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The Global Surge in Type 2 Diabetes Mellitus Among Young Adults: Causes, Habits, and Public Awareness through a Literature Review Study

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Abstract
The prevalence of type 2 diabetes mellitus has doubled globally in the past 40 years, including young adults. This phenomenon was caused by habits, particularly their preferences for snacks and SSBs. Other factors were accessibility, social media influence, and lifestyle changes contributing to the increased consumption of high-sugar foods and drinks. This study was a literature review study. The result of this study is that the lack of public awareness in choosing suitable and halal food was identified as a significant contributor to the high prevalence of diabetes in Indonesia. In addition, it is essential to enhance public knowledge and prevent the escalating diabetes prevalence.

Keywords: Young adult, diabetes mellitus, halal food

Introduction

One out of every ten individuals worldwide is diagnosed with diabetes mellitus. In 2021, it estimated that approximately 537 million people globally experienced diabetes within the age range of 20-79 years, with the number of mortality due to diabetes mellitus (DM) amounting to 6,7 million individuals, equivalent to one every five seconds. (IDF, 2021). In the 10th edition Atlas of the International Diabetes Foundation (IDF), it was reported that the prevalence of DM in Indonesia, among individuals aged 20-79 years, was 10,6%, meaning that 1 out of every nine individuals in Indonesia suffers from diabetes mellitus, whether diagnosed or undiagnosed. The prevalence of type 2 diabetes mellitus has doubled globally in the past 40 years; this is attributed mainly to the concerning increase in obesity rates, which result from reduced physical activity and increased calorie consumption. Hyperglycemic conditions associated with diabetes mellitus can lead to vascular and nerve damage, resulting in microvascular, macrovascular, and neuropathic complications (Dipiro et al., 2012).

Diabetes mellitus is a chronic degenerative disease characterized by elevated glucose levels exceeding normal limits and an imbalance in insulin levels within the body. According to the (Balitbangkes RI, 2018) report, diabetes mellitus is prevalent among individuals aged 15 years and older. Frequently, the symptoms of this disease go unnoticed by many, the cause primarily due to a lack of understanding of diabetes mellitus symptoms. In many cases, individuals only discover their diabetes diagnosis when undergoing routine health check-ups. The late diagnosis of diabetes makes it challenging to recover from the disease and often necessitates years of treatment.

The duration of diabetes mellitus significantly impacts the quality of life for individuals with diabetes. Based on a study by (Roifah, 2016) the majority of respondents were aged between 36-40 years, with 43 respondents (53,1%) having had diabetes mellitus for 5-10 years. The extended duration of the disease often leads patients to feel restless, resigned, and desperate, as they have been dealing with diabetes for an extended period without experiencing significant improvements in their condition. This, in turn, affects treatment compliance. This is primarily because adults over 30 years of age experience a decline in physical, psychological, and even intellectual function, making them more vulnerable to the development of other health conditions. These factors contribute to complications in other organs, leading to prolonged treatment. This is undoubtedly a consequence of one of the risk factors for diabetes mellitus, which is failing to adopt a healthy lifestyle from a young age, such as consuming high-glucose foods and engaging in inadequate physical activity, which can trigger the onset of the disease in later years.

Diabetes can be caused, in part, by the frequent consumption of high-glucose foods, thereby increasing the risk of developing the condition. Individuals who are looking to avoid diabetes should steer clear of certain foods and drinks that elevate the risk of diabetes development. One such factor is foods containing carbohydrates, as carbohydrates are metabolized and broken down into glucose within the body. Excessive consumption of carbohydrates results in an excess of glucose stored in the body, eventually leading to obesity. The glycemic index of carbohydrate-rich foods indicates how quickly these foods raise blood sugar levels. A high glycemic index value signifies that the food rapidly increases blood sugar levels. There are so many foods that have a high glycemic index, such as French fries, processed cereals, drinks sweetened with sugar (12 ounces), noodles, white bread, and white rice. (Sandeep & Dhaliwal, 2022). Consuming two or more SSBs per day can increase the risk of type 2 diabetes by 21% and death caused by cardiovascular disease. (Medicine, 2018). Usually, drinks sweetened with sugar contain more fructose corn syrup (the sweetest sugar). Sweet drinks with caramel coloring often contain more glycation end products and can cause insulin resistance. (Zaitoun et al., 2019)

The results of a survey conducted by Calbee Wings and Jakpat on respondents spread across various cities in Indonesia, as many as 51.33% of Indonesians admitted that they liked to enjoy snacks during their activities. (Oktariani et al., 2022). Snacks nowadays have become complementary foods that are consumed during free time. Therefore, consuming snacks has become a primary need for society. The types of snacks are sweet, salty, and savory snacks or dry snacks such as fried foods or those with soup like fruit ice. Snacks are popular among children and adults. All of those reasons made snacks becoming a choice for people's consumption.

