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Prevalence and Associated Risk Factors of Cholelithiasis in Patients Undergoing Abdominal Ultrasound in a Tertiary Care Hospital, Peshawar, Pakistan

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Abstract
Cholelithiasis, or gallstone disease, is one of the most prevalent gastrointestinal disorders worldwide, often remaining asymptomatic but carrying risks of complications such as acute cholecystitis and gallstone pancreatitis. In Pakistan, limited data exist on its prevalence and risk factors in the Peshawar region. To determine the prevalence of cholelithiasis and identify its associated risk factors among adult patients undergoing abdominal ultrasonography in a tertiary care hospital in Peshawar, Pakistan. A hospital based cross sectional study was conducted from January to August 2025 at Northwest General Hospital, Peshawar. Using convenience sampling, 368 patients aged ≥17 years undergoing abdominal ultrasonography were recruited. Data on sociodemographic characteristics and gallstone presence were confirmed through ultrasound examination. Statistical analysis was performed using SPSS v. 25. Of 368 participants (49.7% male, 50.3% female; age 17-96 years), 35 (9.5%) were diagnosed with cholelithiasis, showing slight female predominance (51.4% vs 48.6%). Peak prevalence occurred in the 37-56 years age group. Significant risk factors included marital status (100% of cases), physical inactivity (54.3%), recent weight loss (45.7%), positive family history (42.9%), and diabetes mellitus (34.3%). Lesser associations were found with obesity (20.0%), smoking (8.6%), liver disease (5.7%), and contraceptive use (2.9%). Cholelithiasis prevalence was 9.5% in this population, predominantly affecting married individuals and those aged 37-56 years. Physical inactivity, weight loss, family history, and diabetes mellitus were identified as major risk factors, while obesity, smoking, liver disease, and contraceptive pills also showed some contribution to cholelithiasis development.

Keywords: Cholelithiasis, Prevalence, Risk Factors, Cholecystectomy.

Introduction

Cholelithiasis, commonly known as gallstone disease, is a condition characterized by the formation of stones within the gallbladder due to imbalances in the composition of bile. These stones are typically composed of cholesterol, bilirubin, and calcium salts [1]. These stones are primarily classified into three types: cholesterol stones (comprising 80% of all gallstones), pigment stones (formed mainly from bilirubin), and mixed stones containing 20-50% cholesterol content [2]. It is one of the most prevalent gastrointestinal disorders worldwide. Globally, it is estimated that approximately 6% of the adult population is affected by gallstones, with the majority remaining asymptomatic [3]. However, complications such as acute cholecystitis, choledocholithiasis, gallstone pancreatitis, and even gallbladder carcinoma can

