2, Q3, maximum, interquartile range, mean and outliers of time spent on exercise in a week while box plot above shows the time spending of 64 respondents on time spent on exercise in a week. The range of this box plot is from 0 minutes to 840 minutes. We can observe that the highest time spent on exercise in a week is 840 minutes whereas some of them are not even doing exercise. From the table, we can conclude that the respondents spend an average time of 114.42 minutes on exercise in a week. Since $Q3-Q2$ is higher than $Q2-Q1$, it is a positively skewed box plot.

9. Total monthly food expenses

Monthly Food Expenses	Frequency
Below RM300	22 (36.67%)
RM301-RM500	32 (53.33%)
RM501-RM800	5 (8.33%)
Above RM800	1 (1.67%)

Table 4: Total monthly food expenses



Pie Chart 4: Total Monthly Food Expenses

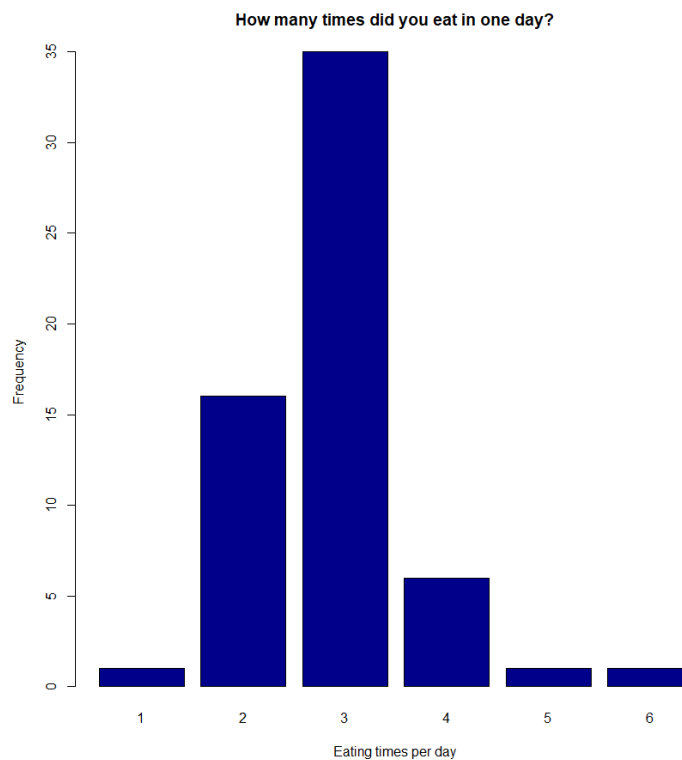
Pie chart above shows the total monthly food expenses by the 60 respondents. There are 4 choices for respondents to choose which included monthly expenses below RM300, between RM301 and RM500, between RM501 and RM800, and above RM 800. Based on the data obtained, most of the respondents spend RM301-RM500 on their monthly food expenses which are 32 respondents among 60 respondents (53.33%). Other than that, the second most monthly food expenses are below RM300, which is 22 respondents among 60 respondents (36.67%). 5

respondents (8.33%) spend RM501-RM800 on their total monthly food expenses, and 1 of the respondent (1.67%) spent above RM800 on food expenses in one month.

10. How many times respondent eat in one day

Eating Times Per Day	Frequency
1	1 (1.67%)
2	16 (26.67%)
3	35 (58.33%)
4	6 (10%)
5	1 (1.67%)
6	1 (1.67%)

