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Risk Factors for the Incidence of Cholelithiasis at Ibnu Sina Makassar Hospital for the 2021-2023 Period

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Abstract

Background: Cholelithiasis is an important health problem with severity and septic complications related to the type of gallstone. Several risk factors also influence the incidence of cholelithiasis. **Objective:** This study aims to determine the distribution of cholelithiasis patients based on gender, Body Mass Index (BMI), age, childbearing age in women, triglyceride levels, and total cholesterol levels at Ibnu Sina Hospital Makassar in the period 2021 to 2023. **Method:** This type of research is descriptive using a Cross Sectional Study approach, namely explaining the risk factors for the incidence of cholelithiasis at Ibnu Sina Hospital Makassar. **Results:** The distribution of cholelithiasis patients at Ibnu Sina Hospital Makassar in 2021-2023 shows that the risk factors are mostly female, overweight/obesity, age >40 years, hypertriglyceridemia, and hypercholesterolemia. However, women of childbearing age suffer less from cholelithiasis than older women. **Conclusion:** Cholelithiasis at Ibnu Sina Hospital Makassar in 2021-2023 is more common in women, >40 years of age, overweight/obesity, hypertriglyceridemia, and hypercholesterolemia, with a lower incidence in women of childbearing age compared to old age.

Keywords: *Cholelithiasis, gender, Body Mass Index (BMI), age, childbearing age in women, triglycerides, cholesterol*

Introduction

The gallbladder is an organ located under the liver. The gallbladder stores and releases digestive fluids known as bile that functions to help the digestion process. Bile also carries other substances such as cholesterol and bilirubin, which are made by the body when breaking down red blood cells [1]. Gallstones are masses in the gallbladder or bile ducts caused by abnormally high cholesterol or bilirubin levels in bile [2]. Stones can form in any part of the bile ducts, but when formed in the gallbladder, it is called cholelithiasis[3]. Cholelithiasis is the presence of stones in the gallbladder where gallstones are deposits of hardened digestive fluids that form in the gallbladder [4].

Cholelithiasis has been described as a disease of civilization. This was observed in Egyptian mummies dating from 3400 BC. It appears Charaka (2nd century BC) and Sushruta (6th century BC) from India were also familiar with this bile duct disease. The severity of gallstone disease previously has been proven to be related to the type of gallstone and particularly septic complications are far more common in patients with pigment gallstones compared to patients with cholesterol gallstones [5].

Cholelithiasis is an important health problem in Western countries. It is estimated

that over 95% of diseases affecting the gallbladder and its ducts are cholelithiasis. It is estimated that over 20 million people in the United States suffer from cholelithiasis. In Asian countries, cholelithiasis prevalence ranges from 3% to 10%. Based on recent data, cholelithiasis prevalence in Japan is about 3.2%, China 10.7%, North India 7.1%, and Taiwan 5.0%. The incidence of cholelithiasis and bile duct diseases in Indonesia is estimated not much different from other countries in Southeast Asia [6].

Cholelithiasis rarely occurs in children but most cholelithiasis cases in children are associated with several factors namely hemolytic diseases, history of therapy with Total Parenteral Nutrition (TPN), Wilson's disease, cystic fibrosis, and use of certain types of drugs. Cholelithiasis with hemolytic disease can be found in children aged 1-5 years, while cholelithiasis in adolescents is usually associated with obesity, pregnancy, and drug use. Risk factors affecting gallstone formation include gender, age over 40 years, hyperlipidemia, obesity, genetics, physical activity, pregnancy, high-fat diet, prolonged gastric emptying, long-term parenteral nutrition, gallbladder dysmotility, anti-hyperlipidemia drugs (clofibrate), and other diseases (pancreatitis, diabetes mellitus, liver cirrhosis, gallbladder cancer, and cystic fibrosis) [6].

