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Meta Analysis of the Relationship of Obesity with Type 2 Diabetes Mellitus in Indonesia

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ABSTRACT

Diabetes mellitus is a world public health problem. This study aims to determine the relationship between obesity and the incidence of type 2 diabetes mellitus in Indonesia. A systematic review and meta-analysis were carried out on case control studies published in the google scholar database. Data processed using RevMan 5.4. Pooled odds ratio (OR) is calculated by fixed effect models. Meta-analysis results showed that there was a significant relationship between obesity and the incidence of type 2 diabetes mellitus ($p = 0.00001$, OR 4.99, 95% CI 3.58-6.96). There is a significant relationship between obesity and the incidence of type 2 diabetes mellitus. These people have a 4.99 times greater risk of suffering from type 2 diabetes mellitus in the case group than the control group. The public is expected to manage their obesity so that they can reduce the risk of suffering from diabetes mellitus.

Keywords: Meta-analysis, Fixed-effect model, Obesity, Diabetes Mellitus Type 2

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BACKGROUND

Diabetes mellitus is an important health problem in the world, because the cases are increasing from year to year. Data from the International Diabetes Federation (2019) shows that the number of cases in 2013 was 382 million cases and continues to increase until 2019 amounting to 463 million cases and is estimated to increase to 578 million people (10.2%) in 2030 and 700 million people (10.9%) in 2045. Based on data from the International Diabetes Federation (2019), it shows that Indonesia is ranked seventh with the most cases of diabetes mellitus in the world with 10.7 million cases and is the country with the highest number of diabetes sufferers in the Asian region, southeast. About 8.8% of the adult population (20-79 years) or the equivalent of 87.6 million adults in the Southeast Asian region live with diabetes mellitus. This figure is estimated to increase to 115 million people in 2030 and 153 million people in 2045. From these figures it is estimated that Indonesia will be as many as 13.7 million people in 2030 and 16.6 million people in 2045. According to the Indonesian Ministry of Health (2019), an increase in the prevalence of diabetes mellitus in Indonesia from 6.9% in 2013 to 8.3% per year 2018.

The high incidence of diabetes mellitus is influenced by various risk factors, one of which is obesity. Obesity is a condition that occurs as a result of excessive fat accumulation and occurs because of an imbalance between calorie consumption and energy needs (WHO, 2016). Obesity is strongly associated with the incidence of type 2 diabetes mellitus because people who are overweight have increased levels of leptin in the body. The more fat a person is, the greater the risk of a person suffering from diabetes mellitus accompanied by other complications (Yulianto, 2019). According to the results of research conducted by Maharani, et al. (2018) with the results that adults with obesity status were 8 times greater at risk of developing type 2 diabetes mellitus compared to people with normal nutritional status. Another study also conducted by Sari (2018) shows that obesity is the most dominant factor affecting the incidence of type 2 diabetes mellitus, where obese individuals are at 8,333 times the risk of developing type 2 diabetes mellitus compared to non-obese individuals.

The large number of studies on obesity with type 2 diabetes mellitus, demands a conclusion that can be used for prevention and control of type 2 diabetes mellitus, especially in Indonesia. One study alone is not enough to generalize to the population, so the conclusions drawn have stronger power. Meta analysis is a form of statistical method that can estimate the combined effect of several studies that have been conducted (Djafri et al., 2016). Based on this, it is necessary to conduct research on Meta-analysis of the relationship between obesity and the incidence of diabetes mellitus in Indonesia.

METHODS

This research is a quantitative research with a meta-analysis study design. This meta-analysis study was conducted based on the PRISMA protocol. The source of this research data was obtained through literature search on the internet through the google scholar database from 2010 to 2020. The keywords used in the search were diabetes mellitus, diabetes mellitus Type 2, obesity. Besides, in doing searches were also given inclusion criteria and exclusion criteria. Inclusion criteria, among others; quantitative research articles, articles on the subject of human research, research areas in Indonesia, case control research designs, publications in 2010-2020. Meanwhile, the exclusion criteria included; articles that are not available in full text and paid articles. After selecting the study, data abstraction was carried out. The results of this data abstraction are in the form of a systematic review of studies that meet the inclusion criteria. Combining the results from

various studies is the most decisive part of the meta-analysis. Data analysis using a fixed effect model. The software used to perform the meta-analysis was Review Manager 5.4 (RevMan 5.4).

RESULTS

The total number of articles that can be identified is as many as 450 articles. After reviewing the title, only 95 articles were relevant to the study. A total of 86 articles did not meet the inclusion and exclusion criteria. Of this review, only 9 articles were included in the systematic review. An overview of the article can be seen in table 1.