The Global Data Survey in 2018 stated that the average person consumes snacks. They usually consume snacks between lunch and dinner. (Oktariani et al., 2022). In the other side, a survey conducted by Polling Opinion (JakPat) on 1-2 October 2022 to 1,209 respondents with several questions distributed via the JakPat mobile application online, the majority of 47% of respondents aged 25-29 years often consume boba, iced tea, and iced coffee followed by 45% of respondents aged 15-19 years, consumers aged 20-24 years and 30-34 years each by 42%, consumers aged 35-39 years by 33%, and consumers aged 40-44 year as much as 32%. Almost all ages usually consume popular drinks such as boba, iced tea, and iced coffee. (Annur, 2022)

The large number of diabetes mellitus cases that occur in Indonesia is due to the lack of public awareness and understanding in selecting suitable (*tayyib*) and halal food and drinks. Thus, it has become a necessary thing to review scientific evidence periodically to improve people's ability to choose foods and drinks to prevent the high prevalence of diabetes mellitus in Indonesia.

Young adulthood is the age transition from adolescence to early adulthood. According to (WHO, 2022), the age range in the young adult category is 20-24 years. This transition period influences poor eating habits and excessive weight gain. Among young adults, sugar-sweetened beverages (SSBs) are the primary source of excess calorie intake and snacks with sweet toppings to consumed. Cause during the transition period, many changes occur, such as habits, activities, and body functions. Habit-formation has attracted interest as a possible mechanism for behaviour change maintenance. (Gardner et al., 2014). So, this paper will review the habits of young adults in consuming foods and beverages with high sugar content that can increase the risk of diabetes mellitus.

Methods

The research in this article used systematic methods (systematic review). This method summarizes evidence obtained from primary research that answers research questions systematically and explicitly. Journals and articles are collected with PoP (Publish or Perish) software and Google Scholar and Scopus pages. The inclusion criteria are trends and habits of consuming foods high in sugar in Indonesia, data on the prevalence of diabetes mellitus among young adults in Indonesia, and *tayyib* food based on an Islamic perspective. The exclusion criteria encompass journals published over ten years ago (prior to 2013-2023), those not in English or Indonesian languages, such as Arabic or Latin, and journals specifically focused on diabetes mellitus in children and the elderly.

Results and Discussion

Diabetes is considered an "old disease" because it is more common in adults (25-54 years old) and people in old age (65 years old and above). However, behavioral patterns of consumption of foods and drinks that are high in sugar, plus obesity, lack of physical activity, and smoking habits make risk factors in young adults (18-24 years) increase. (Marine, 2015). This is by research (Fitriyah & Herdiani, 2022), as many as 76 respondents, 32.9% of them, often consume sugar and suffer from DM. While only 14.5% rarely consume sugar and suffer from DM. Lack of physical activity can also increase the risk of DM at a young age. Lack of physical activity causes a buildup of calories in the body, which can increase Body Mass Index (BMI) and the risk of obesity. Obesity itself can cause several chronic diseases, such as DM. In research (Sitorus et al., 2020), it was stated that there was a positive correlation between physical activity and blood sugar levels in the body.

The young adult age is a productive age (15-64 years) where it is vulnerable and has a risk of DM, which is influenced by lifestyle habits. In addition to consuming foods and drinks high in sugar, risk factors that can increase the prevalence of DM are obesity, lack of physical activity, and smoking. (Marine, 2015). Data presented by (Resti et al., 2022), showed that out of 147 respondents, 49 suffered from DM, 49 respondents who suffered from DM 59.2% had an age of ≤45. This shows that DM is no longer an "old disease" but a disease that can attack all ages, especially young adults. This study also mentioned the high level of stress that attacks productive age and the level of education that results in ignorance about healthy lifestyles, which can increase the risk factors for DM in young adults.

