POTENTIAL RISK OF DIABETES MELLITUS IN HIGH SCHOOL ADOLESCENTS

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Abstract. Diabetes Mellitus is a metabolic disorder characterized by increased blood sugar levels caused by insulin deficiency, insulin resistance, or both. The number of people with Diabetes Mellitus at the age of ≥ 15 years has increased the incidence every year and the majority do not know that they are actually at risk of developing diabetes mellitus. People with pre-diabetes who are not managed properly are at risk of developing diabetes in the future. The risk of development can occur in a period of about 5-10 years. The significant increase in the number of people with diabetes mellitus in Indonesia deserves serious attention from the government. Therefore, early detection of the potential risk of diabetes mellitus in adolescents is an important thing that must be done to avoid mistakes or delays in diagnosis and treatment that can lead to emergencies or death. The research objective was to determine the potential risk of DM in high school adolescents. This research method is an analytic descriptive study with a cross-sectional design. The population in this study namely students enrolled in SMAN1 Pagerbarang Tegal Regency in September 2022 numbered 842. According to Arikunto, if the population is large, 10-15% can be taken so in this study 90 respondents were taken. The instrument used was a standardized questionnaire, namely the Finnish Diabetes Risk Score (FINDRISC). The results showed that all respondents were teenagers. Most were female and in the BMI measurement, there were 28.9% in the excess category (at risk and obesity I). Most of the respondents did not exercise regularly. The results of a risk assessment with FINDRISC, adolescents should not be at risk of developing DM, but in fact, it was found that 10% of adolescents had a slightly increased risk of developing DM, so efforts are needed to reduce this risk by changing a healthy lifestyle, especially in terms of diet and regular exercise.

Keywords: [Potential risk, diabetes mellitus, adolescents]

INTRODUCTION

Diabetes Mellitus is a metabolic disorder characterized by increased blood sugar levels caused by insulin deficiency, insulin resistance, or both (Rother, 2007). The number of people with Diabetes Mellitus has increased the incidence every year. PDiabetes Mellitus disease is one of the causes of mortality and morbidity in all countries, where there is 3.5 - 4.3 percent of the world's population affected by diabetes mellitus (Sudoyo, et., 2010). Based on data from the International Diabetes Federation (IDF) there are at least 463 million people aged 20-79 years in the world suffering from diabetes in 2019, or the equivalent of a prevalence rate of 9.3% of the total population at the same age. The prevalence of diabetes is expected to increase with the increasing age of the population and is expected to reach 578 million in 2030 and 700 million in 2045 (Pusdatin Kemenkes, 2020).

The number of people with Diabetes Mellitus in Indonesia in 2010 reached 6.4 million people or 8.6% of the total population. It is estimated that type 2 Diabetes Mellitus (not insulin related) is the most common, namely 95% of all cases of Diabetes Mellitus (Reta, 2014). The 2018 Riskesdas results show that the prevalence of diabetes mellitus in Indonesia based on a doctor's diagnosis at the age of ≥ 15 years is 2%, this shows an increase compared to the prevalence in 2013 which was 1.5%. Meanwhile, the prevalence based on blood sugar checks also increased from 6.9% in 2013 to 8.5% in 2018. This figure shows that the majority do not know that they are actually at risk of developing diabetes mellitus.

People with pre-diabetes that are not managed properly are at risk of developing diabetes in the future. The risk of development can occur in about 5-10 years (Stefanaki et. all, 2016). A study from BYC Rariden (2019), states that there are around 5% - 19% every year of adolescents with pre-diabetes who have developed diabetes. Likewise, a study from Bansal (2015), reported that there was an 11% incidence of diabetes found in pre-diabetic sufferers.

To prevent the occurrence of diabetes in adolescents, the National Institute of Health Diabetes Prevention Program (NIH-DPP) recommends several things, the main thing is to carry out lifestyle interventions. The lifestyle intervention in question is more focused on improving diet and increasing physical activity (Khokhar and Chin 2017). Improved diet and increased activity can help lose weight (BB) or control BB, minimize cardiovascular risk, and prevent pre-diabetes from developing into diabetes (Hannon, 2020). Another study shows that the development of pre-diabetes into diabetes can

be prevented by up to 58% in 3 years and 34% in 10 years through improving diet (proper diet) and increasing physical activity (American Diabetes Association, 2020).