Cholelithiasis occurs more frequently in women than men. A study states that cholelithiasis prevalence in the United States is 7.9% in men and 16.6% in women. The incidence ratio of cholelithiasis in men and women is 1:3, and in the sixth and seventh decades of life the ratio becomes smaller [6]. Incidence of cholelithiasis has been reported at 5% in the general population, increasing significantly in populations with increasing BMI reaching 45% [7]. Body Mass Index (BMI; in Kg/m²) is a common obesity calculation index often analyzed in studies related to the relationship between obesity and gallstone disease [8]. Obesity occurs due to excess fat accumulation and can adversely affect health [9]. Increasing age increases cholelithiasis risk. Age can be a risk factor for cholelithiasis occurrence, caused by increased bile saturation due to decreased 7α hydroxylase activity which is the rate-limiting enzyme for cholesterol biosynthesis [10]. Women have a two to three times higher risk of developing gallstone disease than men. Because the higher risk for gallstone disease in women is essentially a phenomenon of childbearing age, sex hormones and pregnancy are likely the cause [11]. Almost all patients with hypertriglyceridemia have high-saturation bile in their gallbladders even though the patient is thin, this may be one cause of increased gallstone incidence in patients with hypertriglycerides [12].

Cholesterol secretion is related to gallstone formation. Under abnormal conditions, cholesterol can precipitate, causing gallstone formation. Various conditions that can cause cholesterol precipitation are: too much water absorption from bile, too much absorption of bile salts and lecithin from bile, and too much cholesterol secretion into bile. The amount of cholesterol in bile is partly determined by the amount of fat consumed because hepatocytes synthesize cholesterol as one of the products of fat metabolism in the body [13].

Cholelithiasis is a disease that gives significant impact on patients' quality of life and burdens the healthcare system, both economically and socially. Although research on cholelithiasis prevalence and distribution has been widely conducted in various parts of the world, specific data regarding cholelithiasis characteristics and risk factors in the Indonesian population, particularly in Makassar, remains very limited. This lack of local data becomes an obstacle in formulating prevention, early diagnosis, and evidence-based interventions to reduce the disease's impact. This research is important to fill this

knowledge gap by analyzing the distribution and risk factors of cholelithiasis in patients at Ibnu Sina Hospital, Makassar. Therefore, this research aims to answer the question: What are the risk factors contributing to cholelithiasis incidence in the population in Makassar? The answer to this question is expected to become the basis for developing more effective and contextual approaches for cholelithiasis prevention and treatment at the local level.

Materials and Methods

Study Design

This research uses descriptive design with Cross Sectional Study approach, which aims to analyze risk factors related to cholelithiasis incidence. In this approach, data is collected at one time point to evaluate relationships between characteristics such as gender, age, nutritional status, and lipid profiles with cholelithiasis incidence.

Sample

The research population included all cholelithiasis patients at Ibnu Sina Hospital, Makassar during the research period. From this population, 85 patients were selected as research samples, determined using Slovin's formula to ensure representative data. Sampling was done using random sampling while considering inclusion and exclusion criteria. Inclusion criteria included patients diagnosed with cholelithiasis with complete medical records and adequate data. Exclusion criteria included patients with incomplete medical records and patients suffering from chronic diseases or cancer, as these conditions could affect analysis of cholelithiasis risk factors.

Data Collection Techniques

Data used in this research were secondary data obtained from cholelithiasis patient medical records at Ibnu Sina Hospital, Makassar during the 2021–2023 period. This data included demographic information, cholelithiasis diagnosis, nutritional status, age, and lipid profiles, used to analyze cholelithiasis distribution and risk factors. Using secondary data enabled efficient data collection and provided an accurate picture of the patient population during the period.

Data Analysis Techniques

Data was analyzed descriptively (univariate) to identify distribution and risk factors related to cholelithiasis. Data obtained from medical records were processed using Microsoft Excel to calculate frequencies and percentages of each research variable. Analysis results were then presented in frequency distribution and proportion tables to provide clear understanding of patient characteristics based on medical record data, such as gender, age, nutritional status, and lipid profiles.