Table 1. Overview of the Research that is Analyzed Systematically

Study (location)	Publication year	Study design	Total subject	Number of cases	OR (CI 95%)	Findings
Erris (Indonesia)	2015	Case control	76	47	3.58 (1.34-9.59)	There is a relationship between obesity and diabetes mellitus ($p = 0.018$)
Sundari et. al. (Indonesia)	2016	Case control	212	133	3.68 (2.04-6.67)	Obesity was statistically significant associated with the incidence of type 2 diabetes mellitus ($p < 0.05$).
Suwinawati (Indonesia)	2020	Case control	74	47	3.83 (1.39-10.55)	Obesity has been shown to be associated with the incidence of Type 2 diabetes ($p = 0.020$)
Wacidah (Indonesia)	2018	Case control	60	21	4.00 (1.27-12.58)	The variable associated with the incidence of type 2 diabetes mellitus was obesity ($p = 0.006$)
Trisnawati and Setyorogo (Indonesia)	2013	Case control	50	34	7.15 (1.91-26.80)	The variable that has a strong relationship with the incidence of type 2 diabetes is body mass index ($p = 0.006$).
Ritonga and Siregar (Indonesia)	2019	Case control	60	32	7.67 (2.42-24.24)	Obesity risk factors associated with type 2 diabetes mellitus ($p = 0.001$)
Maharani et. al. (Indonesia)	2018	Case control	42	20	8.00 (2.01-31.80)	There was a significant relationship between obesity and type 2 diabetes ($p = 0.003$)
Sari (Indonesia)	2018	Case control	62	25	8.33 (2.52-27.60)	There is a significant relationship between obesity and the incidence of type 2 diabetes mellitus ($p = 0.000$)
Nasution et. al. (Indonesia)	2018	Case control	62	32	9.86 (3.08-31.59)	The most dominant variable related to the

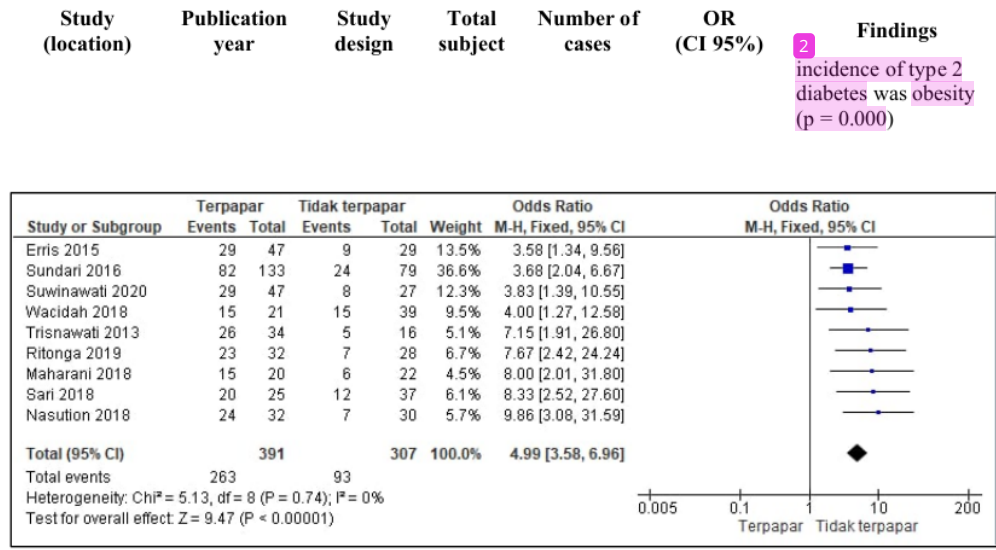


Figure 1. Forest Plot of the Relationship between Obesity and Type 2 Diabetes Mellitus

Using a Fixed-Effect Model

Note:

The blue square represents the OR of each study

The black diamond represents a pooled OR

The horizontal line represents the 95% CI

Based on Figure 1, it can be seen that the analysis with the fixed effect model resulted in a pooled odds ratio of 4.99 (95% CI 3.58-6.96). From these results it can be concluded that there is a significant relationship between obesity and the incidence of type 2 diabetes mellitus, this is evidenced by the value of $p < 0.05$, namely $p = 0.00001$. So it can be concluded that obese people have a 4.99 times greater risk of suffering from type 2 diabetes mellitus in the case group than the control group.

