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# Incidence of Obesity in Diabetes Mellitus Rates, Profile of Teachers and Employees at SMA X Surabaya

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**Abstract**

**Background:** Reduced metabolic function can cause the human body to experience a lack of energy, resulting in the possibility of diseases including diabetes mellitus, hypertension, atherosclerosis, and even coronary heart disease. **Objective:** This study aims to analyze the incidence of obesity through Body Mass Index on the incidence of diabetes mellitus and Lipid Profile at SMA X Surabaya. **Methods:** The research design used was cross-sectional. Sampling was carried out using non-probability sampling with a random sampling technique. Data collection was carried out at SMA X Surabaya by 64 teachers and employees of SMA X Surabaya. Respondents were gathered to receive health education, then went through the registration stages, and vital signs, and then 5 mL of venous blood was taken to measure blood sugar levels and lipid profiles, namely total cholesterol and triglyceride levels. This research uses the Chi-Square test statistical test. **Result:** There is a significant relationship based on the chi square test between body mass index and cholesterol levels and triglyceride levels. because the p-value < 0.05 is 0.041 and 0.050 respectively, but there is no significant relationship between body mass index and glucose levels with a p-value of 0.181**.** **Conclusion**: There is a relationship between the incidence of obesity through Body Mass Index and the incidence of Lipid Profile but there is no relationship with the incidence of diabetes mellitus at SMA X Surabaya**.**

**Keywords:** Diabetes Mellitus, Lipid Profile, Obesity

***Original Research Article***

## INTRODUCTION

As age increases, a person's metabolic function tends to decrease, as well as physical activity also decreases, but body weight tends to increase. This reduction in metabolism can cause the body to experience a lack of energy, so the opportunity for disease is quite large (Rodwell et al., 2006; Wahjuni, 2013; Umbu Henggu & Nurdiansyah, 2022; Bournot et al., 2024).

Weight gain as an adult can be measured by Body Mass Index (Dateki et al., 2020). The prevalence of overweight and obesity is expressed by Body Mass Index (BMI). Calculation of Body Mass Index (BMI) is done by dividing the patient's body mass or weight expressed in kilograms (Kg) by the square of the patient's height expressed in meters (m). In adult men, overweight is declared if they have a BMI value greater than or equal to 25 and lower than 27, while obesity is declared if the BMI

value is greater than or equal to 27. In adult women, overweight is declared if the value BMI is greater than or equal to 23 and lower than 27, while it is said to be obese if the BMI value is greater than or equal to 27(Kemenkes RI, 2017).

One of the characteristics that can be utilized to determine diabetes mellitus risk factors is body weight. There are four categories for body weight: normal, underweight, overweight, and obese. In the meanwhile, one method to gauge and identify this category is by calculating BMI. A person's relative level of body fat is determined by their BMI. This is used to determine if a person is lean, ideal, or overly fat, as well as to assess their weight status in relation to the risk of health issues brought on by being underweight or overweight. Body mass index can be affected by a number of factors, including age, occupation, lifestyle, poor food, inactivity, and health-related knowledge. Obesity is one risk factor that leads to diabetes mellitus. An imbalance in the amount of energy obtained leads to obesity (Pitrida, 2019; Yohana et al., 2022).

Being overweight is a risk factor for death (Ledebur et al., 2024). At least 2.8 million people die every year as a result of being overweight or obese. Apart from that, 44% of people with diabetes, 23% of people with ischemic heart disease, 41% of people with cancer are also overweight or obese. An increase in BMI is a major risk factor for several types of cancer, diabetes, osteoarthritis and the potential for high blood pressure which can lead to heart disease and stroke (Bays et al., 2021; Larsson & Burgess, 2021; Ma et al., 2009). The risks of other diseases from increasing BMI are fatty liver, gallstones, hormonal disorders resulting in infrequent menstruation, difficulty getting pregnant, cholesterol and others (Yuliana, 2016).

The results of the 2007 Basic Health Research (Riskesdas) stated that there was a relationship between degenerative diseases such as metabolic syndrome, stroke, hypertension, obesity and heart disease with the socio-economic status of the community (Sopiah et al., 2021; Septiyanti et al., 2020). Based on the results of blood pressure measurements, the prevalence of hypertension in the population aged >18 years in Indonesia is 31.7%. According to the characteristics of respondents, the prevalence of hypertension increases according to the age of the respondents, namely aged 45-54 years (42.4%), aged 55-64 years (53.7%) and aged 65-74 years (63.5%). The national prevalence of general obesity is 19.1%. Nationally, the general prevalence of obesity in men (13.9) is lower than in women 3 (23.8%). According to the province, the prevalence of hypertension in Central Java province is 37% and the prevalence of obesity is 17% (Dr. Triono Soendoro, 2007; González et al., 2024; Jobe et al., 2024).

