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Research Article

Relationships between body mass index with cholelithiasis

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ABSTRACT

Gallstones formed due to imbalance of bile components, excessive/ high level of cholesterol, nor bilirubin. Obesity was a condition where body mass index (BMI) was excess, which can cause health problems such as an increase of cholesterol, triglycerides, insulin levels, and blood pressure. There's growing attention to cholelithiasis in Indonesia, but there wasn't any data on the prevalence due to the limited amount of study related to cholelithiasis and BMI. This study aimed to analyze the relationship between BMI and cholelithiasis in Dr. Soetomo General Hospital. An analytical descriptive study with the case-control design was conducted, and the data were collected from medical records. The sample was 124 patients from the internal outpatient clinic Dr. Soetomo General Hospital. The data were analyzed using a t-test 2 independent sample. The ratio between female and male patients was 3:1, mean of age was 36-45 years, 45.2% had weight range from 61-70 kg, 51.2% had height range 150-159 cm, the BMI from patient with cholelithiasis specifically 45.3% on at-risk scale and 40% on obese I, the result showed p-value 0.089 ($p > 0.05$), which means that there was no significant differences with the BMI from patients with cholelithiasis and without cholelithiasis. In conclusion, BMI could not be used as a parameter to determine the occurrence of cholelithiasis on an individual.



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INTRODUCTION

Obesity is a condition where body mass index (BMI) is excess, which can cause health problems such as an increase of cholesterol, triglycerides, insulin levels, blood pressure, apnea, orthopedic complications, and mental health problems (Nihiser, 2007). Initially, this problem only considered in countries with high income, but now overweight and obesity were currently dramatically emerging in countries with low and middle income, especially in urban areas (Bonfrate, 2014). The prevalence of overweight in Indonesia compared to Malaysia was 21% to 44.2% (WHO, 2015).

Overweight and obesity were defined as an abnormal or excessive accumulation of fat that can cause health risks. Measurement of obesity population can be done directly by BMI, a person's body weight (kg) divided by the square of a person's height (meters). A person with a BMI of 30 or more was generally considered obese. Whereas someone with a BMI equal to or more than 25 were considered as overweight (WHO, 2015).

Cholelithiasis is the presence of stones in the gallbladder. The imbalance of bile-forming ingredients formed gallstones. Gallstones were formed when the bile contains an excess of cholesterol, excess of bilirubin, or insufficient bile salts. Gallstones were divided into two types; there were cholesterol stones and pigment stones. Cholesterol stones were formed from hardened cholesterol. In the United States, more than eighty percent of gallstones were cholesterol stones.

In Indonesia, the attention about cholelithiasis has begun, however there was still no national data due to the limited research related to cholelithiasis. In Dr. Soetomo General Hospital, the prevalence of people with cholelithiasis in 2016 is 8% of all the disease where the average annual rate of cholelithiasis patients is 860 people.

A recent study from Shamaï (2010) found that there was a positive correlation between body mass indexes with cholesterol in the general population. It means that when the body mass index was increased, cholesterol serum will increase too. Meanwhile, cholesterol has a high effect on cholelithiasis occurrence. But there was no research about the relationship between body mass indexes with cholelithiasis yet. This study aimed to analyze the relationship between body mass index (BMI) and cholelithiasis in Dr. Soetomo General Hospital.

METHODS

This was an observational retrospective study using case-control design, where patients with cholelithiasis were the case group, and non-cholelithiasis patients were the control group. This study had approval by the ethical committee (No: 674/Panke.KKE/XI/2016). The population was patient on the Internal Medicine outpatient clinic. The sample was obtained from the patient's medical record, which was taken using non-random purposive sampling. There were 124 samples, divided into two groups with 62 cholelithiasis patients as case group and 62 non-cholelithiasis patients as control group.

The instrument in this study used the BMI formula, BMI in the Asian population, and medical records of patients with cholelithiasis and non-cholelithiasis in the internal outpatient clinic of Dr. Soetomo General Hospital. The variables of this study were the characteristics of cholelithiasis and non-cholelithiasis patients (consisting of gender, age, weight, and height) and patient's BMI. Data were analyzed using descriptive statistics and parametric statistical comparison test between two groups of independent samples using t-test 2 independent samples in SPSS software.