Diabetes in young adults is closely related to the rampant consumption of sugar-sweetened beverages (SSBs). SSBs that are high in sugar generally contain high levels of fructose. In a study by (Lumbuun & Kodim, 2017), it was stated that there is an influence between the consumption of SSB and consumers' blood glucose levels, one of which can cause impaired glucose tolerance, which is also one of the risk factors for diabetes. As researched by (Daeli & Nurwahyuni, 2019), age is one of the factors that influence the consumption trend of SSB, where increasing age is directly proportional to the increasing desire to consume SSB. However, individuals aged 15-24 years consumed more SSB compared to individuals in the age group over 65 years. Individuals in the young adult category who are married, employed, or live in urban areas also tend to consume more SSB, making them more prone to diabetes.

Several factors influence the habit of young adults consuming snacks, the first of which is the habit of Indonesian people who prefer snacks to heavy meals. In various gatherings, people will look

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for snacks to accompany them. This habit encourages the proliferation of snacks that please the tongue, including intense flavors such as MSG (Monosodium L-glutamate) and SSB. The second factor is the rise of SSB shops, such as coffee shops. The rise of Indonesia's economy has led to an increase in lifestyle. The rise of cafes has become an everyday sight. The various nuances provided such as a comfortable place, musical accompaniment, various types of drinks, a variety of flavors to choose from, and a variety of price ranges, are attractive, especially for young people, whether just as a place to hang out, do college assignments, or as a place to discuss work. The third factor is online access to sweet foods and drinks. The ease of ordering food and beverages through online applications is an essential factor. For example, in 2018, orders for boba milk tea through ride-hailing apps grew exponentially, as in Southeast Asia. Indonesia even ranked first in the orders increase with a growth of more than 8500%. (Grab Indonesia, 2019). The various promos presented on online applications are attractive and the 'home delivery' service makes it very easy for young adults to access sugar-sweetened foods and drinks. The final factor is exposure through social media. Viral marketing plays a significant role in the popularity of high-sugar foods and beverages. Social media is an effective platform for promoting sugary food and beverage products to reach consumers quickly, making them widely accessible. Young adults are very up-to-date with great curiosity. Viral food and drinks spread on social media make young adults interested in trying these products to experience the ongoing trend. There are so many food vloggers promoting viral food and drinks that it creates the phenomenon of FOMO (Fear of Missing Out), where people will feel afraid of being left behind if they don't try it. There is one food vlogger on the Instagram platform with the username (Awlaparr, n.d.)who is classified as a young adult, often posting food and drinks that can be said to contain high sugar content, for example, when he is reviewing fried banana food with very melted chocolate topping, giant donuts with abundant glaze topping, and sometimes reviewing drinks such as Thai tea, coffee, boba, and smoothies with abundant whip cream topping. With food vloggers, these foods and drinks will become a trend that might become a consumption habit for some people.

A Research study by (Daeli & Nurwahyuni, 2019) relates to the results of research conducted by (Puspa et al., 2023) with student research subjects aged 17-21 years who are teenagers and young adults. Periods at that age, diet, and lifestyle will experience changes and affect eating habits in adulthood. The results showed that the average BMI of all respondents was> 25 kg / m2, which classified as heavy towards obesity. At the same time, in research conducted by (Nugroho & Fahrurodzi, 2018), obese people have a 3.338 times greater risk of suffering from diabetes than those who are not obese. Obesity can occur because respondents, primarily students, have bad habits, namely staying up late to complete assignments accompanied by sweet foods and drinks such as sweet tea, coffee, *martabak*. On the other hand, in a study by (Roserlina et al., 2015), consumption of sugary foods and drinks increases the risk by 1.2 times. Eating flour foods can also increase the chances of diabetes by 1.22 times compared to people who rarely consume. Other factors that make students' diets and eating habits unhealthy include limited food choices, preferring food and drinks at more economical prices, and other busy activities.