According to 2013 Basic Health Research (Riskesdas) data, 35.9% of Indonesians have cholesterol levels that are higher than usual. Prevalence is shown by Soebardi et al. hypertriglyceridemia, hypercholesterolemia, and high HDL cholesterol LDL cholesterol levels in T2DM patients can be both high and low. correspondingly, it is 67.7%, 54.9%, and 36.8% in Indonesia. and 91.7%. Additionally, this study discovered that triglyceride levels both low and high HDL are more prevalent in people with type 2 diabetes compared to the general population pre-diabetes (Badan Penelitian dan Pengembangan Kesehatan, 2013)

Given the severity of the issues brought on by atherogenic dyslipidemia, particularly with regard to the risk of cardiovascular consequences, screening recommendations for this cardiovascular risk are included in diabetes mellitus management guidelines (Rosandi, 2021)

DM is a silent killer since it is a risk factor for early atherosclerosis on its own and because it is frequently misunderstood by the general public. In order to prevent atherogenic dyslipidemia, diabetic dyslipidemia, metabolic syndrome diabetes, and obesity, the research we are doing is a first step that involves screening for these conditions as well as cardiovascular risk factors in individuals. As a follow-up, natural food composites will be formulated. which is secure for the community

Given that one of the risk factors for diabetes mellitus is obesity, and that a person's BMI can be used to determine whether or not they are obese, diabetes mellitus and BMI—are two variables that are crucial to examine in addition to the condition of weight gain—are both present at SMA X Surabaya. The purpose of this study was to determine the association between the incidence of obesity, the

incidence of diabetes mellitus, and the lipid profile—that is, the levels of total cholesterol and triglycerides—among high school teachers and staff. Surabaya SMA X.

## MATERIALS AND METHODS

The design used in this research was cross-sectional. Sampling was carried out using non-probability sampling using a simple random sampling technique. Data collection was carried out at SMA X Surabaya with the number of respondents being 64 teachers and employees of SMA X Surabaya as the population at the same time as a sample in this research. Numerical, quantitative variables make up the variable categories that are employed. In the interim, position-based variables are as follows: independent variables in this study are diabetes rate and lipid profile and the dependent variable is the incidence of obesity. This research was assisted by doctors and health analysts who are competent in their fields. The stages of the research were carried out as follows: First: Preparation Stage for Respondents/participants as follows: (1) Preparation of respondents/participants by arranging an appropriate schedule so that it does not interfere with the teaching schedule or existing tasks at SMA X, by dividing into 3 wave groups. Namely 07.00-09.00, 09.00-11.00 and 11.00-13.00. (2) Registration was carried out by filling in identity and providing research informed consent, filling in informed consent accompanied by the researcher (3) Anthropometric measurements were carried out including body weight and height using a weighing scale and height instrument. (4) Vital signs are checked using a stethoscope and blood pressure monitor. (5) Examination by a doctor to obtain health consultation. (6) 5 mL of blood was taken through a vein using a 3 cc syringe, tourniquet, vacuum tube, needle, cotton, and alcohol to check fasting blood sugar (We have informed you to fast for 8 hours before checking your health via the WA group) and lipid profile including total cholesterol using DiaSys reagent, CHOD-PAP enzymatic method, and triglycerides. with DiaSys reagent GPO enzymatic method. The results of this research were analyzed using statistical tests using the Chi-Square. A statistical method commonly employed to assess a hypothesis is the chi-square test. The sample has a large scale, and the population is nominal. The data can be considered significant if the chi-square result is less than 0.05 (Heryana, 2020). Test to determine the influence and measure the strength of the relationship between variables. This research passed the ethical test with ethical number: 92/SLE/FK/UWKS/2023.

## RESULTS

The research implementation at SMA X involved teachers and employees of all school levels and was attended by 64 participants.