Table 1. The proportion of sample groups according to gender

Type Gender	Cholelithiasis		Non-Cholelithiasis		Total	
	n	%	n	%	n	%
Male	24	19.36	15	12.09	39	31.45
Female	38	30.65	47	37.9	85	68.55
Total	62	50.01	62	49.9	124	100.0

Table 2. Frequency distribution of patients' age

Age (year)	Cholelithiasis		Non-Cholelithiasis		Total	
	n	%	n	%	n	%
16-25	1	0.80	2	1.61	3	2.41
26-35	6	4.84	9	7.26	15	12.1
36-45	17	13.71	10	8.07	27	21.78
46-55	16	12.90	9	7.26	25	20.16
56-65	16	12.90	21	16.94	37	29.84
66-75	6	4.84	9	7.26	15	12.1
76-85	0	0	2	1.61	2	1.61
Total	62	49.99	62	50.01	124	100.0

RESULTS

The subject of this study were 124 patients consisting of 62 with cholelithiasis and 62 with non-cholelithiasis. The proportion of each group (cholelithiasis and non-cholelithiasis) according to gender, were shown in Tabel 1.

Based on Table 1, from 62 patients with cholelithiasis, there were 19.36% (24) male and 30.65% (38) female, whereas, from 62 non-cholelithiasis patients, 12.09% (15) male and 37.9% (47) female were found. The number of female patients was higher than male patients.

The demography characteristics of age were shown in Table 2. Mostly cholelithiasis patients' age (17%) was 36-45 years, and non-cholelithiasis patient was 56-65 years group (21%).

The distribution of the patient's height is shown in Table 3, while the distribution of the patient's weight is shown in Table 4. Most of the cholelithiasis (13.71%) patients' height range of 155-159 cm and 165-169 cm. As same as with non-cholelithiasis patients' height (20.16%) range 155-159 cm. Most of cholelithiasis (22.58%) patients' weight range 61-70 kg (excess). Meanwhile, non-cholelithiasis patients' weight range is 51-60 kg. In conclusion, cholelithiasis patients' were fatter than non-cholelithiasis patients.



Table 3. Distribution of patient’s height (cm)

Height (cm)	Cholelithiasis		Non-Cholelithiasis		Total	
	n	%	N	%	n	%
150-154	15	12.1	14	11.29	29	23.39
155-159	17	13.71	25	20.16	42	33.87
160-164	8	6.45	9	7.23	17	13.68
165-169	17	13.71	11	8.87	28	22.58
>170	5	4.03	3	2.42	8	6.45
Total	62	50	62	50	124	100.0

Table 4. Distribution of patient’s weight (kg)

Weight (kg)	Cholelithiasis		Non-Cholelithiasis		Total	
	n	%	n	%	n	%
<50	1	0.81	4	3.23	5	4.04
51-60	24	19.35	31	25	55	44.35
61-70	28	22.58	22	17.74	50	40.32
71-80	8	6.45	5	4.03	13	10.48
>81	1	0.81	0	0	1	0.81
Total	62	50	62	50	124	100.0

Table 5. Distribution of patient’s BMI

BMI	Cholelithiasis		Non Cholelithiasis		Total	
	n	%	n	%	n	%
Under-weight	1	0.81	0	0	1	0.81
Normal	13	10.48	27	21.77	40	32.2
At-risk	27	21.77	20	16.13	47	37.9
Over-weight	21	16.93	14	11.29	35	28.22
Obese	0	0	1	0.81	1	0.81
Total	62	49.99	62	50.01	124	100.0

The distribution of the patient’s BMI is shown in Table 5. The highest number of patients (21.77%) with non cholelithiasis had normal weight (n=27). Whereas, most of the cholelithiasis patients were at risk as many as

27 people. From this data, it can be seen that there was an increase number of Obese I in cholelithiasis patients, while in patients with non cholelithiasis the distribution on each scale



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Table 6. BMI's distribution by groups

Variable	Groups	n	Mean	SD	P
BMI	Cholelithiasis	62	23.7702	2.52181	0.089
	Non-Cholelithiasis	62	24.5119	2.29300	

Based on Table 6, the average BMI of non-cholelithiasis patients was 23.7702, and patients with cholelithiasis were 24.5119. The data distribution was very close to the mean value. The normality of the data distribution was tested using the One-Sample Kolmogorov-Smirnov Test in the SPSS application. The p-value for non-cholelithiasis patients was 0.200 ($p > 0.05$) and p-value for cholelithiasis patients was 0.086 ($p > 0.05$), which mean that data from each group was normally distributed.

