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Interplay between BMI, gender, and gallstone formation: insights from an Iraqi cohort

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ABSTRACT

Gallstone disease (GD; also known as cholelithiasis) is a prevalent illness with many aggravating factors; it is firmly connected with metabolic abnormalities associated with insulin resistance, being overweight, hypertriglyceridaemia, and dietary propensities. Patients at risk of developing cholelithiasis are usually women, of increasing age, and suffering from diabetes mellitus. This study was performed at the Al-Yarmouk Teaching Medical Hospital in Baghdad, Iraq, between January 2020 and December 2021. It involves 250 participants: 103 obese, 100 overweight, and 47 normal-weight patients. The patients' gender, weight, height, and body mass index (BMI) were recorded and studied. Statistical analysis revealed a strong association (p<0.05) between BMI and gallstone formation. Gender also plays a significant role, where women exhibited a higher incidence (p=0.002) than men. Age also significantly correlated with GD development risk (p=0.02). Although demographics and hormonal factors were significant, clinical evaluations revealed a high correlation between BMI and the incidence of GD. The increase in BMI leads to an increase in the incidence of cholelithiasis. Further study into the genetic and environmental factors associated with Middle Eastern populations are essential in order to enhance our understanding regarding this pathological condition and to inform our interventions.

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1. Introduction

Cholelithiasis is considered among the most pervasive and exorbitant gastrointestinal diseases, with a significant load forced on medical service frameworks. Cholelithiasis can occur due to various ailments. The debilitation of the digestion of cholesterol and bile acids is a major cause of gallstone disease (GD)[1]. One of the most common causes of GD is obesity, which is always accompanied by an excess production and elimination of cholesterol into the bile. Simultaneously, being overweight is straightforwardly relative to the quantity of cholesterol being synthesized in one's body[1,2].

Gender differences play a pivotal role in GD epidemiology; the reason behind the high incidence of GD in women might be the existence of high levels of oestrogen, which causes the liberation of a high quantity of cholesterol into the bile. Furthermore, the body mass index (BMI; an indicator used for the quantification of obesity) is a crucial factor in this context. The risk of GD development is enhanced by a higher BMI, which in turn is correlated with a higher bile cholesterol saturation[3].

The multifactorial nature of GD emphasizes the importance of having a thorough understanding of its risk factors. In addition to BMI and gender, eating habits, advanced age, and rapid weight loss play a crucial role in GD formation. Normal-weight people are not immune to the increased bile cholesterol saturation caused by obesity, thereby suggesting the participation of other, less well-studied mechanisms[4,5].

Our study aimed at illustrating the role of BMI and gender on the cholelithiasis incidence among Iraqi patients. This study also provides insights on the burden of GD in an Iraqi cohort.

2. Methodology

2.1. Study design and participants

A cross sectional study was conducted in Baghdad (Iraq), at the Al-Yarmouk Teaching Medical Hospital, from January 2020 to the end of December 2021. Since the hospital provides services to the metropolitan area's population, its patients are considered a reliable representation of the wider Iraqi population. This study included 250 patients suffering from GD. The study considered patients aged from 20 to 75 years with symptomatic GD (as verified by ultrasonography). The exclusion criteria were the following: patients with chronic diseases unrelated to GD, asymptomatic GD, or patients with prior cholecystectomy.

2.2. Data collection

Demographic information regarding all patients, including age and gender were collected. Anthropometric measurements were taken for all patients in light cloth and without shoes. A digital scale was used in order to measure their weight, and a stadiometer was used in order to measure their height. The BMI was calculated as follows: BMI = weight (kg) / (height (m))^2.

2.3. Diagnostic assessment

All participants are assessed by ultrasonography and liver function tests. If the stone in the common bile duct was not detected by ultrasonography, then a magnetic resonance cholangiopancreatography was employed. If the diagnosis was not made by magnetic resonance cholangiopancreatography, then an endoscopic ultrasound was used to confirm the diagnosis instead.