Based on research (Trifosa Veronica et al., 2022) one of the contemporary drinks that contains high sugar is hazelnut chocolate flavored milk tea, which mainly chosen by Depok and Jakarta students with boba toppings and large sizes. This boba drink is part of a sugar-sweetened beverage (SSBs), which generally contains sweeteners in the form of HFCS (55% fructose, 45% glucose) or sucrose (50% fructose, 50% glucose). SSBs are a significant contributor to the increase in obesity and type 2 diabetes mellitus. (Malik et al., 2013). SSBs have high sugar content but do not provide satiety and have low nutritional value. The results of the analysis of sugar content (fructose, glucose, sucrose) by high-performance liquid chromatography (HPLC) in this study showed that one large glass (± 700 mL) of milk tea drink without the boba component contained as much as 45.43 grams of sugar, which means it has contributed 90.86% of the recommended sugar consumption limit. When accompanied by the boba component (120 grams), the sugar content of the drink becomes 47.21 g or equal to 188.84 kcal of sugar, which means it has met about 94.4% of the recommended limit of added sugar consumption.

Based on research conducted by (Maziyah et al., 2023), as many as 91.7% had terrible snacking habits, and as many as 89.3% had excessive sugar intake levels from 84 respondents studied. As many as 66.7% also had high salt levels, and 84.6% had excessive fat intake. The types of snacks most consumed include bread, fried foods, instant noodles, ice cream, packaged drinks, tea, coffee, soda, isotonic, and sweetened condensed.

Humans need halal and *tayyib* food to obtain energy, support growth and development, and maintain health. Health is a tool for a productive life, both in work, worship, and when resting. When illness arises, it only feels good when in good health. The advancement of time affects various human patterns. As with the food problem, we are often negligent about *tayyib* food. Such as foods high in sugar, fat, and calories in excess. So many expert studies have stated that mistakes in consuming food (not *tayyib*) will interfere with the health of the body, namely with the emergence of various diseases such as stroke, obesity, and diabetes. The meaning of "good" (*tayyib*) is that food should benefit the human body, mind, and intellect. Because of the critical role food plays in human physical and mental development, religions call upon all human beings to consume food that has good benefits, both from a medical and religious perspective. The aim is to maintain a healthy mind and body and become physically fit and mentally strong. The commandment to consume halal and wholesome food aims to prevent people from consuming food that can damage them. The importance of food and drink, both halal and haram, can have a good or bad impact on the value of worship.

It should be noted that humans consist of both physical and spiritual elements. Food consumption has a significant influence on both of these elements. Halal food will have a positive impact, while non-halal food will have a negative impact. Hence, a Muslim must ensure that he/she takes only halal food to balance physical and spiritual elements.

Indonesia has the largest Muslim population in the world, increasing the demand for halal food. The Quran and hadith emphasize the importance of humans choosing halal and *tayyib* (good) food. For example, the Quran in Surah Al-Baqarah (2): 168 emphasizes that humans consume good and halal food. Etymologically, *tayyib* food characterizes food that is quality, delicious, healthy (balanced nutrition), and not contaminated with unclean ingredients. *Halalan tayyiban* has principles for improving the health and nutrition of the body by emphasizing the importance of consuming foods/beverages that are nutritious, do not harm health, are safe, and these foods/beverages are not at high risk of chronic diseases. Examples of high-risk foods include foods that can increase the amount of fat, salt, and sugar in the body. Foods that are high in sugar can cause obesity, which is one of the risk factors for chronic diseases such as diabetes mellitus. Someone who consumes high-risk foods and then develops a chronic disease has violated Islamic law, and the food has defied the principle of *halalan tayyiban*. However, many Muslims do not understand the definition of halal and *tayyib* in food because they still think that consuming halal food is an obligation rather than a necessity. Halal and *tayyib* are not only necessarily free from pork content but need to look at the health aspects of the food. (Mohamad et al., 2015)

Conclusion

Diabetes mellitus is a chronic degenerative condition marked by elevated glucose levels, commonly attributed to the consumption of snacks or drinks with a high glucose index. A considerable number of Muslims lack a clear understanding of the concepts of halal and tayyib in food. The insufficient awareness among the public regarding the importance of selecting suitable and halal food has emerged as a significant factor contributing to the high prevalence of diabetes in Indonesia. This lack of knowledge hinders individuals from making informed dietary choices, exacerbating the diabetes epidemic. Bridging this informational gap is vital for promoting healthier dietary practices within the Indonesian community.

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