Ethical Consideration

This research did not involve an ethics committee because it used secondary data from existing patient medical records at Ibnu Sina Hospital, Makassar. The data used did not include direct patient identification, thus maintaining patient confidentiality and privacy. Additionally, this research was conducted while paying attention to research ethics principles such as justice, confidentiality, and respect for individual rights, although it did not require ethics committee approval. The use of secondary data was conducted with official permission from the hospital to ensure all applied procedures complied with applicable ethical standards.

Result

This research is a descriptive study using secondary data from medical records of patients diagnosed with cholelithiasis (gallstones) at Ibnu Sina Hospital, Makassar during the 2021 to 2023 period. Based on data obtained, there were 109 patients diagnosed with cholelithiasis, with details of 16 patients in 2021, 44 patients in 2022, and 49 patients in

2023. Research samples were selected using total random sampling, thus obtaining 85 subjects meeting inclusion criteria for analysis in this research.

Table 1. Distribution of Cholelithiasis

Variable	Frequency	Proportion (%)
Gender		
Male	30	35.3
Female	55	64.7
Nutritional Status		
Underweight	10	11.8
Normal	24	28.2
Overweight	17	20.0
Obesity I	22	25.9
Obesity II	12	14.1
Age		
< 20 years	3	3.5
20-29 years	6	7.1
30-39 years	11	12.9
40-49 years	21	24.7
50-59 years	16	18.8
≥ 60 years	28	32.9
Childbearing Age		
15-49 years	24	43.6
> 49 years	31	56.4
Cholesterol Level		
< 150 mg/dL	39	45.9
> 150 mg/dL	46	54.1
Total Cholesterol		
< 200 mg/dL	35	41.2
> 200 mg/dL	50	58.8
Total	**85**	**100**

Source: *Secondary Data, 2024*

Research results on cholelithiasis distribution showed several interesting findings based on observed variables, including gender, nutritional status, age, total cholesterol, and triglyceride levels. Based on gender, females showed higher proportion (64.7%) compared to males (35.3%). This aligns with literature stating that females tend to have higher cholelithiasis risk, possibly due to estrogen's influence on cholesterol metabolism and gallstone formation.

Distribution based on nutritional status showed cholelithiasis occurred more frequently in individuals with obesity status. Specifically, the highest proportion was found in obesity I group (25.9%) and obesity II (14.1%), while underweight group had the lowest proportion (11.8%). This emphasizes the relationship between obesity and cholelithiasis risk, which can be caused by increased cholesterol secretion into bile in individuals with excess body weight. On the other hand, normal nutritional status group still had significant proportion (28.2%), indicating other risk factors also need consideration.

From age perspective, cholelithiasis cases were most commonly found in ≥60 years group (32.9%), followed by 40-49 years (24.7%) and 50-59 years (18.8%). This reflects the tendency of risk increasing with age, possibly due to physiological changes affecting gallbladder motility and bile composition changes. Although cases also occurred in younger age groups like 20-29 years (7.1%) and <20 years (3.5%), showing cholelithiasis is not exclusively an elderly disease but can occur across various age groups depending on involved risk factors.

Total cholesterol and triglyceride levels also showed clear relationships with cholelithiasis. Most cases were found in individuals with total cholesterol >200 mg/dL (58.8%) and triglycerides >150 mg/dL (54.1%). These results indicate a relationship between poor lipid profiles and increased cholelithiasis risk, which can be caused by excess cholesterol precipitating in bile and triggering stone formation. Conversely, groups with total cholesterol <200 mg/dL and triglycerides <150 mg/dL still had significant case proportions, showing that other factors like genetics or dietary patterns may also contribute to cholelithiasis risk.