**Table 1.** Research results on glucose levels, cholesterol levels and triglyceride levels

| RESPONDENT | IMT | CATEGORY | KADAR GLUKOSA | CATEGORY | KADAR KOLESTEROL | CATEGORY | KADAR TRIGLISERIDA | CATEGORY |
|---|---|---|---|---|---|---|---|---|
| **P1** | 24 | NORMAL | 97 | Normal | 155 | Normal | 57 | Normal |
| **P2** | 29 | OBESITY | 103 | Prediabetes | 261 | Hight | 209 | Hight |
| **P3** | 33 | OBESITY | 117 | Prediabetes | 325 | Hight | 560 | Hight |
| **P4** | 38 | OBESITY | 106 | Prediabetes | 245 | Hight | 232 | Hight |
| **P5** | 29 | OBESITY | 90 | Normal | 203 | intensify | 200 | Hight |
| **P6** | 25 | FAT | 93 | Normal | 202 | intensify | 100 | Normal |
| **P7** | 27 | FAT | 117 | Prediabetes | 265 | Hight | 161 | intensify |
| **P8** | 28 | OBESITY | 100 | Prediabetes | 158 | Normal | 213 | Hight |
| **P9** | 27 | OBESITY | 195 | Diabetes | 241 | Hight | 201 | Hight |
| **P10** | 30 | OBESITY | 164 | Diabetes | 230 | intensify | 247 | Hight |
| **P11** | 26 | FAT | 109 | Prediabetes | 202 | intensify | 173 | intensify |
| **P12** | 32 | OBESITY | 112 | Prediabetes | 174 | Normal | 199 | intensify |
| **P13** | 30 | OBESITY | 95 | Normal | 243 | Hight | 123 | Normal |
| **P14** | 25 | NORMAL | 92 | Normal | 189 | Normal | 170 | Meningkat |
| **P15** | 22 | NORMAL | 69 | Normal | 178 | Normal | 146 | Normal |

| RESPONDENT | IMT | CATEGORY | KADAR GLUKOSA | CATEGORY | KADAR KOLESTEROL | CATEGORY | KADAR TRIGLISERIDA | CATEGORY |
|---|---|---|---|---|---|---|---|---|
| **P16** | 28 | OBESITY | 90 | Normal | 211 | intensify | 64 | Normal |
| **P17** | 29 | OBESITY | 81 | Normal | 262 | Hight | 189 | intensify |
| **P18** | 25 | FAT | 74 | Normal | 190 | Normal | 173 | intensify |
| **P19** | 31 | OBESITY | 93 | Normal | 230 | intensify | 175 | intensify |
| **P20** | 30 | OBESITY | 150 | Diabetes | 364 | Hight | 898 | Hight |
| **P21** | 29 | OBESITY | 105 | Prediabetes | 251 | Hight | 365 | Hight |
| **P22** | 27 | OBESITY | 91 | Normal | 202 | intensify | 84 | Normal |
| **P23** | 24 | NORMAL | 77 | Normal | 194 | Normal | 56 | Normal |
| **P24** | 28 | OBESITY | 73 | Normal | 250 | Hight | 200 | Hight |
| **P25** | 25 | GEMUK | 98 | Normal | 203 | intensify | 286 | Hight |
| **P26** | 26 | GEMUK | 87 | Normal | 222 | intensify | 190 | intensify |
| **P27** | 19 | NORMAL | 94 | Normal | 248 | Hight | 149 | Normal |
| **P28** | 21 | NORMAL | 76 | Normal | 231 | intensify | 170 | intensify |
| **P29** | 29 | OBESITY | 81 | Normal | 200 | intensify | 66 | Normal |
| **P30** | 21 | NORMAL | 79 | Normal | 135 | Normal | 46 | Normal |
| **P31** | 30 | OBESITY | 83 | Normal | 157 | Normal | 104 | Normal |
| **P32** | 17 | VERY THIN | 84 | Normal | 144 | Normal | 117 | Normal |
| **P33** | 34 | OBESITY | 89 | Normal | 250 | Hight | 200 | Hight |
| **P34** | 23 | NORMAL | 70 | Normal | 242 | Hight | 175 | intensify |
| **P35** | 26 | FAT | 90 | Normal | 142 | Normal | 130 | Normal |
| **P36** | 18 | KURUS | 75 | Normal | 208 | intensify | 151 | intensify |
| **P37** | 21 | NORMAL | 64 | Normal | 238 | intensify | 74 | Normal |
| **P38** | 25 | NORMAL | 85 | Normal | 202 | intensify | 93 | Normal |
| **P39** | 29 | OBESITY | 113 | Prediabetes | 240 | Hight | 160 | intensify |
| **P40** | 26 | FAT | 73 | Normal | 357 | Hight | 207 | Hight |
| **P41** | 25 | FAT | 98 | Normal | 303 | Hight | 304 | Hight |
| **P42** | 22 | NORMAL | 75 | Normal | 160 | Normal | 395 | Hight |
| **P43** | 23 | NORMAL | 87 | Normal | 205 | intensify | 147 | Normal |
| **P44** | 24 | NORMAL | 170 | Diabetes | 199 | Normal | 292 | Tinggi |
| **P45** | 30 | OBESITY | 188 | Diabetes | 170 | Normal | 115 | Normal |
| **P46** | 23 | NORMAL | 90 | Normal | 170 | Normal | 94 | Normal |
| **P47** | 32 | OBESITY | 94 | Normal | 243 | Hight | 74 | Normal |
| **P48** | 30 | OBESITY | 71 | Normal | 200 | intensify | 81 | Normal |
| **P49** | 34 | OBESITY | 165 | Diabetes | 205 | intensify | 230 | Hight |
| **P50** | 25 | GEMUK | 71 | Normal | 242 | Hight | 199 | intensify |
| **P51** | 27 | GEMUK | 71 | Normal | 215 | intensify | 75 | Normal |
| **P52** | 29 | OBESITY | 83 | Normal | 240 | Hight | 52 | Normal |
| **P53** | 21 | NORMAL | 82 | Normal | 205 | intensify | 81 | Normal |
| **P54** | 32 | OBESITY | 127 | Diabetes | 200 | intensify | 108 | Normal |
| **P55** | 27 | OBESITY | 73 | Normal | 160 | Normal | 141 | Normal |
| **P56** | 17 | KURUS | 95 | Normal | 197 | Normal | 169 | intensify |
| **P57** | 27 | OBESITY | 90 | Normal | 245 | Hight | 180 | intensify |
| **P58** | 24 | NORMAL | 82 | Normal | 213 | intensify | 326 | Hight |
| **P59** | 29 | OBESITY | 64 | Normal | 201 | intensify | 203 | Hight |
| **P60** | 29 | OBESITY | 75 | Normal | 250 | Hight | 201 | Hight |
| **P61** | 27 | OBESITY | 67 | Normal | 203 | intensify | 169 | intensify |
| **P62** | 32 | OBESITY | 84 | Normal | 205 | intensify | 315 | Hight |
| **P63** | 27 | OBESITY | 88 | Normal | 243 | Hight | 247 | Hight |
| **P64** | 31 | OBESITY | 80 | Normal | 204 | intensify | 213 | Hight |

