
The Knowledge on Type 2 Diabetes Mellitus and Sugar Intake Practices Among City University Students

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Abstract

Introduction: Type 2 diabetes is a common condition that leads to high blood sugar (glucose) levels. Type 2 used to be called "adult diabetes" because it was diagnosed mainly in the elderly. The cause is a problem with a chemical (hormone) in the body called insulin. It is often associated with overweight, sluggishness, or a family history of type 2 diabetes. The main source of energy comes from the blood glucose and mainly from the food that have been consumed. It may cause symptoms such as excessive thirst, frequent peeing and malaise. It can also increase the risk of serious eye, heart and nerve problems. It is a lifelong condition that can affect those daily life routines. Thus, a diet plan, medication, and have regular health checkups are very important to live with this disease. This study is aimed to determine the knowledge of type 2 diabetes and practices of sugar intake among students in City University Malaysia.

Methodology: A cross-sectional study was conducted among 341 respondents of students from City University Malaysia by using a validated questionnaire. The data were analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0.

Result and discussion: Findings revealed that majority of the respondents have high knowledge (63.9%) on type 2 diabetes mellitus and medium practices (79.8%) on sugar intake among City University students. The results showed that there was no relationship between selected demographic variables includes age and highest education level with knowledge level on type 2 diabetes mellitus and practices level towards sugar intake ($p = 0.038$). There was a significant relationship between knowledge on type 2 diabetes mellitus and practices on sugar intake ($p < 0.05$) among students.

Conclusion and recommendations: Students from City University Malaysia are having sufficient understandings and beliefs on the importance of maintaining a healthy lifestyle and its consequences. Yet it is still important to provide more information on the sugar intake to ensure students obtain an education, discipline and healthy eating lifestyle habit which helps in preventing type 2 diabetes mellitus.

Keywords: Type 2 diabetes mellitus, sugar intake, university students.

1. Introduction

Seshadri et al., (2020) claims that sugar was the most favorite food and beverages among university students in recent era, which are regularly consume in their daily life. The major consumer of sugar-sweetened beverages (SSBs) was among the university students. SSBs is a beverage that has added sugar in it. This can range from can drinks (sodas), natural product beverages such as fruit drinks, sugar- sweetened coffee or tea even vitamin and energy drinks. These drinks have been consistently expanding to different degrees across the globe by consuming sugar-sweetened beverages.

Sugar-sweetened beverages contained little nutritional and less satiety compared to solid food. Hence, consuming SSBs could result in many diseases and one of the major diseases is type 2 diabetes. Diabetes is one of the major non-communicable diseases in a worrying trend in Malaysia. The global prevalence of type 2 diabetes is increasing in countries undergoing rapid socio-economic development including Malaysia (Chan et al., 2016).

Other studies also confirmed that sugar, especially fructose-containing sugar, is considered to be an important factor in increasing the incidence of type 2 diabetes. Sugar intake are the largest source of fructose in the diet, and constitute most of the basis of diabetes. The association between SSB and type 2 diabetes in the beverages still remains to be unclear. Several high-quality systematic reviews and meta-analysis have assessed the association of sugar intake beverages with type 2 diabetes. The goal is to conduct a systematic review and meta- analysis of prospective cohort studies to determine the role of fructose-containing sugars in the development of type 2 diabetes regardless of food format (Papier et al., 2017).

According to World Health Organization data (2020), there are about 422 million people worldwide have diabetes, in most of the countries and 1.6 million deaths are caused by diabetes each year. The number of cases and the prevalence of diabetes have been gradually increasing over the past few decades. Furthermore, Asians have a higher chance of developing type 2 diabetes when compared to individuals of European ancestry. This implies that even though an Asian populace has a lower predominance of overweight and obese populace within the West, they have an excessively high rate of individuals with diabetes.