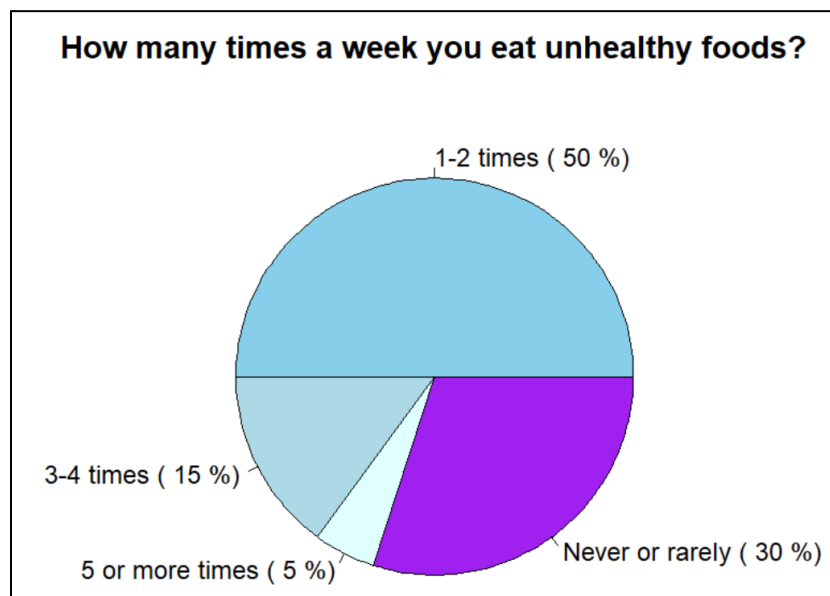
Table 5: How many times did you eat in one day?



Bar Chart 3: How many times did you eat in one day?

The bar chart above shows the total time that the respondents ate per day. There are 6 choices for the respondents to choose which are 1, 2, 3, 4, 5, and 6 times eating per day. The mode for this data is 3 eating times per day, which the frequency is 35 respondents per 60 respondents (58.33%). Besides, the number of respondents who eat 2 times per day is the second highest which is 16 respondents among 60 respondents (26.67%). Next, there are 6 respondents who have 4 eating times per day, which the percentage is 10%. Moreover, the total eating times for 1, 5 and 6 are the same, which is 1 respondent per 60 respondents (1.67%). In conclusion, most of them are having a normal eating frequency which they have 3 meals per day (58.33%).

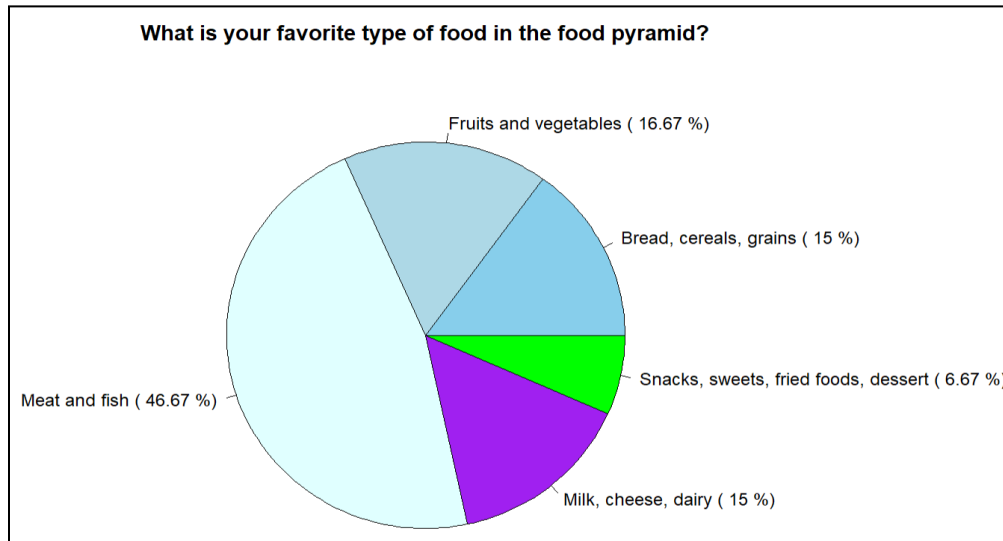
11. How many times of respondents eat unhealthy food in a week



