



## Original Article

## Association of Diet Consumption with Gallbladder Changes in Females After Birth of Child

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## ABSTRACT

The postpartum period is characterized by remarkable physiological adaptations to accommodate the demands of childbirth and lactation. These physiological changes, coupled with the unique nutritional needs of both the mother and newborn, can lead to gallbladder stasis and increased cholesterol absorption in the gallbladder. **Objective:** To assess the correlation between diet consumption and gallbladder changes in females after childbirth. **Methods:** This observational study was conducted at the department of Gastroenterology, Jinnah Medical and Dental College, Sohail University, Karachi, Pakistan from December 2022 to June 2022. Females of reproductive age who had normal child delivery were evaluated after 6 weeks of delivery. The medical examination, anthropometric measures, nutritional assessment, and laboratory testing were performed in all eligible females. An ultrasonographic was done after a typical fatty food in order to assess gallbladder changes. SPSS version 21.0 was used to do statistically analysis. **Results:** The mean age was  $28.89 \pm 4.73$  and mean BMI was  $22.78 \pm 4.09$  kg/m<sup>2</sup>. Of 100 females, 17% had gallbladder stasis, 26% had gallstones, and 17% had sludge. The females with low protein consumption had significantly higher proportion of gallbladder stasis as compared to females with high protein consumption in diet (76.5% vs 23.5%,  $p=0.001$ ). Furthermore, females with high carbohydrate (61.5% vs 38.5%,  $p=0.011$ ) and fructose (53.8% vs 46.2%,  $p=0.037$ ) consumption had significantly higher proportion of gallstones as compared to females with low consumption. **Conclusions:** High protein consumption was linked to gallbladder stasis, while high carbohydrate and fructose intake were associated with an increased proportion of gallstones.

## INTRODUCTION

Gallbladder disorders, particularly cholelithiasis, have emerged as significant health concerns affecting millions of individuals worldwide, especially females [1]. The prevalence of gallstone disease varies among different countries. Approximately 10% of individuals residing in Western countries and 5% of those in underdeveloped nations such as Pakistan experience cholelithiasis [2]. Evidence showed that gallstone disease is linked to a range of potentially life-threatening consequences, including gallbladder cancer [3]. Cholelithiasis is the 2nd most frequent emergency during or shortly after delivery and the leading cause of maternal re-admission in the first two months after delivery [4, 5]. Around 8% of the pregnant

females develop new gallstones by the third trimester, and only about 1% experience symptoms. Among those who do experience symptoms, less than 10% encounter complications [6]. The postpartum period is characterized by remarkable physiological adaptations to accommodate the demands of childbirth and lactation [7]. These physiological changes, coupled with the unique nutritional needs of both the mother and newborn, can lead to gallbladder stasis and increased cholesterol absorption in the gallbladder [8, 9]. In a large study on pregnant females, it has been observed that high fructose and carbohydrate consumption increases the risk of gallstone [10]. In Pakistan, a significant portion of females being treated for

gallstones are slender, undernourished, multiparous young women from lower socioeconomic backgrounds [11]. Understanding the potential risk factors contributing to gallstones in this particular demographic can aid in the development of preventive measures and offer valuable insights into the etiology of gallstone disease. Hence, the aim of current study was to assess the association between gallbladder changes and nutritional deficiencies in females after childbirth.

## METHODS

This observational study was conducted at the department of gastroenterology, Jinnah Medical and Dental College, Sohail University, Karachi, Pakistan from Dec 2022 to Jun 2022. Sample size of 98-100 females was estimated using Open Epi sample size calculator by taking statistics of incidence of gallbladder as 10.2% in pregnant females [10], a bound-on error as 6% and 95% confidence level. The study included postpartum females aged above 18 years who had given birth to a single live infant at full term. Females with frequent pancreas inflammation, biliary distress syndrome, prior cholecystectomies, and complications such as congenital defects, restricted intrauterine growth, stillbirths, or multiple gestations were excluded. Non-random purposive sampling technique was employed for participant selection. Ethical approval for the study was obtained from the ERC of Sohail University, and informed consent was obtained from all eligible females. Data on demographics, medical history, anthropometric measures, and dietary intake were collected. Dietary intake was assessed using a meal frequency questionnaire, and a comprehensive nutritional evaluation was performed, with special emphasis on carbohydrate, fructose and protein consumption per day. Consumption of carbohydrate > 210 g/day, fructose > 25 g/day and protein >100 g/day were labelled as high consumption. Gallbladder (GB) function was evaluated using real-time ultrasound imaging conducted by a GI radiologist with over 5 years of experience. Participants were required to fast overnight for the study, and GB volume was measured using the ellipsoid technique. After consuming a common fatty meal, GB emptying was assessed by capturing ultrasound images of the GB at specific intervals, enabling the calculation of variables such as basal volume, ejection fraction at various time points, and the duration for the greatest constriction. Data were analyzed using SPSS version 21.0. Descriptive analysis of numeric and categorical data were performed. Frequency and percentage were computed for parity, gestational diabetes mellitus, pregnancy-related hypertension, dietary consumption, family history of gallstones, biliary symptoms, gallbladder stasis, gallstones, and sludge. Mean and Standard Deviation were

reported for age, BMI, gallbladder volume left over after 60 mins, fasting volume in the gallbladder, gallbladder ejection fraction. Comparison between gallbladder changes and dietary intake was done using Chi-square/Fisher Exact test. A p-value less than and equal to 0.05 was considered as statistically significant.