2.4. Ethical considerations

The Al-Yarmouk Teaching Medical Hospital's Institutional Review Board has examined and approved the study's protocol (approval number: YTMH5122019; date: December 2019). All participants provided written informed consent before being included in this study, thereby guaranteeing compliance with ethical guidelines for studies involving human participants.

2.5. Statistical analysis

Data were analysed using the SPSS v. 22 software.

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Table 1. Gallstone disease patient characteristics and statistical correlations. The table presents the demographic distribution of the study's participants based on their body mass index (BMI; categories: healthy, overweight, and obese), their respective age groups, and their gender. Note: * denotes statistical significance.

Age						
	N	**Mean**	**Standard deviation**	**Minimum value**	**Maximum value**	
Age (years)	250	46.3	11.14	20	75	
Gender and age						
	N	**Mean**	**Standard deviation**	**Minimum value**	**Maximum value**	***p*-value**
Female	169	46.5	10.9	20.5	39.4	0.002*
Male	81	45.8	11.4	23.3	35.9	0.06
Age and BMI categories						
Age (years)		**Healthy**	**Overweight**	**Obese**	**Total**	***p*-value**
<30		4	9	6	19	0.08
30–50		26	55	66	147	0.02*
>50		25	28	31	84	0.04*
BMI categories and gender						
		Gender		**Total**	***p*-value**	
		Female	**Male**			
BMI categories	**Healthy**	33	14	47	0.09	
	Overweight	76	24	100	0.04*	
	Obese	60	43	103	0.04*	

Descriptive statistics were used in order to summarize the participants' characteristics. Logistic regression models were employed in order to assess the relationship between the GD presence, gender, and BMI, adjusting for potential confounders. Statistical significance was set at $p<0.05$.

3. Results

Our study involved 250 GD patients of both sexes. The male patients were fewer (N=81; 32.4%) than the female ones (N=169; 67.6%). The age of the patients included in our study ranged from 20 to 75 years and the mean of their age was 46.3 years (Table 1). Most patients in this study were between 30–50-years-old (N=147; 58.8%). According to the BMI classification, most of the GD patients were obese (N=103; 41.2%), followed by patients who were overweight (N=100; 40%), and patients of "healthy" weight (N=47; 18.8%). Statistical analysis has confirmed a significant association between BMI and gallstone formation (Table 1). Women exhibited a higher incidence of GD compared to men ($p=0.002$). Moreover, age also significantly correlated with a GD development risk (Table 1).

4. Discussion

Gallstone prevalence increases with age, with most cases being asymptomatic for extended periods. This study reaffirms the strong association between BMI, gender, and GD, in a manner consistent with global research. Our study has shown that women exhibit a 2:1 ratio of GD prevalence compared to men ($p=0.002$), thereby aligning with the belief that oestrogen-related mechanisms increase biliary cholesterol. This finding is also consistent with previous studies[6,7] that have reported a higher incidence of GD in women (compared to men), suggesting that the female gender is a significant risk factor for GD development.

BMI has emerged as a critical determinant of gall-

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stone pathogenesis. An elevated BMI correlates with increased risk of GD formation. Our study has confirmed a significant association between BMI and gallstone formation (p<0.05), consistently with the studies by Kim *et al.*[8], Zhang *et al.*[9], and Xie *et al.*[10], that have identified similar patterns of BMI-related risk of GD development across diverse populations.

Age remains an independent risk factor, as evidenced by the predominance of patients above 35 years in this study (p<0.05). Lifestyle factors, including diet and physical activity, further influence GD development risk. This underscores the importance of targeted prevention strategies, particularly in high-risk populations. Identifying and managing these factors early could substantially reduce the disease burden.

5. Conclusion

This study focuses on an Iraqi cohort and concludes that obesity significantly increases the GD development risk. Gender and age also substantially seem to influence gallstone formation, with women and older individuals being at a higher risk. Public health initiatives should prioritize lifestyle interventions in an attempt to reduce the GD burden in Iraq.

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Conflicts of interest

None exist.

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