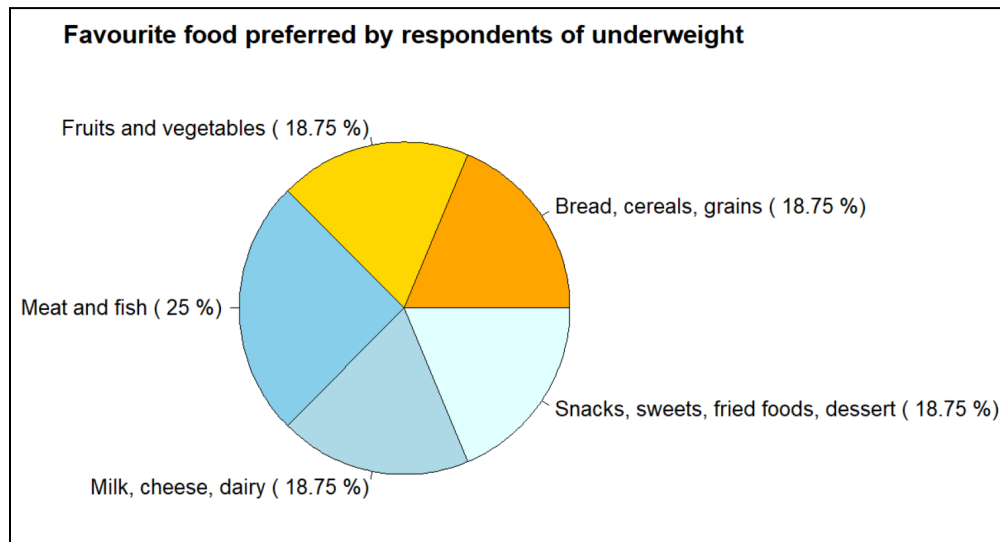
Pie chart 5: How many times a week do you eat unhealthy foods?

The pie chart shows the Data about How many times a week you eat unhealthy food such as fried foods, desserts and fast food. There is a total of 60 respondents are covered in this statistical survey. According to the pie chart, about 50% which is 30 of the respondents eat 1 or 2 times unhealthy food in a week. Among the respondents, 30% of the respondents which is 18 respondents never or rarely eat unhealthy foods. Meanwhile, out of 60 respondents, there are 9 respondents who eat unhealthy foods 3 or 4 times a week. There are 3 respondents who eat unhealthy food 5 or more times a week which occupied 5% of the pie chart.

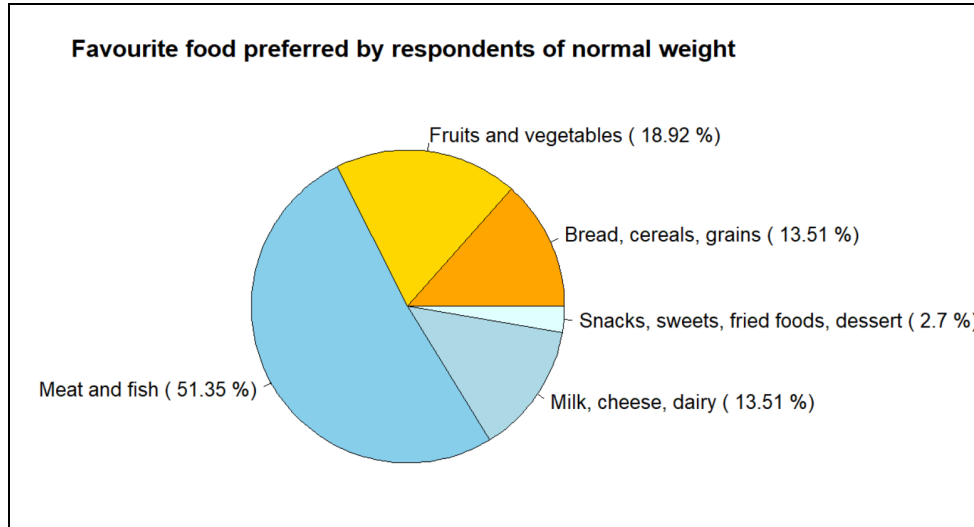
12. The favourite food of the respondents of different BMI in the food pyramid



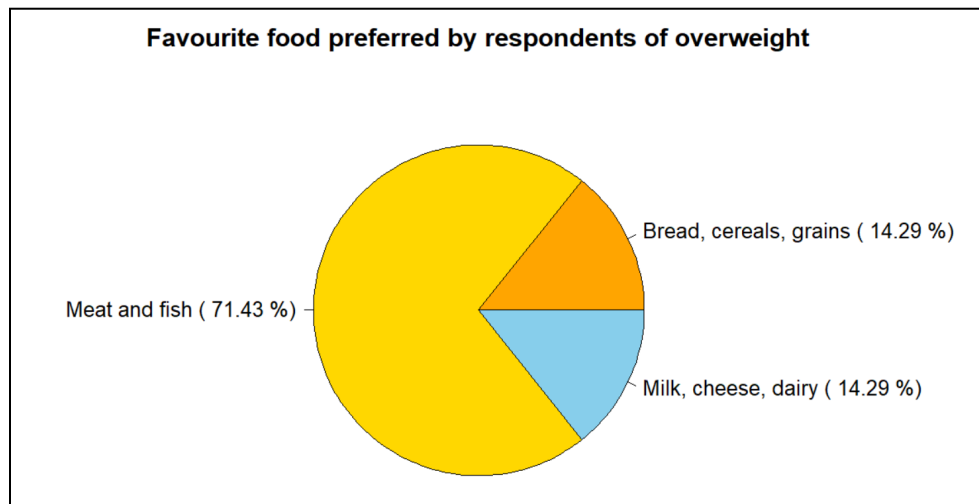
Pie chart 6: the favourite food of all BMI level respondents in the food pyramid