The significant increase in the number of people with diabetes mellitus in Indonesia deserves serious attention from the government. Therefore, early detection of the potential risk of diabetes mellitus in adolescents is an important thing that must be done to avoid mistakes or delays in diagnosis and treatment that can lead to emergencies or death.

METHODS

The research method used is descriptive-analytic research with a cross-sectional approach. The research was conducted at SMAN 1 Pagerbarang Tegal Regency in September 2022. The population in this study namely students enrolled in SMAN1 Pagerbarang Tegal Regency in September 2022 numbered 842. According to Arikunto, if the population is large, 10-15% can be taken so in this study 90 respondents were taken. Respondents were selected using simple random sampling. The instrument used was a standardized questionnaire, namely the Finnish Diabetes Risk Score (FINDRISC). Finnish Diabetes Risk Score (FINDRISC) is an effective questionnaire to assess the risk level of individuals suffering from T2DM in 10 years. FINDRISC is one of the questionnaires recommended by the IDF and has been translated into 16 languages and used in many countries around the world. This questionnaire was developed by Professor Jaana Lindström, Diabetes Prevention Unit, National Institute for Health and Welfare, Finland, and Professor Jaakko Tuomilehto, Center for Prevention of Vascular Diseases, Danube- University Krems, Austria.

FINDRISC consists of 8 items, which include age, body mass index (BMI), abdominal circumference, history of using high blood pressure medications, history of high blood sugar (hyperglycemia), family history of DM, daily vegetable or fruit consumption, and physical activity. Each question has provided answer options that have varying scores. The variation in the score adjusted for increased risk is related to the score in the regression model in the original cohort design study. The total score of all questions can then be interpreted as a probability number for an individual suffering from T2DM within 10 years by referring to the reference table provided in the questionnaire. The total score can vary from 0 to 26. This questionnaire can be accessed via the Internet and can be completed in just a few minutes and does not require laboratory tests. The interpretation of the results of completing the Finnish Diabetes Risk Score (FINDRISC) is as follows:

Table 1. Interpretation of the results of the DM risk assessment with FINDRISC

No	Score	Risk
1	< 7	Low : It is estimated that 1 in 100 will develop the disease
2	7 – 11	Slight increase: It is estimated that 1 in 25 will develop the disease
3	12 – 14	Currently : It is estimated that 1 in 6 will develop the disease
4	15 – 20	Tall : It is estimated that 1 in 3 will develop the disease
5	>20	Very high : It is estimated that 1 in 2 will develop the disease

RESULTS AND DISCUSSION

The results of the research on 90 students of SMAN 1 Pagerbarang Tegal Regency based on the characteristics are as follows:

Table 2. Research results based on the characteristics of the respondents

No	Characteristic		
1	Age		
	a. 15 years	8	8,9
	b. 16 years	12	13,3
	c. 17 years	48	53,4
	d. 18 years	12	13,3
	e. 19 years old	10	11,1
2	Gender		
	a. Woman	70	77,8
	b. Man	20	22,2

3	BMI		
	a. Not enough	24	26,7
	b. Normal	40	44,4
	c. At risk	14	15,6
	d. Obesity I	12	13,3
4	Abdominal circumference		
	a. Normal	72	80
	b. Central obesity	18	20
5	Sports Habits		
	a. Routine	42	46,7
	b. No	48	53,3
6	Habits of fruit/vegetable consumption		
	a. Routine	65	72,2
	b. No	25	27,8
7	Fast food consumption habits		
	a. Yes	62	68,9
	b. No	28	31,1
8	The habit of consuming sweet drinks		
	a. Yes	58	64,4
	b. No	32	35,6
9	HT history		
	a. Yes	8	8,9
	b. No	82	91.1
10	DM history		
	a. Yes	0	0
	b. No	90	100
11	DM Family History		
	a. Yes	20	22,2
	b. No	70	77,8
	Amount	**90**	**100**

The results showed that all respondents were teenagers, and the majority (53.4%) were 17 years old. Most of them are female, namely 77.8%. In BMI measurements, it was found that most of them were in the normal category (44.4%) and then in the excess category (at risk and obesity I), there were 28.9%. For exercise habits, most (53.3%) did not exercise regularly.