Overall, these findings provide a picture that cholelithiasis is a multifactorial disease involving various aspects including gender, nutritional status, age, and lipid profiles. This analysis emphasizes the importance of holistic approaches in cholelithiasis prevention and management, considering major risk factors in the local population. These findings can also serve as a basis for developing more specific

and evidence-based intervention strategies to reduce cholelithiasis incidence, particularly in Makassar region. Furthermore, continuous health education and routine screening are essential to detect early risk factors and improve community awareness.

Discussion

Cholelithiasis is gallstone formation in the gallbladder or bile ducts, still a common and clinically significant condition affecting millions worldwide. This condition becomes a major burden on healthcare systems due to related complications, including biliary colic, cholecystitis, and potentially life-threatening conditions like choledocholithiasis. Etiology of cholelithiasis is multifactorial, involving complex interactions between genetic, environmental, and lifestyle factors. Cholelithiasis is the condensation of cholesterol or bile pigments causing solid deposit formation in the gallbladder. The gallbladder stores bile acids and bile salts until needed to help digest fatty foods. These deposits can block bile flow, resulting in biliary colic, belching, food intolerance, and severe right upper abdominal pain radiating to the right shoulder [14].

In Table 1, the majority of respondents were female with a percentage of 64.7% and males were only 35.3%. Women have a 3 times higher risk of developing gallstones compared to men. This is due to estrogen hormones affecting increased cholesterol excretion by the gallbladder. During pregnancy, increased estrogen levels can also increase gallstone risk. Use of contraceptive pills and hormone therapy (estrogen) can increase cholesterol in the gallbladder and decrease gallbladder emptying activity [10].

This aligns with Theresia's (2023) research showing a female percentage of 56.25% while males were only 43.75% [15]. This research also aligns with Gobinda et al.'s (2021) research showing a female percentage of 72% while males were only 28% [16]. Estrogen is suspected to play an important role in women with cholelithiasis where estrogen can stimulate hepatic lipoprotein receptors and increase cholesterol bile formation as well as increase dietary cholesterol. This is strengthened by Andreyne et al.'s (2016) research showing female dominance at 55% and males at 45% [14].

Research by Zamil et al. (2021) also showed that women have higher susceptibility to cholelithiasis compared to men, especially due to the influence of female sex hormones like estrogen and progesterone. This risk increases further in women of childbearing age who have experienced multiple pregnancies [17]. Repeated pregnancies change bile composition and slow gallbladder movement (stasis), creating optimal conditions for gallstone formation. Increased estrogen and progesterone levels during pregnancy increase cholesterol saturation in bile, thus increasing the likelihood of cholesterol crystallizing into gallstones. This fact emphasizes the need for extra attention to women with high parity history in cholelithiasis prevention efforts [18].

Women have higher cholelithiasis risk because estrogen and progesterone hormones play roles in gallstone formation processes. Estrogen increases cholesterol levels in bile, while progesterone slows gallbladder motility, especially during pregnancy. Both factors cause bile to be more saturated with cholesterol and tend to experience stasis, thus increasing gallstone formation chances, especially in women with repeated pregnancy histories.

In Table 1, it can be concluded that the distribution of patients with increased BMI (overweight, obese 1, and obese 2) was more numerous with a percentage of 60% compared to patients with normal BMI (28.2%), and underweight BMI (11.8%) which when combined was only 40%. Body Mass Index (BMI) is a practical and simple approach to assess a person's nutritional status[19]. Nutritional status is the result of food intake consumed over

a long period[20]. Excess body weight is a significant risk factor for gallstones[21]. The theory states that in obesity, bile acid compartments and secretion are normal but cholesterol bile secretion increases. In individuals with obesity, intrahepatic cholesterol secretion will increase [22]. This increased secretion supports gallstone formation. Additionally, body fat distribution can affect gallstone formation.