occur in symptomatic individuals [4]. Gallstone development is caused by a complex interaction of imbalances in bile composition, including those involving cholesterol, bile salts, lecithin, calcium carbonate, and bilirubin[5]. Among various diagnostic tools available for identifying cholelithiasis, abdominal ultrasonography is considered the gold standard due to its non invasiveness, high sensitivity and specificity, cost effectiveness, and accessibility. Ultrasonography offers approximately 90–95% sensitivity and specificity in detecting gallstones, making it especially suitable for both symptomatic and incidental diagnosis in hospital and outpatient settings [6]. In tertiary care hospitals, where patients are presented with a wide range of abdominal complaints, routine abdominal ultrasound is often the first line imaging modality employed for evaluation [7]. Several risk factors have been consistently associated with Cholelithiasis development, including increasing age, female gender, obesity, rapid weight loss, high fat diets, diabetes mellitus, and certain genetic predispositions [8]. Hormonal factors, particularly those related to pregnancy and oral contraceptive use, have also been implicated, making women, especially those of reproductive age, a high risk group [9]. In South Asian populations, these risk factors are further amplified by regional dietary patterns rich in refined carbohydrates and saturated fats, low physical activity levels, and limited health literacy, contributing to the growing burden of gallstone disease [10]. Several hospital based and regional studies in Pakistan confirm a rising prevalence of gallstones, particularly among women aged 30–50 years. The disease is notably more common in females, with several studies reporting that women account for 75–88% of gallstone cases, and the mean age at presentation typically falls within the 35–45 year range [11]. A study conducted in Karachi reported a prevalence of 10.2%, with female patients disproportionately affected (14.8% in women vs. 5.7% in men) [12]. Other studies from Lahore, Multan, and Faisalabad have similarly reported high gallstone incidence among women, often associated with obesity, diabetes, and family history [13]. Despite these insights, limited data exist specifically for Peshawar, the capital city of Khyber Pakhtunkhwa province. The unique ethnic, dietary, and genetic characteristics of this population necessitate a localized understanding of gallstone prevalence and risk profiles. Moreover, while global and national data provide useful epidemiological insights, there is a notable gap in the literature concerning gallstone prevalence and associated risk factors among patients undergoing abdominal ultrasonography in Peshawar. Clarifying these associations will support targeted preventive strategies and early interventions for high-risk groups in this population, ultimately contributing to improved patient outcomes and reduced burden of gallstone-related complications through timely identification and management The results will enable healthcare professionals to develop culturally appropriate prevention programs and establish evidence-based guidelines specific to the local demographic profile. This study, therefore, aims to determine the prevalence of cholelithiasis and identify its associated risk factors among patients undergoing abdominal ultrasound in a tertiary care hospital in Peshawar, Pakistan.

Materials and Methods

Study Design and Setting

This was a hospital based cross sectional study conducted at the Radiology Department of Northwest General Hospital, Peshawar, Pakistan. The study was carried over a period of 8 months from January to August 2025 to determine the Prevelance of cholelithiasis and identify associated risk factors among patients undergoing abdominal ultrasonography at the radiology department of the hospital.

Study Population and Sampling

The target population included patients who underwent abdominal ultrasonography for any clinical indication during the study period. Both male and female patients were included. A non probability convenience sampling technique was used. The sample size was calculated using

the Raosoft sample size calculator, with 95% confidence level and 5% margin of error, a minimum sample of 368 participants was determined to be statistically adequate.

Inclusion and Exclusion Criteria

The study included patients aged 17 and above, of any gender, who underwent abdominal ultrasonography and provided informed consent. Exclusion criteria were participants having, prior cholecystectomy, or severe comorbidities hindering gallbladder visualization.

Data Collection Tools and Procedure

For each participant, demographic information such as age, sex, marital status, BMI, and medical history was recorded. The presence or absence of gallstones was confirmed from the ultrasound report obtained from the radiology department.

Statistical Analysis

Data were entered into SPSS version 25 for analysis. Descriptive statistics such as frequencies and percentages were calculated for sociodemographic variables. The prevalence of cholelithiasis was determined as the percentage of patients with confirmed gallstones on ultrasound. To identify associations between gallstone presence and potential risk factors, Chi square tests were applied. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of Northwest Institute of Health Sciences, and informed verbal consent was obtained from all participants prior to data collection.

Results and Analysis

Patient Demographics

A total of 368 patients underwent abdominal ultrasonography during the study period. Of these, 183 (49.7%) were male and 185 (50.3%) were female, indicating an almost equal gender distribution with a slight female predominance. The age of participants ranged from 17 to 96 years, with the majority falling into two age groups: 17–36 years (153 patients, 41.6%) and 37–56 years (151 patients, 41.0%). Within these groups, males were more prevalent in the 17–36 years category (85 males vs. 68 females), while females predominated in the 37–56 years group (86 females vs. 65 males). *Details in the table*.