When viewed from the consumption habits of vegetables and fruit, the majority (72.2%) had good habits but some consumed them in the form of iced juice so they had experienced added sugar/artificial sweeteners. This can also be seen from the data on the habit of drinking sweets, where the majority (64.4%) stated that they regularly drink sweets. For fast food consumption habits, most (68.9%) have a habit.

Based on medical history, there were 8.9% of respondents who had experienced high blood pressure/hypertension and 22.2% of respondents had a family history of DM. While the results of the assessment of the risk of diabetes mellitus with FINDRISC are:
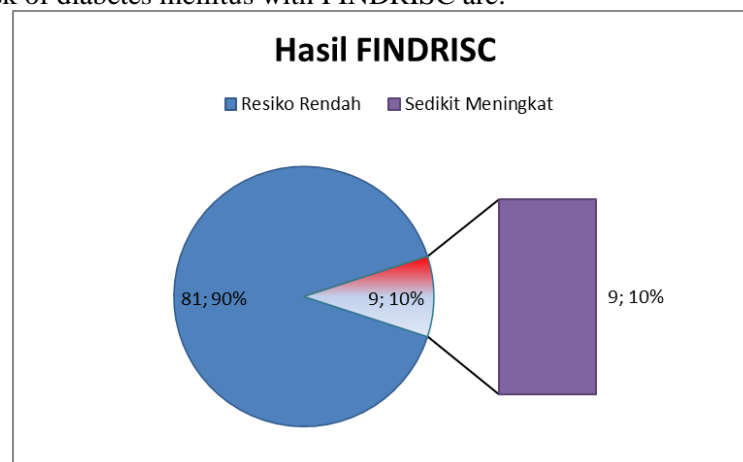

Figure 1. Results of DM risk assessment with FINDRISC

Diabetes mellitus risk assessment with FINDRISC found that there were 10% of students had a slightly increased risk of DM. Measuring the risk of developing diabetes mellitus uses FINDRISC (Finnish Diabetes Risk Score), which consists of 8 items, which include age, body mass index (BMI), abdominal circumference, history of high blood drug use, history of high blood sugar (hyperglycemia), history of DM in the family, daily consumption of vegetables or fruit, and physical activity.

Based on age characteristics, it is known that the age of the respondents in the range of 15-19 years is included in the adolescent category, as the distribution according to the WHO range shows that the ages of adolescents are between 10-19 years. In adolescents starting at 15 years of age, an assessment of the risk of developing diabetes mellitus should begin. The results of Basic Health Research state that symptoms of type 2 Diabetes Mellitus and prediabetes started to appear at the age of 15 years (RI Ministry of Health, 2018). The Ministry of Health also stated that age ≥ 15 years is included in the target of preventing non-communicable diseases. They should not be at risk at this age, but modern lifestyle changes can increase the risk of various diseases such as DM and HT.

Fundamental changes due to lifestyle changes are mainly diet patterns that will affect BMI and abdominal circumference. Although the results of the study some had normal BMI, quite a number were in the excess range (28.9%) in the risk and obesity category, so attention was needed so that the number did not increase. According to Fauziyah's research, et al (2020) stated that respondents who had a BMI ≥ 25 Kg/m² were caused by an unbalanced diet. During adolescence, physical changes occur which are characterized by rapid body growth. Not only physical changes, but changes that occur in adolescents can cause various problems and changes in behavior in adolescent life. One of the behavioral changes that can be seen in adolescents is eating behavior where healthy eating behavior tends to lead to unhealthy eating behavior. Teenagers tend to follow the trend of consuming fast food. Fast food or fast food when consumed in large quantities and as often as possible can lead to increased body weight and obesity because fast food's energy and fat content is very high (Takumansang, 2017). The more frequent consumption of fast food or fast food, the greater the risk of obesity and increasing the risk of Diabetes Mellitus (Susanti, 2016). This condition was also found in research respondents where the consumption rate of fast food and contemporary sweet drinks was relatively high, reaching more than 60%.