1. Number of Respondents by Gender

**Table 2.** Number of Respondents by Gender

| Gender | ∑ | Percentage |
|---|---|---|
| Men | 42 | 65,63% |
| Women | 22 | 34,37% |
| Total | 64 | 100% |

From the data in Table 1, the gender of the largest number of respondents was male, 42 people (65,63%), then female, 22 people (34,37%).

2. Respondents by Age.

**Table 3.** Percentage Respondent's age by Age

| | Age Group | ∑ | Percentage |
|---|---|---|---|
| **1** | 21-30 | 10 | 15,63% |
| **2** | 31-40 | 14 | 22,22% |
| **3** | 41-50 | 21 | 33,33% |
| **4** | 51-60 | 19 | 29,69% |
| **TOTAL** | | 64 | 100 % |

Based on Table 2, data obtained for the Age Group 1 (21-30 Years) category was 10 (15.63%), Age Group 2 (31-40 Years) was 14 (22.22%), Age Group 3 ( 41-50 Years) as many as 21 (33.33%), Age Group 4 (51-60 Years) as many as 19 (29.69%), meaning that the largest number is age group 3, namely 21 people (33.33%).

3. Nutritional Status of Respondents Based on Gender

**Table 3.** Nutritional Status of Respondents Based on Gender

| Gender | Nutritional Status | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Obesity | | Fat | | Normal | | | |
| **Men** | 23 | 67,6% | 8 | 72,7% | 10 | 52,6% | 41 | 64.1% |
| **Women** | 11 | 32,4% | 3 | 27,27% | 9 | 47,4% | 23 | 35,9% |
| **Total** | 34 | 100% | 11 | 100% | 19 | 100% | 64 | 100% |

Based on table 3 and figure 1, it was found that the dominance of obese respondents was 23 people (67.6%) for men and 11 people (32.4%) for women**.**

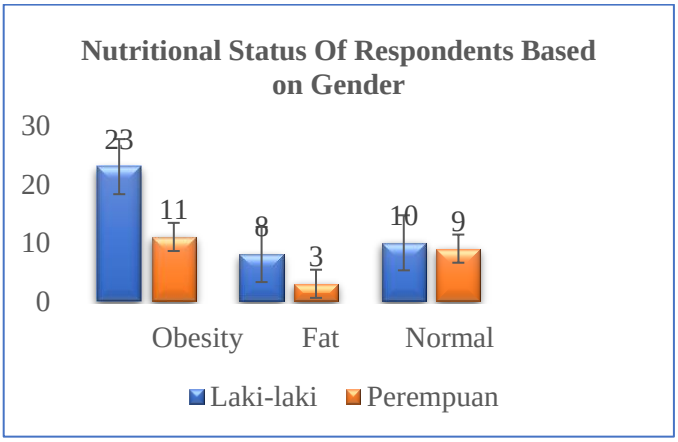


**Figure 1.** Nutritional Status of Respondents Based on Gender

**DISCUSSION**

Analysis of the incidence of obesity through BMI (Nutritional Status) on Cholesterol Levels: Based on statistical tests using the Chi Square Test, it shows that there is a significant relationship between the incidence of obesity through BMI and cholesterol levels. The obtained asymp.sig (2-sided) value is <0.05, namely 0.041.