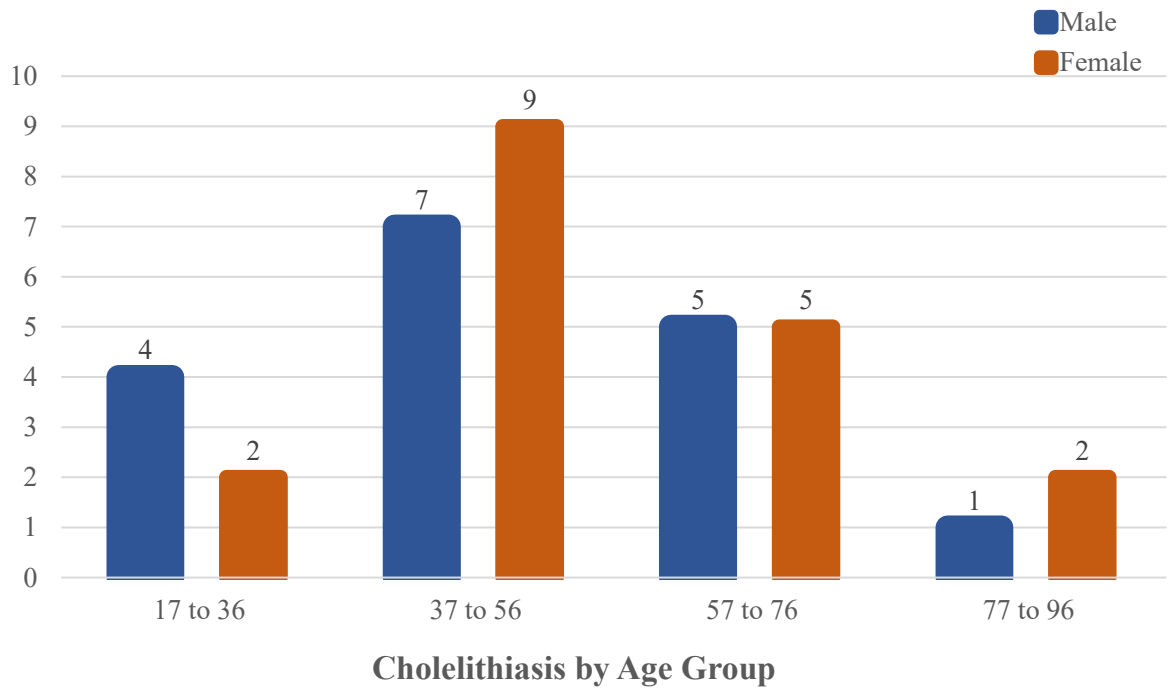
Table 1: Patient Demographics

Characteristic	Frequency	Percent
Gender		
Male	183	49.7
Female	185	50.3
Age Group (Years)		
17 to 36	153	41.6
37 to 56	151	41.0
57 to 76	56	15.2
77 to 96	8	2.2
Gender wise Age Distribution	**Male**	**Female**
17 to 36 years	85	68
37 to 56 years	65	86
57 to 76 years	31	25
77 to 96 years	2	6
Total	183	185
	368	

Prevalence and Characteristics of Cholelithiasis:
Out of 368 patients examined, 35 (9.5%) were diagnosed with cholelithiasis. Among these 35 patients, there was a slight female predominance with 18 females (51.4%) and 17 males (48.6%). The majority of female patients were in the 37-56 years age group (9 females), and this age bracket accounted for the highest number of cholelithiasis cases overall (16 patients). *Details in Table 2.*

Table 2: Prevalence and Characteristics of Cholelithiasis

Characteristic	Frequency	Percent
Overall Cholelithiasis		
Yes	35	9.5
No	333	90.5
Cholelithiasis by Gender		
Male	17	48.6
Female	18	51.4
Cholelithiasis by Age Group (Years)	**Male**	**Female**
17 to 36	4	2
37 to 56	7	9
57 to 76	5	5
77 to 96	1	2
Total	17	18
	35	