As of now, 60% of the world's diabetic populace is Asian (Teng et al., 2020). According to the National Health and Morbidity Survey (NHMS) 2019 by the Ministry of Health (MOH), the prevalence rate of diabetes in adults has increased in Malaysia from 13.4% in 2015 to 18.3% in 2019. In 2019, an estimated 3.9 million adults in Malaysia aged 18 and above had diabetes higher than 3.5 million in 2015. It has been stated the that 49% of people with diabetes had never been examined with the chronic disease (NHMS, 2019).

Diabetes is a disease that occurs when the blood glucose, also called blood sugar, is too high. Blood glucose is the main source of energy and comes from the food that is consumed. Insulin, a hormone made by the pancreas, helps glucose from food get into the cells to be used for energy. Sometimes the body doesn't make enough or any insulin or does not use insulin well. Glucose then stays in your blood and does not reach the cells. Over time, having too much glucose in the blood can cause health problems. There are a few types of diabetes such as diabetes type 1 which is an autoimmune disease. It occurs when the immune system attacks and destroys the cells in the pancreas. Then, type 2 diabetes which the body becomes resistant to insulin. Next, prediabetes is a condition where the blood glucose is higher than normal but it is not similar to type 2 diabetes. Lastly, gestational diabetes is a condition where a pregnant woman's blood glucose is high. This type of diabetes happens when an insulin-blockage hormone is produced by the placenta. Diabetes is a chronic medical condition in which sugar, or glucose, levels build up in the bloodstream. With the help of the hormone insulin, it moves the glucose from the blood into the cells for energy use. The body's cells aren't able to respond to insulin in type 2 diabetes. The body may also not produce enough insulin in the late stages of type 2 diabetes. (Lawrence, 2018).

According to researcher Imamura et al., (2016) type 2 diabetes is a chronic disease which is characterized by high levels of sugar within the blood. Type 2 diabetes is also known as type 2 diabetes mellitus and adult-onset diabetes because it starts in the middle or late adulthood which is around the age 25 and above. Therefore, there are many adolescents who are at risk of this disease at present. Type 2 diabetes is more common in regards to type 1 diabetes. Yet, it shares with type 1 diabetes high blood glucose levels, and the complications of high blood sugar.

2. Literature Review

2.1 What is Sugar?

According to Vermunt et al., (2017) sugar is an important structural component of living cells and a source of energy for many organisms. Sugars are classified according to the number of monomer units present. Sugar is a term that includes all sweet carbohydrates, although the term is most commonly used to describe sucrose or table sugar, or "disaccharides." The body breaks down carbohydrates into simple sugars, such as glucose, that can be easily used in the body. All carbohydrates, they provide a source of energy for our diet. There are several types of sugar. Sugar is naturally found in certain foods, such as fruits and dairy products, and it is also added to various foods. Sugar can take many different forms, including white sugar, raw or brown sugar, honey, or corn syrup. Too much sugar in the diet can cause health problems like obesity and tooth decay. Refined (or processed) sugar provides a quick and easy source of energy, but does not contain other nutrients such as vitamins and minerals. Sugar is very popular in the processed food industry because it can increase the flavor, color, volume, and thickness of foods. They can also prevent mold and act as preservatives (Dahlia, 2021).

Wattelez et al., (2019) reported that sugar, like other carbohydrates, is an organic compound. Organic compounds are usually compounds that contain carbon covalently attached to other atoms, especially carbon-carbon (CC) and hydrocarbon (CH). The four main elements that make up sugars and other carbohydrates are carbon, hydrogen, oxygen, and nitrogen. The general chemical formula for sugar is $C_n(H_2O)_n$ (or $C_nH_{2n}O_n$), where n can range from 3 to 7. The ratio of hydrogen atoms to oxygen atoms is usually 2: 1. Most sugar names usually end in -ose. They may contain aldehyde or ketone groups. The monomer unit of carbohydrate is monosaccharides. Carbohydrate monomers (i.e. monosaccharides) can be linked together to form longer chains. Monosaccharides are connected to each other (or to another non-carbohydrate group) through glycosidic bonds (also known as glycosidic bonds), which are covalent bonds (Brittany, 2019).