Adding weight will of course increase your BMI in the obese category. A person who is overweight or obese is found to experience an increase in total cholesterol levels, an increase in LDL cholesterol levels and a decrease in HDL cholesterol levels (Milyani & Al-Agha, 2019). There is a positive correlation between BMI and total cholesterol levels in serum, so BMI can be used as a screening tool for the risk of cardiovascular disease where conditions do not allow for routine checking of serum cholesterol levels(Nwaiwu & Ibe, 2015). BMI is a strong predictor of total cholesterol levels. BMI can also be used as a means of health education regarding behavior modification, nutrition, and the benefits of physical activity to prevent diabetes and cardiovascular disease. This is in line with the results of this study where a significant relationship was found between body mass index and total cholesterol levels.

Our findings support those of Dana and Maharani research from 2022, which found a correlation between elevated serum cholesterol and weight gain in individuals. The purpose of this study is to ascertain how Kudus Polytechnic staff and students' body mass index and cholesterol levels relate to one another. This study employs observational research methodology and makes use of secondary data from Posbindu, such as name, anthropometry (TB, BW), cholesterol level information, and medical history. Therefore, researchers used supplementary questionnaires to examine data in order to complete the basic data of respondents. Using the purposive sampling technique, the sample consisted of Kudus Polytechnic staff members and students. The Pearson correlation test and association strength (r) were employed in the data analysis. The Pearson test results provide a value of ($p<0.05$), indicating that the blood cholesterol levels are significantly correlated with the BMI variable. Correlation ($r = 0.4$) indicates a modest level of correlation. Individuals with higher BMIs tend to have higher blood cholesterol levels. Age and cholesterol levels are significantly correlated in external variables. You will have greater cholesterol as you age because of a moderately strong positive link with cholesterol(Dana & Maharani, 2022).

This is also consistent with a study that was carried out on April 19, 2022, at the Faculty of Medicine, Al-Azhar Islamic University, by Parta Wibawa et al. There were 81 responders in the study sample. The Spearman Rank correlation test was used to examine the collected data. ($p\leq0.05$) is the significance threshold. Findings: The Body Mass Index (BMI) of the respondents was 21.59 kg/m2, which is within the normal range. In the typical group, respondents' average upper arm circumference (LiLA) is 28 cm. For respondents in the typical category, the average waist circumference is 78 cm. The average total cholesterol level among the participants was determined to be 189 mg/dl. Body Mass Index (BMI) and total cholesterol levels are significantly correlated, with a p-value of 0.00 (p-value < 0.05) and a coefficient value of 0.556 (Parta Wibawa et al., 2022)

Analysis of Obesity Incidents via BMI on Glucose Levels: Based on statistical tests using the Chi-Square Test, it shows that there is no significant relationship between the incidence of obesity through BMI and glucose levels. The obtained asymp.sig (2-sided) value is >0.05, namely 0.181.

Although many studies have concluded that there is a significant relationship between BMI and blood glucose levels, namely that individuals with a high BMI have a higher risk of developing diabetes mellitus where their blood glucose levels are high(Agrawal et al., 2017)(Patel et al., 2023). BMI is closely related to insulin resistance and diabetes. In obese individuals, there are increased levels of non-esterified fatty acids, glycerol, hormones, cytokines, pro-inflammatory compounds, and other compounds involved in the development of insulin resistance. Failure of pancreatic beta cells to produce insulin will be exacerbated by insulin resistance(Al-Goblan et al., 2014).