This research aligns with Dewa et al.'s (2020) research with 47 respondents categorizing diagnosed and undiagnosed patients, showing increased BMI category cholelithiasis results at 61.3%, while undiagnosed was only 6.3 [13]. Then Nurhikmah et al.'s (2019) research categorizing diagnosed and undiagnosed patients showed increased BMI category cholelithiasis results at 76.5%, while undiagnosed was 23.5% [7]. The strong relationship between obesity and cholelithiasis re-emphasizes the role of excess adiposity in gallstone formation. Obesity triggers various metabolic changes that increase cholesterol saturation in bile, promoting nucleation and stone growth. Additionally, obesity-related changes in gut hormones and adipokins can affect gallbladder motility and contribute to gallstone development [18]. This is strengthened by Regi's (2017) research showing an increased BMI percentage of 73.1% while normal BMI was 18.3%, and underweight BMI was 8.6%.

This research's results are also supported by Bonfrate et al.'s (2014) research explaining that obesity is a major risk factor for cholesterol cholelithiasis. This condition increases cholesterol levels in bile, contributing to cholesterol saturation and gallstone formation. In individuals with obesity, accumulation of body fat, especially abdominal fat, increases cholesterol production in the liver, which is then excreted into bile.

Increased cholesterol levels, combined with decreased gallbladder motility often occurring in obesity, increase gallstone formation risks. Obesity not only affects lipid balance in bile but also reduces the gallbladder's ability to empty bile effectively, increasing gallstone formation chances.

Nunes (2014) research explains that obesity can increase cholelithiasis risk, especially in individuals showing biliary symptoms. Research shows many obese patients with cholelithiasis experience abnormal aminotransferase levels, often related to increased liver enzymes. Increased liver enzymes are more frequently seen in patients with biliary sludge compared to those with only cholelithiasis [23].

Dietary patterns also play an important role. Diets high in saturated fat and sugar are proven to increase triglyceride and cholesterol levels in the blood, changing bile composition. This is directly related to decreased gallbladder emptying, worsening bile stasis, and creating an ideal environment for gallstone formation. Research shows that poor dietary patterns, rich in cholesterol and triglycerides, are significant risk factors in gallstone development [24].

In Table 1, it can be concluded that the distribution of patients aged >40 years was more numerous with a combined percentage of 76.4% while patients aged <40 years were only 23.5%. Increasing age carries high risk because it relates to increased cholesterol bile secretion, decreased bile acid compartment size, and decreased bile salt secretion [21]. Increasing age shows increased bile saturation caused by decreased 7α hydroxylase activity which is the rate-limiting enzyme needed for cholesterol biosynthesis. This may be due to a significant relationship between age and cholelithiasis consistent with the cumulative nature of gallstone formation. This emphasizes the importance of age as an important risk factor that must be considered in clinical assessment and prevention efforts [18].

Dewa et al.'s (2020) research categorizing diagnosed and undiagnosed patients, but in their research they grouped age into two

categories: 41-59 years and ≥60 years (meaning all >40 years) showing 31 (65.9%) people, all diagnosed with cholelithiasis [13]. Then Regi's (2017) research showed an increased BMI percentage of >40 years at 74.2% while <40 years was only 25.8%. This proves that age >40 years is more at risk for cholelithiasis. With increasing age, factors such as decreased gallbladder motility, changes in bile composition, and decreased bile acid synthesis can contribute to gallstone formation [18]. This is strengthened by Febyan et al.'s (2017) research showing >40 years at 86% and <40 years at 14% [25].

These findings align with previous research from Baddam et al. (2023) showing cholelithiasis incidence increases with age, especially after age 40. Factors such as decreased gallbladder motility, changes in bile composition, and decreased bile acid synthesis play roles in gallstone formation in older age groups. This research also confirms that women over 40 have higher risk of developing cholelithiasis, emphasizing the importance of age as a risk factor that must be considered in clinical assessment and prevention efforts at hospitals [18].

Zdanowicz et al. (2022) explain that increasing age increases cholelithiasis risk due to several physiological changes, such as decreased gallbladder motility making bile retained longer, giving cholesterol time to crystallize and form stones. Additionally, increased cholesterol in bile and decreased bile acid synthesis reduce bile's ability to dissolve cholesterol. Metabolic changes with age, such as decreased estrogen and progesterone, also affect cholesterol solubility in bile. These factors make older age a more vulnerable period for gallstone formation [24].