Overweight obesity can not only be affected by an unbalanced diet-, but can occur in someone who is not doing enough physical activity, as found in this study that there were still 46.7% of respondents who did not do regular exercise. Kurdanti et al. (2015) stated that overweight and obesity in adolescents can be caused by unhealthy lifestyles such as excessive intake of macronutrients, frequent fast food consumption, and lack of physical activity. Adolescents are prone to experiencing weight gain because at this age adolescents need a lot of energy to balance their increased growth and development.

The increase in overweight and obesity in adolescents can be caused because teenagers tend to have consumptive behavior and follow trends towards fast food. Not only that, this weight gain can also occur due to decreased physical activity. Most teenagers nowadays spend more of their free time on non-physical activities, such as playing mobile phones, watching TV, and playing online games (Mandriyarini et al., 2016).

Some of these risks are also in line with the results of Ary & Evi's research (2018) which states that the risk factors that cause a relatively high risk of adolescent diabetes mellitus are consumption of fast food with a percentage of 71%, consumption of instant drinks around 31%, and smoking habits around 5%.

To prevent diabetes in adolescents and reduce risk, the National Institute of Health Diabetes Prevention Program (NIH-DPP) recommends several things, the main one being lifestyle intervention. The lifestyle intervention in question is more focused on improving diet and increasing physical activity (Khokhar and Chin 2017). Improved diet and increased activity can help lose weight (BB) or control BB, minimize cardiovascular risk, and prevent pre-diabetes from developing into diabetes (Hannon 2020). Another study shows that the development of pre-diabetes into diabetes can be prevented by up to 58% in 3 years and 34% in 10 years through improving diet (proper diet) and increasing physical activity (American Diabetes Association, 2020).

Another risk factor is genetics/family history of diabetes mellitus. In this study, there were 20% of adolescents who had a family history of DM. This group needs extra attention considering the risk is quite large. This is in line with previous studies which stated that there was a significant relationship between family history of DM and the incidence of DM. Valliyot (2013) in his research in India stated that there was a significant relationship between a family history of DM and the incidence of DM.

Valliyot (2013) also added that people who have a family history of DM are at a three times greater risk of suffering from DM than people who do not have a family history of DM. Likewise, the results of Trisnawati & Setyorogo's (2013) study conducted at the Cengkareng Health Center, stated that there was a significant relationship between a family history of DM and the incidence of DM.

Genetic factors are the basis underlying the high risk of DMT2 in individuals who have family members who have been diagnosed with DM. Several variants of the transcription factor 7 gene are thought to change the function of the islets of Langerhans in the pancreas (Longo, et. all. 2012).

The results of the DM risk assessment based on FINDRISC found that the majority (90%) were low and a small proportion (10%) were in the slightly increased category. Even though the numbers are not too big, it is still a concern because there is a risk of becoming a DM within 10 years.

According to Alya Azzahra, et al (2020), Type 2 DM has risk factors that are divided into two, namely risk factors that cannot be changed and risk factors that can be changed by adopting a healthy lifestyle. These factors can increase the risk of developing type 2 DM. Risk factors that cannot be changed are family history and age. While risk factors that can be changed include obesity, lack of physical activity, dyslipidemia, smoking habits, hypertension, and stress management.

CONCLUSION

The results of a risk assessment with FINDRISC, adolescents should not be at risk of developing DM but in fact, it was found that 10% of adolescents had a slightly increased risk of developing DM. Several risk factors can be changed to reduce the risk of DM, namely obesity, lack of physical activity, dyslipidemia, smoking habits, hypertension, and stress management. Several conditions increase the risk of DM, including:

a. Having excess BMI (28.9%) with risk and obesity category I
b. Not exercising regularly / physical exercise: 53.3%
c. Habit of consuming fast food: 68.9%
d. Current sweet drinking habits: 64.4%
e. Have a history of high blood pressure: 8.9%
f. Family history of DM: 22.2%

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