DISCUSSION

There are various limitations in conducting literature searches on the internet through a database. there are several limitations. A search data base using only google scholar with a publication span of the last 10 years can reduce the number of relevant studies. Searches based solely on the internet also limit the number of studies relevant to research. This has the potential to cause publication bias. This meta-analysis study aimed to determine the relationship between obesity and the incidence of type 2 diabetes mellitus. However, the small number of studies that met the inclusion and exclusion criteria did not show any variation between studies. Therefore, the results of the fixed effect model are significant and show a significant relationship between obesity and the incidence of type 2 diabetes mellitus. Based on the results of the study, it can be concluded that obese people have a 4.99 times greater risk of suffering from type 2 diabetes mellitus in the case group than control group. These results are in line with the research of Jellantik and Hayati (2014) showing that obesity is a factor in the incidence of type 2 diabetes and there is a significant relationship between obesity and the incidence of type 2 diabetes with a value of $p = 0.000$.

The results of another study conducted by Zulkifli (2013) showed that respondents who were obese had a risk of developing type 2 diabetes as much as 3.092 times compared to respondents who were not obese.

There is a significant relationship between obesity and diabetes mellitus because obesity is a predisposing factor for insulin resistance. The more fat tissue in the body, the more risky the body will be to insulin action, especially if body fat or excess weight accumulates in the central area or the stomach. This is because fat can block the work of insulin so that glucose cannot be transported into cells and accumulate in blood vessels, resulting in an increase in blood glucose levels (Clare Salzler et al, 2012). The same theory was put forward by Decroli (2019) that apart from increasing free fatty acids (FFA) in cells can reduce glucose transporter translocation to cell membranes, increased FFA can also lead to insulin resistance in muscle and adipose tissue. People who are obese accompanied by type 2 diabetes are caused by an unbalanced diet and like to consume foods that have high enough calorie levels and lack of physical activity. On the other hand, this is because most people choose to buy food that is cooked or ready to eat without thinking that the food is nutritious or not. Things like this that must be paid more attention to by the community that the importance of self-awareness to change a healthy lifestyle, especially a balanced diet or better to cook nutritious and healthy food yourself and not forgetting to be balanced with sufficient physical activity. Being overweight in obese people will increase the need for insulin in the body. Overweight adults have larger fat cells in their bodies, and these fat cells do not respond well to insulin. ²

Obesity is a risk factor that plays an important role in the incidence of type 2 diabetes mellitus. This is in line with the theory presented by Yulianto (2019) that the more fat a person is, the greater the risk of a person suffering from diabetes which is accompanied by other complications, so obesity is the biggest risk factor. which resulted in the incidence of type 2 diabetes mellitus. If the body is fat, it will be difficult to use the insulin produced, this is called a state of insulin resistance. Obesity is also influenced by physical activity which can control blood sugar levels, glucose will be converted into energy during physical activity so that it can cause insulin to increase so that blood sugar levels will decrease. A diet that does not consume less fruits and vegetables and tends to be excessive can lead to obesity (Hutagol, 2014). Based on this, it can be concluded that the importance of public awareness to maintain their health by routinely controlling health to the nearest health service and still implementing a healthy lifestyle by starting to pay attention to a balanced diet such as reducing the habit of eating high carbohydrate foods at night and more regularly ² doing physical activity such as exercise and cycling to reduce the incidence of obesity in the community, especially for people with type 2 diabetes mellitus. This can reduce the incidence of type 2 diabetes mellitus. it is necessary to pay attention to diet, physical activity patterns, emotional eating patterns, and sleep or rest patterns.

Obesity factor is a predisposing factor for increasing blood sugar which is an indicator of diabetes mellitus. Pathologically, this is because beta cells are less sensitive to stimuli due to blood sugar levels and obesity will suppress the number of insulin receptors on cells throughout the body. This statement is supported by the theory of Isnaini and Ratnasari (2018) which states that high fatty acid levels and the emergence of several metabolites such as kinases and resistin, which can interfere with cell sensitivity to insulin in obese sufferers, are the main causes of insulin resistance. Blood sugar levels are also influenced by factors of physical activity and diet intake. Sports programs, maintaining diet and physical activity are highly recommended to maintain blood sugar levels and obesity (Indonesian Ministry of Health, 2018). Maintaining health is very important,

knowing the risk of type 2 diabetes mellitus is useful for efforts to prevent disease, especially at the age of > 40 years because work productivity decreases, so that they are prone to the risk of developing type 2 diabetes mellitus. If the development of diabetes mellitus is not immediately controlled and prevented, will affect public health status.

CONCLUSION

The results of this systematic review and meta-analysis showed that 9 studies were included in the systematic review. From the analysis, it is concluded that there is a significant relationship between obesity and the incidence of type 2 diabetes mellitus. In addition, it is also known that obese people have a 4.99 times greater risk of suffering from type 2 diabetes mellitus in the case group than in the control group. Meanwhile, differences in effects the specifics of the study could not be seen because the number of studies was very small.

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