In Table 1, it can be concluded that childbearing age distribution (15-49 years) was slightly less with a percentage of only 43.6%, while age >49 years was 56.4%. Childbearing age is defined as the age range where a woman can still conceive and give birth, namely between 15–49 years. Childbearing age can also be interpreted as reproductive age, from first menstruation until menstruation stops or menopause. However, existing theory has associated female gender with childbearing age, where childbearing age is defined between 15 and 49 years, while old age is above 49 years. Based on analysis data in this research, it was found that respondents in older age group were more numerous, so research results show that respondents in childbearing age were fewer compared to older age. Nevertheless, childbearing age actually contributes significantly to cholelithiasis incidence.

Littlefield and Lenahan (2019) [26] showed that an estimated 10% of all pregnant women experience cholelithiasis. High parity indicates increased number of pregnancies, closely related to intensive hormonal changes and weight gain during pregnancy. Hormones that increase during pregnancy, such as progesterone and estrogen, play roles in slowing gallbladder motility and increasing cholesterol saturation in bile, thus creating ideal conditions for gallstone formation. Increased estrogen and progesterone levels during pregnancy form deposits in the gallbladder as precursors to gallstone formation. Additionally, other risk factors for gallstone formation during pregnancy include decreased HDL levels and metabolic syndrome [26].

Littlefield and Lenahan (2019) explain that in women of childbearing age, there is an increased risk of cholelithiasis due to hormonal factors affecting bile composition and motility, as well as the possibility of other complications. In cholelithiasis cases at childbearing age, examinations such as liver function tests and pregnancy tests are usually performed to help diagnose and evaluate the condition. Although liver function, amylase, and lipase test results may still be normal in uncomplicated cases, increased enzyme levels often occur if obstruction occurs due to

gallstones. Such obstruction, which can cause bile reflux or complications like obstructive cholangitis, potentially damages liver and pancreatic cells, thus increasing liver enzymes, amylase, and lipase levels. This shows the importance of careful monitoring for women of childbearing age with cholelithiasis symptoms to prevent more serious complications [26].

Women are more vulnerable because estrogen and progesterone hormones affect cholesterol saturation in bile and slow gallbladder motility, where for fertile (childbearing) age, related to pregnancy and contraceptive hormonal use, also play roles in increasing risk because these hormones affect bile stasis [30].

In Table 1, it can be concluded that the distribution of patients with triglyceride levels >150 mg/dL was more numerous with a percentage of 54.1% compared to patients with triglyceride levels <150 mg/dL with a percentage of only 45.9%. Then in Table 1, it can be concluded that the distribution of patients with cholesterol levels >200 mg/dL was more numerous with a percentage of 58.8% compared to patients with cholesterol levels <200 mg/dL with a percentage of only 42.2%. From Table 1, it can be said that dyslipidemia affects gallstone formation. Almost half of gallstone patients will have abnormal lipid profiles [31]. Hari et al. (2023), in their research, revealed that 19.3% of gallstone patients experienced dyslipidemia, showing a correlation between dyslipidemia and gallstone formation risk factors [32].

Cholesterol and triglycerides are the main components of cholesterol-containing gallstones. The pathogenesis of cholesterol gallstones involves cholesterol saturation in the bile duct due to hypersecretion of cholesterol from the liver. The main event in cholesterol gallstone pathogenesis is changes in lipid metabolism causing increased relative cholesterol levels in bile [33]. Most gallstone compositions are based on cholesterol, which leads to increased role of cholesterol metabolism in gallstone production. The mechanism of cholesterol gallstone formation is related to crystalline bile cholesterol with high relationship to increased cholesterol bile saturation [34].