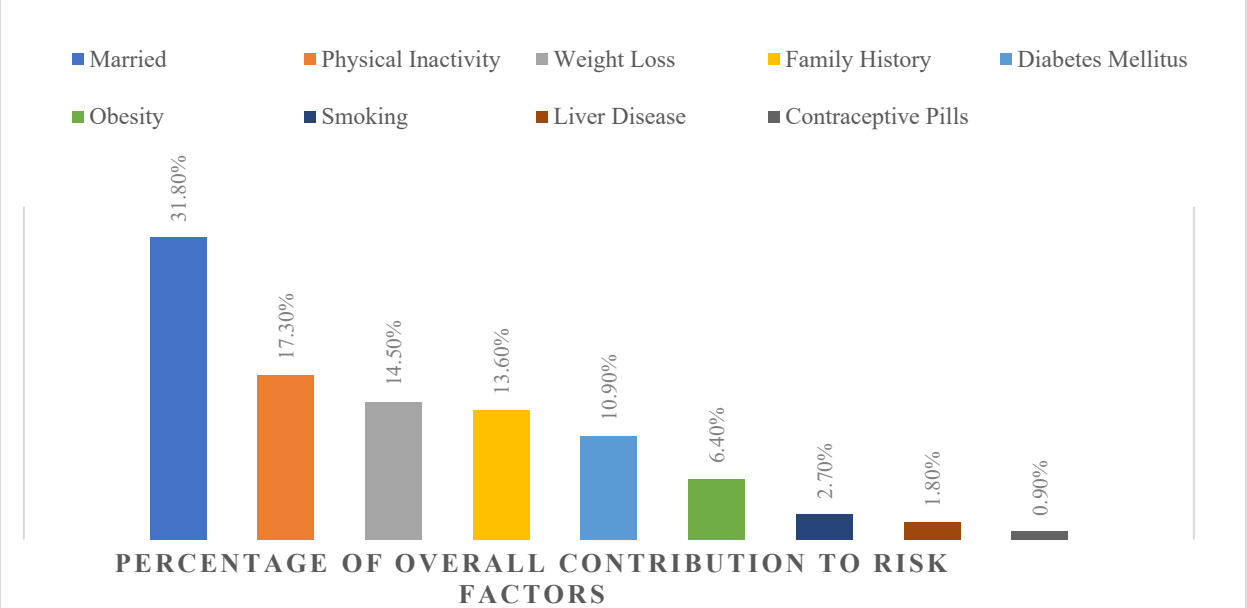
Cholelithiasis by Age Group

Associated Risk Factors for Cholelithiasis
The study identified several associated risk factors among the 35 cholelithiasis patients, with varying degrees of contribution to the overall risk profile. A notable finding was that all 35 patients diagnosed with cholelithiasis were married (100%). This factor was reported to contribute 31.8% to the overall risk factors identified in the study. 31.8% figure refers to its proportion among all identified risk factors listed in *Table 3.* The observation that all affected individuals were married is a very strong association, which could indicate a significant link to lifestyle changes, dietary habits, or parity (number of pregnancies) in females, all of which are

known risk factors for gallstones. A significant proportion, 19 patients (54.3%) with cholelithiasis, reported physical inactivity, comprising 11 males and 8 females. This was identified as a major risk factor, accounting for 17.3% of the overall risk factors. Sixteen patients (45.7%) among those with cholelithiasis reported a history of weight loss, consisting of 7 males and 9 females. This was categorized as a major risk factor, contributing 14.5% to the overall risk factors. A positive family history of cholelithiasis was present in 15 patients (42.9%) with the condition, comprising 5 males and 10 females. This non modifiable factor was a major risk factor, contributing 13.6% to the overall risk factors, with a notably higher ratio observed in females. Twelve patients (34.3%) with cholelithiasis were diagnosed with diabetes, consisting of 7 males and 5 females. This was also considered a major risk factor, accounting for 10.9% of the overall risk factors, with a higher prevalence among males. Seven patients (20.0%) with cholelithiasis were classified as obese, comprising 2 males and 5 females. While a contributing factor, its overall contribution was relatively smaller at 6.4% of overall risk factors, with females showing a higher incidence of obesity. Only 3 patients (8.6%) with cholelithiasis were smokers, all of whom were male. Smoking contributed a minor 2.7% to the overall risk factors. Two patients (5.7%) with cholelithiasis had coexisting liver disease, both of whom were male. This factor contributed a minor 1.8% to the overall risk factors. Only 1 female patient (2.9% of cholelithiasis patients) reported taking contraceptive pills. This factor had the smallest contribution to the overall risk factors at 0.9%. *Details in table 3.*