Carbohydrates are essential macromolecules, which can be divided into three subtypes such as monosaccharides, disaccharides, and polysaccharides. Monosaccharides include fructose, galactose, and glucose. Fructose is also called fruit candy (Michelle, 2018). It is found naturally in fruits, sucrose, and honey. It is the sweetest in sugar. Galactose is another type of monosaccharide, but it is often seen attached to another molecule. Glucose is the most common form of monosaccharide in the body because it is essential for various cellular activities such as cellular respiration. In plants, glucose is the main product of photosynthesis. These simple sugars are the simplest form of carbohydrates. They combine as monomers to form fairly complex carbohydrates, for example. Disaccharides and polysaccharides. Disaccharides are carbohydrates made up of two monosaccharides. Some examples are lactose, maltose, and sucrose. Table sugar is sucrose, which is a disaccharide made up of glucose and fructose. It is often used as a sweetener. It is used in the preparation of beverages and foods, such as cakes and cookies. Common sources of sugar for commercial use are sugar cane and sugar beets. These plants are harvested to make refined sugar (Watson, 2020).

2.2 Type 2 Diabetes Mellitus

Based on the researcher Neelakantan et al., (2021) the most common type of diabetes is type 2 diabetes mellitus which the disease takes place in blood and the glucose level is high. About 90% to 95% of people with diabetes have type 2 diabetes. Being overweight (BMI greater than 25) increases the risk of type 2 diabetes. Type 2 diabetes involves a genetic mutation, although researchers cannot determine the exact mutation. Type 2 is called as adult diabetes because it was diagnosed mainly in the elderly. The main source of energy comes from the blood glucose and mainly from the food that have been consumed.

Furthermore, Karbalaefar et al., (2016) has reported that pancreas produce hormone which is called as insulin which helps the glucose get into the cells and used as an energy. In type 2 diabetes, the body does not make enough insulin or insulin has not been used well which caused in too much of glucose stays in blood and it does not reach to the cells. This condition is known as type 2 diabetes. According to Nanditha et al., (2016) the body does not fully respond to insulin, it is classified as an insulin resistance. The blood glucose levels gradually arising because the insulin is malfunction.

This condition may eventually cause the pancreas to dysfunction hence this may result the body to produce less amount of insulin which can cause high blood sugar, also known as hyperglycemia. Type 2 diabetes mellitus is very commonly diagnosed in adolescence from the age 25 and above due to the rising levels of obesity, consuming sweet drinks, poor diet and physical inactivity. Type 2 diabetes can usually be controlled by choosing a healthier eating plan, physical exercise, and oral medications. Some people may need to take insulin to better control their blood sugar level (Franken,2018).

2.3 Correlation Between Sugar intake and Type 2 Diabetes Mellitus

Peter, (2016) studies shows that suspecting sugar is the cause of diabetes, the scientific community has pointed the finger at carbohydrates. Furthermore, Grieger, (2018) corroborated that both simple and complex carbohydrates are metabolized in the form of sugar, causing fluctuations in blood sugar levels.

However, the way carbohydrates are processed in the body differs according to their type. Although simple carbohydrates are digested and metabolized quickly, complex carbohydrates take longer to pass through this system, which makes the blood sugar level more stable. "It all comes down to its chemical form where simple carbohydrates have simpler chemical components where it does not require much digestion. Complexes, on the other hand, would take longer time for its digestion," Grieger explained (Grieger, 2018).

3. Methodology

In this analysis, a quantitative cross-sectional method was applied. The study instrument that was used in the research is the questionnaire. The questionnaire comprised of three sections, respectively known as section A, B, and C. Section A mainly focused on demographic questions to assess the profile of respondents. Section B mainly concerned on the knowledge level of type 2 diabetes mellitus among the respondents while section C mainly focus about the practices of the sugar intake. These questionnaires were adopted from past journals (insert the references) and data was collected using the online platform, Google forms.