## RESULTS

The mean age was  $28.89 \pm 4.73$  and mean BMI was  $22.78 \pm 4.09$  kg/m<sup>2</sup>. Most of the females were multiparous (88%), 3% had gestational diabetes mellitus, 12% had pregnancy-related hypertension and 2% had family history of gallstones (Table 1). Biliary colic was the most frequent biliary symptom during pregnancy (10%), followed by itching (6%), cholestasis (5%) and jaundice (1%), respectively. The mean gallbladder volume left over after 60 mins was  $12.08 \pm 1.82$ , mean fasting volume in the gallbladder was  $20.58 \pm 2.68$ , and mean gallbladder ejection fraction was  $50.67 \pm 10.26$ . Of 100 females, 17% had gallbladder stasis, 26% had gallstones, and 17% had sludge.

**Table 1:** Baseline characteristics of study variables (n=100)

Characteristics	Statistics
Age (years)	28.89±4.73
BMI (kg/m <sup>2</sup> )	22.78±4.09
Parity	
Nullipara	4 (4)
Single para	8 (8)
Multipara	88 (88)
Gestational diabetes mellitus	
Yes	3 (3)
No	97 (97)
Hypertension	
Yes	12 (12)
No	88 (88)
Family history of gallstones	
Yes	2 (2)
No	98 (98)
Data presented as Mean ± SD or n (%)	

The females with low protein consumption had significantly higher proportion of gallbladder stasis as compared to females with high protein consumption in diet (76.5% vs 23.5%, p=0.001). Furthermore, females with high carbohydrate (61.5% vs 38.5%, p=0.011) and fructose (53.8% vs 46.2%, p=0.037) consumption had significantly higher proportion of gallstones as compared to females with low consumption (Table 2).

**Table 2:** Comparison of diet intake and gallbladder changes during pregnancy

Diet	Gallstones	Sludge	Gallbladder stasis
<b>Consumption of protein</b>			
High (n=40)	12 (46.2%)	8 (47.1%)	13 (76.5%)
Low (n=60)	14 (53.8%)	9 (52.9%)	4 (23.5%)
p-value	0.457	0.514	0.001*
<b>Consumption of carbohydrates</b>			
Low (n=21)	10 (38.5%)	1 (5.9%)	5 (29.4%)
High (n=79)	16 (61.5%)	16 (94.1%)	12 (70.6%)
p-value	0.011*	0.093	0.343
<b>Consumption of fructose</b>			
Low (n=30)	12 (46.2%)	7 (41.2%)	8 (47.1%)
High (n=70)	14 (53.8%)	10 (58.8%)	9 (52.9%)
p-value	0.037*	0.271	0.092

## DISCUSSION

The present study aimed to assess the association between gallbladder changes and diet in females after childbirth. The results indicate that gallbladder disorders are not uncommon in the postpartum period, with a considerable proportion of women experiencing gallbladder stasis, gallstones, and sludge. These findings are in line with previous studies that have reported an increased risk of gallstone formation during and after pregnancy, particularly in females with certain dietary habits [10, 12, 13]. In our study, the incidence of gallstones aligns with global estimates, with almost 26% of pregnant females have cholelithiasis [2, 14, 15]. Six weeks after giving birth, we found that these women had a higher incidence of gallbladder stasis, which refers to a reduced flow of bile from the gallbladder. This condition was associated with several other factors, including a lower ejection percentage (indicating impaired gallbladder function), larger baseline gallbladder volumes, and slower responses to fatty meals. It is essential to address this issue to improve maternal health and reduce maternal re-admissions related to gallbladder complications. Although earlier research has indicated that in women who are pregnant average basal levels are around 70% greater than those of non-pregnant supervises, the volumes revert to baseline as soon as two weeks after delivery [16, 17]. Yet, at just six weeks after giving birth, our patients showed higher volumes and stasis, which could have been related to their diet's lack of protein, low BMI, or concurrent lack of iron. Additionally, the study revealed a significant link between inadequate carbohydrate and calorie consumption and an increased prevalence of gallstones in postpartum females. Those with high carbohydrate and calorie intake had a 61.5% and 53.8% occurrence of gallstones, respectively, compared to 38.5% and 46.2% in those with low consumption. The majority of the females, we discovered,

consumed more carbohydrate and less protein than what was advised for women in the postpartum period [18, 19]. This observation corresponds with previous studies that have reported a positive correlation between gallstone formation and low-fat diets [20-22]. A study by Park *et al.*, also suggested an association between fatty foods and increased risk of gallstone development [23]. Hence, high protein intake has been associated with increased cholesterol saturation in the bile, which can lead to the formation of gallbladder sludge and stasis. On the other hand, diets rich in refined carbohydrates and high fructose intake can lead to insulin resistance and altered lipid metabolism, contributing to gallstone formation [21, 23, 24].

## CONCLUSIONS

High protein consumption was linked to gallbladder stasis, while high carbohydrate and fructose intake were associated with an increased proportion of gallstones. These findings underscore the importance of promoting a balanced diet during and after pregnancy to mitigate the risk of gallstone-related complications in vulnerable populations.

## Authors Contribution

Conceptualization: AAR

Methodology: SSR, JU

Data Collection: SSR, JU

Formal analysis: SSR, JU

Writing-review and editing: AAR, SSR, JU

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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