Table 3: Frequency and Percentage of Associated Risk Factors in Cholelithiasis Patients

Risk Factor	Frequency	Percentage	Male (Yes)	Female (Yes)	Overall Contribution to Risk Factors
Married	35	100.0%	17	18	31.8%
Physical Inactivity	19	54.3%	11	8	17.3%
Weight Loss	16	45.7%	7	9	14.5%
Family History	15	42.9%	5	10	13.6%
Diabetes Mellitus	12	34.3%	7	5	10.9%
Obesity	7	20.0%	2	5	6.4%
Smoking	3	8.6%	3	0	2.7%
Liver Disease	2	5.7%	2	0	1.8%
Contraceptive Pills	1	2.9%	0	1	0.9%



Discussion

The findings of this study reveal a cholelithiasis prevalence of 9.5%, which is consistent with previous research conducted in various regions of Pakistan. For instance, a similar prevalence of 10.2% in Karachi, 12.3% in Larkana, and 9.03% was reported in Multan[12], [14][15]. Overall, national prevalence is estimated around 10% across Pakistan, but with considerable regional variations reflecting lifestyle, dietary habits, and demographic differences [16]. This prevalence aligns with figures observed even in Western nations, where cholelithiasis affects approximately 10-15% of the U.S. population and varies in prevalence across Western Europe, 5.9-21.9% suggesting that cholelithiasis is a common biliary pathology worldwide [17]. A significant finding of our study is the slightly higher prevalence in females (51.4%) compared to males (48.6%), consistent with both local and international literature. This gender disparity is well documented and is largely attributed to hormonal influences, especially the role of estrogen in increasing cholesterol saturation in bile, predisposing women to gallstone formation [18]. Additionally, this finding aligns perfectly with the classic 4 F's (Female, Fat, Fertile, Forty) mnemonic, where female is a key risk factor for gallstones [19]. In terms of age distribution, our findings revealed the highest prevalence in the 37–56 years age group, followed closely by the 17–36 years cohort. This pattern suggests that gallstone formation may begin earlier than traditionally anticipated and tends to peak in middle adulthood. Similar patterns have been reported in other Pakistani and South Asian populations[20]. Among the various risk factors analyzed, both modifiable and non modifiable factors were found to have significant associations with gallstone formation. Obesity, family history, diabetes mellitus, and recent weight loss were notably prevalent among those diagnosed with gallstones. These findings align with previous studies demonstrating that obesity increases hepatic cholesterol secretion and leads to bile supersaturation [21]. Similarly, rapid weight loss, particularly through crash dieting, may promote gallstone formation due to increased cholesterol mobilization and reduced gallbladder emptying [22]. The role of diabetes mellitus is also significant, as insulin resistance affects lipid metabolism and gallbladder motility, increasing the risk for stone formation [23]. Physical inactivity, more common among male participants in our study, was another strong predictor of gallstones. Several international studies have underscored the protective effect of regular physical activity, suggesting improved bile circulation and gallbladder function [23]. Interestingly, all patients diagnosed with cholelithiasis in this study were married, indicating a statistically significant association. The association of smoking, liver disease, and use of hormonal contraceptives with cholelithiasis was relatively weaker compared to other risk factors. This may be due to a lower prevalence of smoking among females in this population or underreporting due to social desirability bias.

Conclusion

The study highlights that cholelithiasis remains a significant health concern, with multiple contributing factors. The near equal gender distribution, higher frequency in middle aged adults, and strong associations with obesity, diabetes, physical inactivity, and weight loss emphasize the need for targeted screening and lifestyle modification campaigns. Further longitudinal and multicenter studies are needed to explore causality, incorporate dietary assessments, and evaluate interventions aimed at reducing the burden of this preventable condition.

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