Pie chart 7: the favourite food of underweight respondents in the food pyramid



Pie chart 8: the favourite food of all normal weight respondents in the food pyramid



Pie chart 9: the favourite food of all overweight respondents in the food pyramid

From the pie chart 6, we can observe that the respondents whether are underweight, normal weight or overweight, most of them prefer meat and fish in the food pyramid. It is overall occupied 46.67% of all the respondents, 25% of the respondents in underweight BMI level, 51.35% of the respondents in normal-weight BMI level and 71.43% of the respondents in overweight BMI level.

According to pie chart 7, we can observe snacks, sweets, fried foods and desserts have the least percentage of respondents chosen. It is overall occupied 6.67% of all the respondents, 18.75% of the respondents in underweight BMI level, 2.7% of the respondents in normal-weight BMI level and no respondents in overweight BMI level choose the above foods in the food pyramid.

From the pie chart of underweight respondents' favourite foods, this statistical survey involved a total of 16 underweight respondents. 25% of the respondents preferred meat and fish, and the other foods in the food pyramid occupied 18.75% of the respondents respectively.

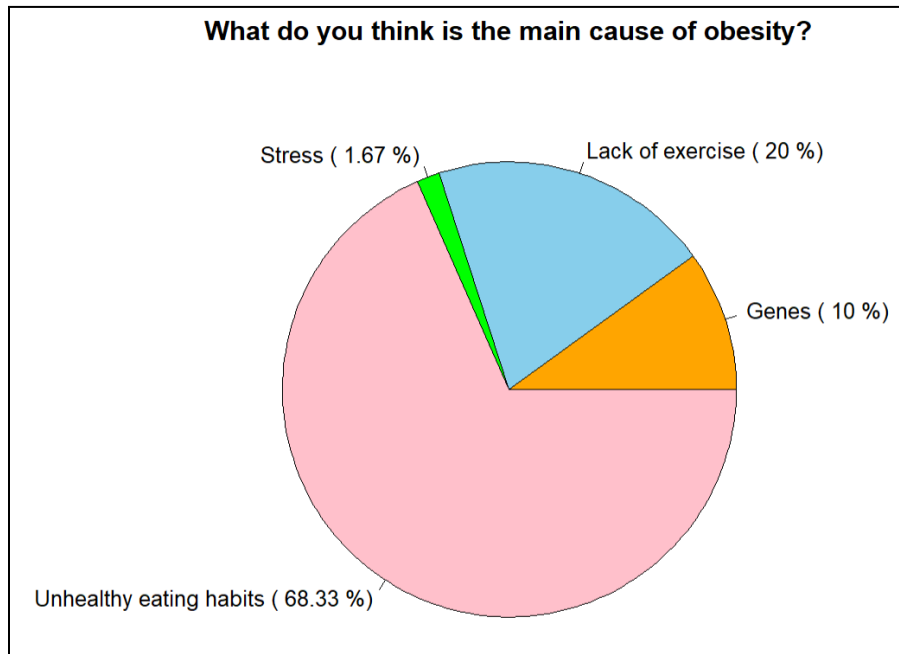
Pie chart 8 shows the favourite foods preferred by the normal weight respondents, there are 37 respondents covered in this statistical survey. Meat and fish have the largest percentage which is 51.35%. The second-largest percentage is vegetables and fruits (18.92%). The remaining percentage of favourite foods preferred by normal-weight respondents is 13.51% for milk, cheese, and dairy, 13.51% for bread, cereal, grain, 2.7% for snacks, sweets, fried foods and dessert.