Several studies also found that there was no significant relationship between body mass index and blood glucose levels(Suryanti et al., 2019). Likewise, in this study it was also found that there was no significant relationship between body mass index and blood glucose levels. This can be caused because obesity is not the only factor that can influence blood glucose levels. The pancreas plays an important role in maintaining blood glucose levels by producing insulin and glucagon. These two hormones not only interact with each other but also interact with other organs, such as the brain, liver, intestines, fat tissue, and muscles. All of them synergize with each other also with the help of messenger molecules such as neuropeptides, hepatocytes, enteroendocrine hormones, adipokines (leptin and adiponectin), and myokines. In good body condition, all of these interactions will ensure that glucose homeostasis occurs. However, if there is a disturbance in one of them, it can cause an increase in blood glucose levels and even diabetes mellitus(Röder et al., 2016). Lifestyle Is Another Factor That Causes Diabetes Mellitus, at a young age, type 2 diabetes is becoming more and more common due to changes in lifestyle and the rise in the number of obese patients. In actuality, type 2 diabetes mellitus can strike people as early as age 25. On the other hand, type 2 diabetes is avoidable. The first step in preventing this is to monitor what you eat and keep your body in good physical condition. Diabetes disease specialist Sidartawan Soegondo thinks that an unhealthy lifestyle, specifically physical activity, is the cause of the relatively large rise in the number of diabetes patients. Obesity is easily caused by this lifestyle. An individual's chance of having diabetes also rises with increased body weight. Diabetes mellitus is a risk factor in addition to inactivity, dangerous food consumption, alcohol use, and cigarette smoking. It was discovered from the interview data that most informants did not smoke or drink alcohol. On the other hand, one individual drank alcohol occasionally, while another individual had smoked in the past(Betteng et al., 2014)

Analysis of the incidence of obesity via BMI on triglyceride levels: Longitudinal cohort studies obtained positive results for the correlation between triglycerides and body mass index and the incidence of diabetes mellitus(Cheng et al., 2023). This correlation is caused by several things, including (1) the development of social life where young people lead unhealthy lifestyles due to life pressures and the desire for entertainment which will change the body's metabolism, (2) body composition and metabolic speed which vary between women and men. , (3) alcohol consumption will affect libido, lipid metabolism, and gut microbiome composition, (4) high blood pressure that occurs over a long period of time can also increase the risk of diabetes mellitus. The incidence of obesity through high body mass index and triglyceride levels has also been proven to be associated with an increased incidence of cardiovascular disease(Cheng et al., 2023)(Quesada-Caballero et al., 2024). Insulin resistance is the main factor causing diabetes mellitus, dyslipidemia, obesity, and cardiovascular disease. High triglyceride levels are a factor in insulin resistance, so high triglyceride levels are also a cause of cardiovascular disease.

The results of this study are different from research at the Indonesian Christian University Hospital which stated that there was no significant relationship between body mass index and LDL cholesterol and triglyceride levels (Prihantini et al., 2023). This occurs because there is an influence of compounds that reduce lipid levels in diabetes mellitus patients so that patients who are obese have triglyceride levels that are not high. This study had limitations because its data collection process involved the use of secondary data, specifically medical records. When a patient receives care outside of UKI General Hospital and takes medication that is not prescribed by a physician, the medical records do not accurately document the course of treatment received. Another restriction on this study is the quantity of samples that were used.

Due to financial constraints, at this early stage of our study, we are only able to screen for novel events that have never been conducted at SMA Natural Food and that are safe for participants who are obese and may have a high lipid profile. The goal of performing health examinations, which involve determining height and weight in order to calculate body mass index values, is to be realistic and useful in educating participants so they can perform their own nutritional screening and determine whether or not they are obese or at risk of malnutrition. This way, they will be expected to do it on their own. Future respondents should exercise caution in upholding their lifestyle, which includes selecting a

menu high in nutritious options. The research we are doing is a first step that involves screening for these conditions as well as cardiovascular risk factors in individuals. As a follow-up, natural food composites will be formulated. which is secure for the community.

## CONCLUSION

According to research conducted at SMA Surabaya, there was a significant influence based on the chi-square test between the indices, but there was no significant influence between body mass index and glucose levels or the incidence of diabetes with a p-value >0.05, namely 0.181. triglyceride and cholesterol levels with body mass because the p-values are 0.041 and 0.050, respectively, less than 0.05. This value is significant because the count (0.406) is more than the t table, which is 0.05.

It is hoped that the research's findings can serve as a guide for future studies on a variety of other lipid profiles, including those that measure LDL and HDL levels. Our research is the first step toward screening for both this condition and cardiovascular risk factors in individuals. It can serve as a guide for future studies that aim to develop community-safe natural food composite formulations and as a reference for additional screening in clinical practice.

## CONFLICT OF INTEREST

The authors declared that there is no conflict of interest.

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## REFERENCES

Agrawal, N., Kumar Agrawal, M., Kumari, T., & Kumar, S. (2017). Correlation between Body Mass Index and Blood Glucose Levels in Jharkhand Population. *International Journal of Contemporary Medical Research ISSN*, *4*(8), 1633.