Independent samples t-test comparative test were used to see differences between the BMI of patients with cholelithiasis and non-cholelithiasis. The results showed that the p value was 0.089 ($p > 0.05$), which means that there were no significant differences in BMI from patients with cholelithiasis and non-cholelithiasis in the Dr. Soetomo General Hospital.

DISCUSSION

In this observational study, we found that there were less significant differences in the BMI of both the cholelithiasis and non-cholelithiasis patients. Our results are consistent with the previous study. Study conducted by Shrestha (2012) found that cholelithiasis patients with normal BMI were 60% ($n = 72$) and overweight were 27.5% ($n = 33$). It means that not all cholelithiasis patients were obese patients, but there was an impact of gender (female). The incidence of cholelithiasis was higher in females than males, increasing with age and BMI.

Cholelithiasis or gallstones are common in women due to high estrogen levels (Omana, 2013). This result found that the prevalence of female cholelithiasis patients was 61.29% (38 from 62 people). This is consistent with a study by Sharma et al. (2013). Estrogen is the primary reproductive hormone in women, this hormone binds to several receptors. It regulates both healthy and sick mechanisms by regulating cholesterol synthesis and transport of HDL and cholesterol through receptors such as ESR1, SR-BI, and $ER\alpha$ (Maruyama, 2013). ESR1 activates SREBP-2 and Cholesterol 7α -hydroxylase sterol27-hydroxylase, which will affect the synthesis of cholesterol and bile salts resulting in supersaturation of bile salts with cholesterol (Sharma, 2013).

From Table 2, this study found an increase in prevalence at the age of 36-45 years by 27.4%, 46-55 years at 25.8%, and 56-65 years at 25.8%. These facts are related to the speed of gallstone formation by age. Gallstones can occur at any age but are very rarely found at less than 30 years of age (Panpimanmas & Manmee, 2009). A study using population screening with ultrasound explained that the prevalence of cholelithiasis in Mexican-American, Cuban-American, and Puerto Rico mainland populations increased related to age.

Height and weight are physiological measurements carried out in medical practice and used to measure growth, nutritional status, and influential health risk factors (Engstrom, 2003). In this study, measurements of height and weight were taken from medical records. From 124 samples, most patients' height, either



cholelithiasis or non-cholelithiasis, was spread evenly (155-159 cm). Height and weight are used routinely to measure BMI, to assess the nutritional status of patients, and to screen malnourished patients.

Bodyweight is not a direct measurement of body fat, but there is a correlation between body weight and body fat (CDC, 2015). Excessive weight gain or rapid weight loss that is unnatural can cause cholelithiasis because people with above-normal weight have more cholesterol levels in the gallbladder (Acalovschi, 2001).

From 124 samples, an increase in the occurrence of cholelithiasis was seen in the range of 61-70 kg (22.58%). This is influenced by the consumption of high-fat foods which will increase the risk for cholelithiasis (Panpimanmas & Manmee, 2009). The saturated fats and processed sugars were associated with the occurrence of cholelithiasis (Nunes & Beckingham, 2005). Therefore, weight can indirectly describe the condition of fat in a person's body.

Height and weight are used routinely to measure BMI, to assess the nutritional status of patients, and to screen malnourished patients (DiMaria, 2006). BMI was categorized according to BMI classification in Asians, underweight (<18.5), normal weight (18.5-22.9), at-risk (23.0-24.9), obese I (25-29.9), and obese II (> 30) (Who.int, 2015). This is not a direct measurement of body fat but is correlated with body fat. The BMI more than the normal range will increase risk of health problems such as Coronary Heart Disease (CHD), Hypertension, stroke, Diabetes Mellitus Type 2, hypercholesterolemia, metabolic syndrome, cancer, osteoarthritis, sleep disorders, hypoventilation syndrome in patients with obesity, reproductive health problems and gallstones (Shrestha, 2012).

Based on the result, 21.77% of cholelithiasis

patients' BMI were on a risk scale. Meanwhile, most of non-cholelithiasis patients (21.77%) have normal BMI. So that BMI cannot be used as a parameter for the occurrence of cholelithiasis in a person but increases the risk of the occurrence of health problems.

This study cannot be generalized because the number of research subjects was limited and only taken in one location. The other limitation is the measurement of body fat was not done, so no more specific results were obtained to explain the relationship between body mass index and cholelithiasis.=

CONCLUSION

BMI is not a direct measurement of body fat but has a relationship with body fat. In conclusion, BMI cannot be used as a parameter for cholelithiasis, but it can increase the risk factor for health problems.

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