Pie chart 9 depicts the favourite food preferred by overweight respondents. There are 7 overweight respondents covered in this statistical survey. Meat and fish have occupied the most percentage of respondents in this pie chart which is 71.43%. Milk, cheese, dairy and bread, cereals, grains occupied 14.29% of respondents respectively.

13. What do you think is the main cause of obesity ?

CAUSES	FREQUENCY
Genes	6
Drugs	0
Unhealthy eating habits	41
Lack of exercise	12
Stress	1
Environment	0

Table 6: What do you think is the main cause of obesity ?



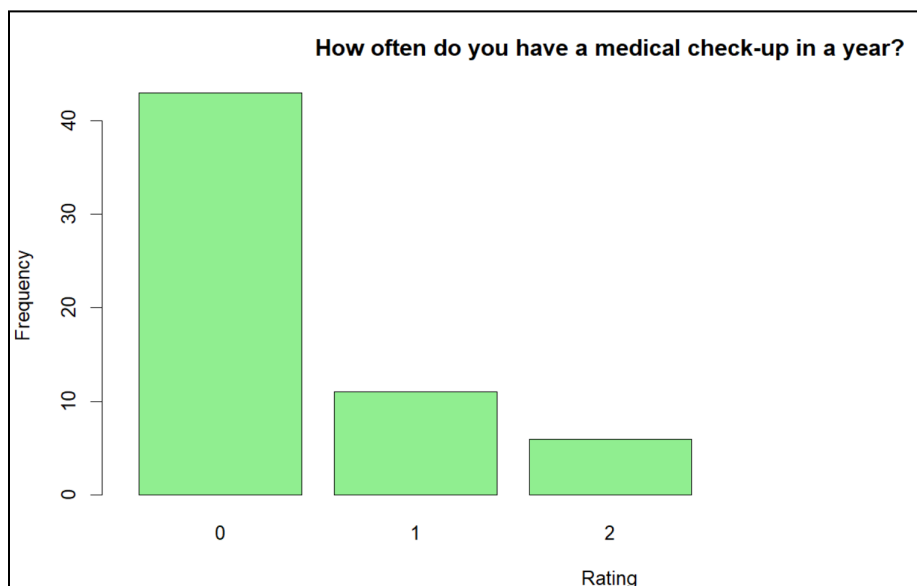
Pie chart 10: What do you think is the main cause of obesity ?

Table 6 and pie chart 10 are data about “What do you think is the main cause of obesity?”. The mode for this data is unhealthy eating habits which occupied 68.33% of the respondents (41 out of 60 respondents). There are 12 respondents who choose lacking exercise as the main reason for obesity which occupied 20% of the pie chart. There are 6 respondents (10% in the pie chart) who choose genes and it is higher than stress which has only 1 respondent (1.67%) choosing it as the main cause of obesity.

14. How often do you have a medical check-up in a year?

RATE	FREQUENCY
0	43
1	11
2	6
3	0
4	0

Table 7: How often do you have a medical check-up in a year



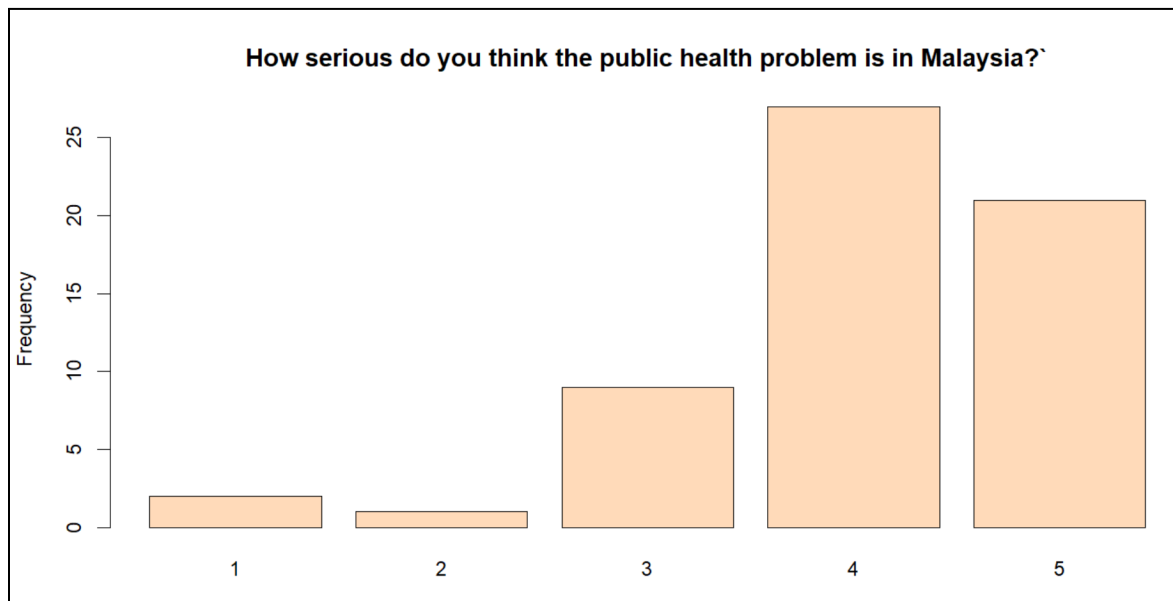
Bar chart 4: How often do you have a medical check-up in a year?