The distribution of questionnaire was done within the months of September to October 2021. The questionnaire was distributed to more than 341 potential respondents, taking into accounts refusal or possible dropouts. Lastly, email address was a required question in the demographic section to ensure that each person can answer only once.

The data about the knowledge of type 2 diabetes mellitus and the sugar intake practices among the City University students has been analyzed by using Statistical Package Social for Sciences (SPSS) version 26.0. The data analysis is divided into two types. One being descriptive analysis and the other being, inferential analysis. Descriptive analysis was performed to access the demographic data and were reported as frequency and percentage values. The knowledge and practice score is calculated by the respective answers from the participants (Ndumele,2020).

4. Result

4.1 Demographic distribution of respondent.

Based on the total of 341 respondents, 217 respondents (64%) were female, while the remaining 124 respondents (36%) were male respondents. Its shows that female respondents were way higher compared to male respondents. As for the age groups, it has been classified into 4 groups which are 18-20 years old, 21-23 years old, 24-26 years old and 27 years above. In total of 341 respondents, 43 respondents (13%) between 18-20 years old, 96 respondents (28%) are between the ages of 21-23 years old, 164 respondents (48%) are ages between 24-26 which is the highest respondents' age group, followed by respondents aged 27 years above which comprised of 38 respondents with 11% the least respondents. As for the education level, most of the respondents are Bachelor's Degree students which is 63.9% of total respondents.

4.2 Knowledge level on Type 2 Diabetes Mellitus.

The mean of knowledge level on type 2 diabetes mellitus was 2.60 (SD=0.557). 63.9% has a high knowledge level on type 2 diabetes. The remaining 32.6% respondents showed medium level of knowledge while 3.5% of the respondents had low level of knowledge on type 2 diabetes.

Table 1: Level of knowledge on type 2 diabetes mellitus (N=341)

Level of Knowledge	Frequency, n (%)
Low	12 (3.5%)
Medium	111 (32.6%)
High	218 (63.9%)

4.3 The level of sugar intake practices among the students

The mean of sugar intake was 2.07 (SD = 0.444). From the total of 341 respondents, 79.8% have medium level of sugar intake. The remaining 13.8% of respondents have high level 6.5% respondents have low level of sugar intake.

Table 2: Level of sugar intake (N=341)

Level of sugar intake	Frequency, n (%)
Low	22 (6.5%)
Medium	272 (79.8%)
High	47 (13.8%)

4.4 The correlation between the Knowledge of type 2 Diabetes Mellitus and level of sugar intake practices

To determine the correlation between knowledge and practices towards sugar intake that leads to type 2 diabetes mellitus among students City University, the output revealed there is statistically significant since the p value is 0.038. Since the p value is more than 0.05, thus, null hypothesis was rejected. This is because there was a statistically significant correlation between knowledge and practices towards sugar intake that leads to type 2 diabetes mellitus among City University.

The result showed that there is a significant correlation between the knowledge of type 2 diabetes and sugar intake practices, albeit weak ($r = -0.112$, $p < 0.05$). This is demonstrated as when the knowledge of type 2 diabetes increases, the sugar intake practices among the students' decreases.

Table 3: Correlation on knowledge and practice of sugar intake leads to type 2 diabetes mellitus

		Knowledge	Practice
Knowledge	p value	.	0.038
	r value	1.000	-0.112

* significant value $p < 0.05$

Even though there is a weak correlation between the two variables, the correlation is statistically significant, and the correlation cannot be ignored if it is practically significant.

5. Discussion

According to Zhang et al., (2019) in the study reported that complex carbohydrate sources include whole wheat bread and brown rice, black beans and other legumes and quinoa. These foods contain fiber, vitamins and minerals suitable for any meal plan, whether they have pre- diabetes, diabetes or complete health. In fact, experts know that adding complex carbohydrates on daily diet can help maintain a healthy weight, as well as other health benefits. Compared to researcher Zhang et al., (2019) the findings that they obtain on the respondents that had practice eating carbohydrates food comprise of 198 (57%). In this research, 113 (33.1%) respondents had practice eating carbohydrate foods such as breads, cereals, or oats every day apart from rice.