Triglyceride levels that are high disrupt gallbladder motility. The underlying mechanism is decreased gallbladder sensitivity to the hormone cholecystokinin (CCK), which stimulates gallbladder contraction. In Agus et al.'s (2017) research, it was said that patients with increased triglyceride levels were 120 people where 88 patients among them were diagnosed with gallstones and 32 were not diagnosed [12]. Hypersecretion of cholesterol due to high serum cholesterol levels can increase cholesterol saturation in bile. Bile saturated with cholesterol can undergo nucleation process which is one of the initiation factors for gallstones [29]. Research aligned with this has been conducted by Agus et al. (2017), showing patients with increased cholesterol levels were 139 people where 95 patients among them were diagnosed with gallstones and 44 were not diagnosed [12]. Disrupted lipid homeostasis can cause hypersecretion of cholesterol from bile ductules. Therefore, the incidence of cholesterol gallstones with high prevalence compared to pigment gallstones is estimated to occur in patients with disrupted lipid homeostasis. Cholesterol bile supersaturation has been identified as a major prerequisite for cholesterol gallstone formation [35].

However, several studies mention that high triglyceride levels and low HDL cholesterol levels are associated with increased gallstone formation risk. Saldanha et al. (2020) [33] in their research in India said that high triglycerides and low HDL are most consistently associated with cholelithiasis, while total cholesterol and LDL show less association. Then Preetha et al. (2020) [36], in their research, said there was a significant increase in triglyceride levels in cholelithiasis patients compared to normal

control group subjects and no significant change in total cholesterol levels in cholelithiasis patients compared to control subjects [36]. Then there is also research stating that abnormal lipid profiles do not affect gallstone formation. In Mutiara's (2022) research [29], it was said that lipid profile levels in almost all cholelithiasis patients were normal with total cholesterol percentage of 60.5% and triglycerides of 81.3%. Some studies also mention that high triglycerides and low HDL are most consistently associated with cholelithiasis, while total cholesterol and LDL show less association [33].

Triglycerides and dyslipidemia have a strong relationship with gallstone formation risk. High triglyceride levels can change bile composition, increasing cholesterol saturation, a condition that promotes gallstone formation. Research shows that increased triglycerides and cholesterol, especially in high-risk lipoprotein forms like VLDL and LDL, lead to changes in bile lipid balance. Excess cholesterol in bile will crystallize, and over time, these crystals will form gallstones.

Insulin resistance, which often occurs in individuals with dyslipidemia, worsens this condition. In insulin resistance, the body produces more cholesterol, which contributes to increased cholesterol levels in bile. This reduces bile's ability to manage cholesterol properly, worsening cholesterol saturation, and increasing gallstone formation likelihood. Thus, from this research's results and several previous studies, it cannot be definitively stated that abnormal lipid profiles are risk factors for cholelithiasis occurrence.

Conclusion

The conclusion that can be drawn is that women suffer more from cholelithiasis at Ibnu Sina Hospital, Makassar in 2021-2023. Overweight/obesity sufferers are more numerous with cholelithiasis at Ibnu Sina Hospital, Makassar in 2021-2023. Age >40 years is more numerous with cholelithiasis at Ibnu Sina Hospital, Makassar in 2021-2023. Women of childbearing age suffer less from cholelithiasis compared to older women at Ibnu Sina Hospital, Makassar in 2021-2023. Hypertriglyceridemia is more commonly found in cholelithiasis at Ibnu Sina Hospital, Makassar in 2021-2023. Hypercholesterolemia is more commonly found in cholelithiasis at Ibnu Sina Hospital, Makassar in 2021-2023.

This research is an initial study, further research (cohort) is recommended to determine the relationship between several risk factors with gallstone occurrence with larger samples and more variables to obtain more representative research results describing the actual population. It is hoped that research results on risk factor relationships with gallstone occurrence can serve as reference for clinicians to know high-risk groups for gallstone formation, thus enabling design of gallstone formation prevention strategies.

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