Al-Goblan, A. S., Al-Alfi, M. A., & Khan, M. Z. (2014). Mechanism linking diabetes mellitus and obesity. *Diabetes, Metabolic Syndrome and Obesity*, *7*, 587–591. https://doi.org/10.2147/DMSO.S67400

Badan Penelitian dan Pengembangan Kesehatan. (2013). Riset Kesehatan Dasar (RISKESDAS) 2013. *Laporan Nasional 2013*. https://doi.org/1 Desember 2013

Bays, H. E., Taub, P. R., Epstein, E., Michos, E. D., Ferraro, R. A., Bailey, A. L., Kelli, H. M., Ferdinand, K. C., Echols, M. R., & Weintraub, H. (2021). Ten things to know about ten cardiovascular disease risk factors. *American Journal of Preventive Cardiology*, *5*, 100149.

Betteng, R., Pangemanan, D., Mayulu, N., Fakultas, K. S., Universitas, K., Ratulangi, S., Fakultas, B. F., & Fakultas, B. G. (2014). Analysis of Risk Factors Causing Type 2 Diabetes Mellitus in Women of Productive Age at Wawosana Community Health Center. In *Jurnal e-Biomedik (eBM)* (Vol. 2, Issue 2).

Bournot, L., Payet, T., Marcotorchino, J., Awada, M., Rouquet, T., Breniere, T., Couturier, C., Astier, J., Halimi, C., & Reboul, E. (2024). Vitamin D metabolism is altered during aging alone or combined with obesity in male mice. *BioFactors*.

Cheng, Y., Fang, Z., Zhang, X., Wen, Y., Lu, J., He, S., & Xu, B. (2023). Association between triglyceride glucose-body mass index and cardiovascular outcomes in patients undergoing percutaneous coronary intervention: a retrospective study. *Cardiovascular Diabetology*, *22*(1), 1–14. https://doi.org/10.1186/s12933-023-01794-8

Dana, Y. A., & Maharani, H. (2022). Hubungan Indeks Massa Tubuh Dengan Kadar Koleterol Pada Karyawan Dan Mahasiswi Politeknik Kudus. *Florona : Jurnal Ilmiah Kesehatan*, *1*(1).

Dateki, S., Furukawa, S., Noda, S., & Sameshima, H. (2020). The Effect of Body Mass Index Changes between Two Consecutive Pregnancies on the Recurrence of Gestational Diabetes Mellitus in Japan. *Journal of Womens Health and Development*, *3*(1), 56–64.

Dr. Triono Soendoro, P. (2007). Riset Kesehatan Dasar (RISKESDAS). In *Badan Penelitian dan Pengembangan Kesehatan* (Vol. 2). https://doi.org/10.1007/BF00006513

González, L., Dunstan, J., Cuadrado, C., Avalos, D., Correa, J., Tronscossa, N., & Vasquez, O. C. (2024). The problem of estimation and forecasting of obesity prevalence using sparsely collected data. *The International Journal of Intelligent Real-Time Automation A Journal of IFAC, the International Federation of Automatic Control*, *132*, 107860. https://doi.org/https://doi.org/10.1016/j.engappai.2024.107860

Haryana, A. (2020). Pemilihan uji statistik. *Jurnal Universitas Esa Unggul*, *1*(1).

Jobe, M., Mactaggart, I., Bell, S., Kim, M. J., Hydara, A., Bascaran, C., Njai, M., Badjie, O., Perel, P., & Prentice, A. M. (2024). Prevalence of hypertension, diabetes, obesity, multimorbidity, and related risk factors among adult Gambians: a cross-sectional nationwide study. *The Lancet Global Health*, *12*(1), e55–e65.

Kemenkes RI. (2017). *Panduan Pelaksanaan Gerakan Nusantara Tekan angka Obesitas (GENTAS)* (K. RI, Ed.; pp. 1–41).

Larsson, S. C., & Burgess, S. (2021). The causal role of high body mass index in multiple chronic diseases: a systematic review and meta-analysis of Mendelian randomization studies. *BMC Medicine*, *19*, 1–10.

Ledebur, K., Kautzky-Willer, A., Thurner, S., & Klimek, P. (2024). Optimal prevention strategies for chronic diseases in an compartmental disease trajectory model. *ArXiv Preprint ArXiv:2403.14296*.

Ma, R. C. W., Ko, G. T., & Chan, J. C. (2009). Health hazards of obesity—an overview. *Obesity: Science to Practice. Hoboken, NJ: John Wiley & Sons*, 215–236.