On the other hand, examples of simple or refined carbohydrates exist in various forms, from sucrose in sugar used for baking biscuits, to various types of sugar added to packaged snacks, fruit drinks, sodas, and cereals. Simple carbohydrates are also natural components of many fresh foods, such as lactose in milk and fructose in fruits, so a healthy, balanced diet will always include these types of sugars. The problem with sugar, regardless of type, is the large amount of sugar found in the Standard American Diet (SAD), which is a typical diet plan for many people in the United States, and more and more. Modern country-a taste has been formed. If eaten in excess, these foods can cause heart disease, stroke, and other serious health problems. "In general, foods with added sugars also contain fat," Grieg explained, noting that these ingredients are closely related to the risk of insulin resistance, which is a sign of type 2 diabetes (Grieg, 2018).

Additionally, being not knowledgeable about diabetes had 77.3% decreases in their practice level compared to those who were knowledgeable. This means that "the higher their knowledge, the better their practice. These finding is supported by the ideas about positive correlation between knowledge and good practice observed among participants in studies done in Riyadh, Saudi Arabia (Salem et al., 2018) and in Ethiopia (Kashahun et al., 2017). Unlike based on these findings the correlation of knowledge and practice of the findings is vice versa. When the knowledge level is high the practice level is low. In a nutshell, the respondents have good knowledge on type 2 diabetes mellitus but they still practice consuming sugar intake.

6. Conclusion, Recommendation and Limitation

6.1 Conclusion

This research has assessed the knowledge level of type 2 diabetes mellitus among City University Malaysia students. The findings of this research shows that most respondents had a high level of knowledge and moderate practices. 63.9% of the respondents have shown to have a high knowledge level indicating that they have much of the basic knowledge about type 2 diabetes mellitus.

However, there are also people who really lack with this knowledge as well. Therefore, in order to obtain a good knowledge on type 2 diabetes mellitus, it is important to provide a good educational program on this topic to the students at higher learning institutions. It is also recommended that the health education programmed be supplied through the media, as it is currently the most effective source of knowledge within the general population.

Students can be impacted later in their lives if they continue to resume and practice their unhealthy lifestyles which they may end up resulting from type 2 diabetes mellitus due to their lack of knowledge and awareness on this issue. According to the output of results, the demographic variables, total score of knowledge and total score of practices were not satisfactory. The age and highest education were not significant for both level of knowledge on type 2 diabetes mellitus and practices level towards sugar intake. Furthermore, the relationship between knowledge of type 2 diabetes mellitus and practices towards sugar intake output revealed significant and has a negatively low correlation which indicate that the variables are hardly related.

6.2 Recommendation

After completing this study, it shows that the objectives of this research have been accomplished. However, there were few things need to be considered to improve the results. In order to collect reliable statistics, future studies should execute with other methods such as a direct face-to-face session in order to deliver questionnaire. In addition, future studies should include the whole population of City University Malaysia students in order to obtain the accurate and precise level of knowledge and practices. Lastly, student respondent results should be compared to working adults in order to know the gap in the level of knowledge of type 2 diabetes mellitus and practices on sugar intake.

6.3 Limitation

First and foremost, lack of prior research studies on the selected topic, available and reliable data needed for this research as the access was limited. This caused the research to feel quite difficult to find some important information related to the research as well as preventing further investigation to build more solid foundation on the topic. Next, as the nation is facing the Coronavirus disease (COVID- 19) pandemic, another research limitation is due to the Movement Control Order (MCO), as it was very difficult to collect data yet the full response was achieved within the targeted time. Nevertheless, the current study provides a clearer picture of the knowledge and practice among City University students.

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