The bar chart above shows the frequency of the respondents having a medical check-up in a year. 43 respondents among 60 respondents (71.67%) are not having any medical check-ups in a year. Thus, the mod for this data is 0, which the frequency of it is the most (43 respondents). Other than that, there are 11 respondents among 60 respondents who do medical check-ups once per year. Moreover, 6 of the respondents do medical check-ups twice per year. Based on the data obtained, teenagers nowadays are not aware of their self-health as they do not do medical check-ups even once per year. It is important to have a medical check-up for everyone to make sure that everyone is in good condition.

15. How seriously do you think the public health problem is in Malaysia?

CAUSES	FREQUENCY
Totally not serious (1)	2
Not serious (2)	1
Neutral (3)	9
Serious (4)	27
Very serious (5)	21

Table 8: How seriously do you think the public health problem is in Malaysia?



Bar chart 5: How seriously do you think the public health problem is in Malaysia?

Table 8 and bar chart 5 show the rating for “How seriously do you think the public health problem is in Malaysia?”. From the bar chart above, we can observe that most of the respondents feel serious about the statement with a percentage of 45% (27 out of 60 respondents) followed by the second largest percentage (35%) which has 21 respondents who feel it is very serious. There are 9 respondents who occupied 15% of the survey rate with a neutral attitude on this statement. While the number of respondents rated as not serious and totally not serious is 1 (1.7%) and 2 (3.3%) respectively.

4.0 Discussion and Conclusion

One of the way to determine whether an individual is obese is by calculating BMI. Therefore, we collected the height and weight of our respondents. From *Boxplot 1*, we can know that the range height of our respondents is from 155 cm to 175 cm, while from *Boxplot 2*, the range of weight is from 40 kg to 90 kg. Respondents will calculate their BMI by using weight (kg) divided by height square (m^2). The result in *Pie Chart 2* shows that 61.7% of the respondents have a normal BMI Classification.

Furthermore, we can use the analysis above to observe the relation between an individual's lifestyle with their BMI classification. According to *Pie Chart 3* and *Boxplot 3*, there is a total of 51.67% of teenagers choose physical exercise as the way to control their BMI and the average time spent on exercise in a week is 114.42 minutes. This shows that there are still teenagers who enjoy exercise as well as maintain healthy habits.

On to the eating habits of the teenagers, most of the teenagers' monthly food expenses are the 2 lower range choices which are below RM300 and RM 301-RM500 (*Pie Chart 4*). Even though the budget is quite low, most of the teenagers manage to have a normal eating pattern, 3 meals a day (*Bar Chart 3*) and half of them usually eat 1-2 times unhealthy foods like fast food, junk food and desserts within a week (*Pie Chart 5*). For respondents who have an underweight BMI level, their favourite food is meat and fish (25%) (*Pie Chart 7*), it is also the same situation for the respondents who are categorized as having normal BMI levels (*Pie Chart 8*). As for overweight respondents, the percentage of them having meat and fish as their favourite food in the food pyramid is 71.43%, it has a greater percentage than the two other categories (*Pie Chart 9*). In all of the 3 BMI categories, the meat and fish option occupied the largest proportion. Thus, we can conclude that meat and fish (46.67%) are overall teenagers' favourite food from the food pyramid (*Pie Chart 6*).