Milyani, A., & Al-Agha, A. (2019). The effect of body mass index and gender on lipid profile in children and adolescents in Saudi Arabia. *Annals of African Medicine*, *18*(1), 42–46. https://doi.org/10.4103/aam.aam_17_18

Nwaiwu, O., & Ibe, B. C. (2015). Relationship between serum cholesterol and body mass index in Nigeria schoolchildren aged 2-15 years. *Journal of Tropical Pediatrics*, *61*(2), 126–130. https://doi.org/10.1093/tropej/fmu080

Parta Wibawa, I. N. B. A., Rini, S., Sabariah, S., & Setyowati, E. R. (2022). Hubungan Indeks Massa Tubuh (IMT), Lingkar Lengan Atas (LiLA) Dan Lingkar Pinggang Dengan Kadar Kolesterol Total Pada Mahasiswa Fakultas Kedokteran Universitas Islam Al-Azhar. *Jurnal Fakultas Kedokteran Universitas Islam Al-Azhar*, *1*.

Patel, B., Mehta, D., Vaghani, A., & Patel, K. (2023). Correlation of Body Mass Index (BMI) with Saliva and Blood Glucose Levels in Diabetic and Non-Diabetic Patients. *J Pharm Bioallied Sci*, *15 Suppl 2*(suppl 2), S1204–S1207. https://doi.org/10.4103/jpbs.jpbs_159_23

Pitrida, G. (2019). Faktor Resiko Kejadian Diabetes Melitus Terhadap Pasien Yang Datang Berobat Ke Klinik Asri Wound Medan Tembung Tahun 2019. *Koleksi KTI D3 Keperawatan*.

Prihantini, N. N., Adintia, M., & Utomo, T. Y. (2023). Relationship between Body Mass Index and Low-Density Lipoprotein and Triglycerides in Type 2 Diabetes Mellitus Patients. *Asian Journal of Medicine and Health*, *21*(7), 65–74. https://doi.org/10.9734/ajmah/2023/v21i7843

Quesada-Caballero, M., Carmona-García, A., García-Lara, R. A., Caballero-Mateos, A. M., Suleiman-Martos, N., Cañadas-De la Fuente, G. A., & Romero-Béjar, J. L. (2024). Assessing the Risk of Hypertension in Chronic, Elderly Patients during the COVID-19 Pandemic: A Prospective Study. *Journal of Cardiovascular Development and Disease*, *11*(1), 21.

Röder, P. V., Wu, B., Liu, Y., & Han, W. (2016). Pancreatic regulation of glucose homeostasis. *Experimental & Molecular Medicine*, *48*(November 2015), e219. https://doi.org/10.1038/emm.2016.6

Rodwell, V., Bender, D., Botham, K., Kennelly, P., & Weil, A. (2006). *Harper's Illustrated Biochemistry, 30th Edition*.

Rosandi, R. (2021). Dislipidemia Aterogenik pada Pasien Diabetes Melitus Tipe 2: Patofisiologi dan Pilihan Terapi. *MEDICINUS*, *34*(1). https://doi.org/10.56951/medicinus.v34i1.47

Septiyanti, S., Jafar, N., & Hendrayati, H. (2020). Hubungan Pola Konsumsi Sayur dan Buah dengan Kejadian Sindrom Metabolik pada Pasien Rawat Jalan di RSUD Labuang Baji Kota Makassar. *Window of Public Health Journal*, *1*(1), 38–47.

Sopiah, L., Lestari, W., Suraya, R., Yulita, Y., & Nababan, A. S. V. (2021). Faktor yang Berhubungan dengan Obesitas Remaja di Kelurahan Bunut Barat Kecamatan Kisaran Barat. *Journal of Nursing and Health Science*, *1*(1), 8–13.

Suryanti, S. D., Raras, A. T., Dini, C. Y., & Ciptaningsih, A. H. (2019). Hubungan Indeks Masa Tubuh Dengan Kadar Gula Darah Puasa Pada Pasien Diabetes Melitus Tipe 2. *Poltekita: Jurnal Ilmu Kesehatan*, *13*(2), 86–90.

Umbu Henggu, K., & Nurdiansyah, Y. (2022). Review dari Metabolisme Karbohidrat, Lipid, Protein, dan Asam Nukleat. *QUIMICA: Jurnal Kimia Sains Dan Terapan*, *3*(2), 9–17. https://doi.org/10.33059/jq.v3i2.5688

Wahjuni, S. (2013). Metabolisme Biokimia. In *Journal of Chemical Information and Modeling* (Vol. 53, Issue 9).

Yohana, Y., Meiyanti, M., Kartadinata, E., & Margo, E. (2022). Pengukuran Status Gizi dan Pengobatan Penyakit Metabolik Warga Kelurahan Angke, Jakarta Barat. *Jurnal ABDINUS: Jurnal Pengabdian Nusantara*, *6*(2). https://doi.org/10.29407/ja.v6i2.16080

Yuliana, E. (2016). *Hubungan Indeks Massa Tubuh dengan Kadar Kolesterol Total pada Lansia di Posyandu Lansia*.