It is a good sign that about 40 respondents strongly agree and 16 respondents agree that it is important to maintain a healthy BMI (*Bar Chart 2*). This indicates that the awareness of having a good well being is spreading. Based on what we know, there are several factors that contribute to obesity, for example, genetics, drugs, unhealthy eating habits, lack of exercise,

stress and environment. Referring to *Pie Chart 10*, many teenagers believe that the main factor of obesity is unhealthy eating habits (68.33%) and lack of exercise (20%). This may be related to *Pie Chart 3*, after consuming unhealthy foods with high energy, calories and sugar, those components will be stored in the body as fats, only physical activity and exercise can help to burn those extra energies away. On the downside, 43 of our teenage respondents do not go for a medical check-up in a year (*Bar Chart 4*). It is alarming because going for a medical check-up can help individuals to identify their current state as well as diagnose health problems earlier. Besides that, doctors will also assist patients in the correct way to prevent overweight so harmful acts like “directly not eating” or “having no awareness of BMI control” will happen (*Table 4, Pie Chart 3*). In general, teenagers in Malaysia indicate this public health concern as a serious problem (*Table 8, Bar Chart 5*)

At the end of the discussion and analysis of data collected throughout the study, we can conclude that most of the teenagers in Malaysia are trying their best to maintain a healthy lifestyle and are aware of their BMI classification. However, there are still some aspects that teenagers should improve like going for a medical check-up or learning the right way to maintain a healthy BMI. Our group believes that the growing awareness of public health problems among teenagers would lead them to a healthier life.

5.0 Appendix

- Google form

Survey on Obesity Among Teenagers

Dear Respondents,

Greetings and Salam Sejahtera

We are Data Engineering students from School of Computing, Faculty of Engineering, Universiti Teknologi Malaysia.

We are conducting this survey to collect data about obesity among teenagers for Probability & Statistical Data Analysis course. Thank you for spending the time to take part in this survey.

You may take 5-10 minutes to answer the survey. All data and answers will be kept secret, anonymous and use for survey purpose.

Presented by:

- 1) Fong Khah Kheh
- 2) Ang Yi Qin
- 3) Soo Wan Ying
- 4) Kee Shin Pearl

* Required

Survey starts

1. Your Gender *

Mark only one oval.

Male

Female

2. Your Age *

eg : 20

3. Your height *

eg: 170 (in cm)

4. Your weight *

eg : 45 (in kg)

5. Please select your BMI classification *

BODY MASS INDEX (BMI)	
CLASSIFICATION	BMI SCORE (kg/m ²)
Underweight	< 18.5
Normal	18.5 - 24.9
Overweight	25.0 - 29.0
Obese	30.0 - 40.0
Extreme Obese	> 40.0

Mark only one oval.

- Underweight
 Normal
 Overweight
 Obese
 Extreme Obese

6. How important do you think it is to maintain a healthy BMI? *

Mark only one oval.

1 2 3 4 5

Not important Very important

7. How do you control your BMI? *

Mark only one oval.

- Physical exercise
- Dieting with plan
- Seek medical help
- Directly not eating
- No awareness of BMI control

8. Exercise time spent in a week *

eg : 10 mins / 2 hrs

9. Total monthly food expenses *

Mark only one oval.

- Below RM300
- RM301 - RM500
- RM500 - RM800
- Above RM800

10. How many times did you eat in one day? *

Mark only one oval.

0	1	2	3	4	5	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. How many times a week you eat unhealthy foods? (etc McDonald, potato chips, dessert) *

Mark only one oval.

- Never or rarely
 1-2 times
 3-4 times
 5 or more times

12. What is your favorite type of food in the food pyramid? *

Mark only one oval.

- Bread, cereals, grains
 Fruits and vegetables
 Milk, cheese, dairy
 Meat and fish
 Snacks, sweets, fried foods, dessert

13. What do you think is the main cause of obesity? *

Mark only one oval.

- Genes
 Drugs
 Unhealthy eating habits
 Lack of exercise
 Stress
 Environment

14. How often do you have a medical check-up in a year? *

Mark only one oval.

0	1	2	3	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. How serious do you think the public health problem is in Malaysia? *

Mark only one oval.

	1	2	3	4	5	
Totally not serious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very serious

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