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Original Research Article

Dietary habits as risk factor of gallstone disease in Benghazi, Libya: a case control study

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ABSTRACT

Background: Gallstone disease is one of the most common diseases in developed and developing countries; recent studies have expressed evidence in the context of the role of nutrition in the gallstone disease etiology. The most common risk factors for gallstones formations are old age, female gender, obesity and diabetes mellitus. The dietary risk factors, includes consumption of carbohydrates, fats, proteins and dietary products, Moreover, healthy dietary pattern, coffee, rich sources of vitamins as fruits and vegetables do have protection role of gallstones. Our aim is to determine the dietary habits as a risk factor of gallstone diseases admitted in Al-Jala Hospital.
Methods: An analytic case control study the data collected from documents of gall bladder stone (GBS) cases that have presented in surgical department and controls from other departments at Al Jala Hospital of Benghazi-Libya between January 2023 and December 2023.
Results: The results of the study showed that cases diagnosed with GBS had high dietary intake of carbohydrates, fat, dairy products and meats and whereas had low dietary intake of vegetables and fruits which highly containing fibers, vitamins and minerals in contrast controls had low intake of carbohydrates, fat, dairy products and meats and whereas had high dietary intake of vegetables and fruit (vitamins and minerals) and caffeine.
Conclusions: The study concluded that dietary risk factors that contributing to the high prevalence of gall stone formation were because of high intake of high carbohydrates, proteins and fatty diets and low intake of dietary fiber vitamins and minerals as well as caffeine also cases ender and high body mass index (BMI) play important role in gall stone formation.

Keywords: Gall bladder stone, Dietary risk factors, Al-Jala Hospital, Case-control study

INTRODUCTION

The gallbladder is a small, pear-shaped organ located in the right upper abdomen, measuring approximately 7-10 cm in length and 4 cm in width.[1] Despite its size, it is a frequent cause of abdominal pain due to gallstones, often leading to surgical removal. Anatomically, the gallbladder lies beneath liver segments IV and V, with an inferior peritoneal surface and a superior liver surface.[2] It lacks a true capsule, though some sources suggest an extension of Glisson's capsule covers the exposed surface.

The gallbladder originates from the cystic diverticulum during the fourth week of embryonic development, which differentiates into the gallbladder, while the hepatic diverticulum becomes the biliary tree. This development shows significant variation in humans. The gallbladder stores 30-50 ml of bile, which is released during digestion, triggered by the secretion of cholecystokinin (CCK) from the duodenum in response to gastric distension and fatty food intake. Disruptions, such as neuro-innervation issues or cystic duct blockages due to gallstones, can lead to symptoms of cholecystitis.[3]

Gallstones, or cholelithiasis, affect 10-15% of the global adult population, with prevalence increasing with age. In the U.S., over 20 million adults between 20 and 74 have gallstones, a common gastrointestinal disorder, primarily due to cholesterol-rich bile. Other types of stones include pigmented, mixed, and calcium stones, which can develop from various factors like bile stasis, strictures, or hypercalcaemia.[4]

Risk factors for gallstones include obesity, rapid weight loss, hormonal changes (e.g., estrogen), and chronic diseases like diabetes, which reduce gallbladder contractility. Gallstones can be asymptomatic but often cause complications requiring medical intervention.[5-8] Understanding the role of genetic, metabolic, and environmental factors, including dietary habits, is essential for prevention. About 75% of gallstones in Western countries are cholesterol-based, with links to obesity, dyslipidemia, and metabolic syndrome.[9] Our objectives to determine the dietary habits as a risk factor of gallstone diseases admitted in Al-Jala Hospital. To analyze the relationship between dietary intake and gallstone formation. The aim of the study was to assess the impact of dietary choices on gallstone disease, to investigate the role of dietary components in gallstone development, and to highlight the importance of healthy dietary patterns in preventing gallstone formation.

METHODS

Study design

The study is described as an analytic case-control study focusing on gallbladder stone cases that presented at Al Jala Hospital in Benghazi, Libya, between January 2023 and December 2023.

Data collection

Data for the study was collected from documents of gallbladder stone cases from the surgical department and controls from other departments at Al Jala Hospital. The study included 108 cases (patients with gallstones) and 218 controls (patients without gallstones, matched for age and sex).

Data sources

Medical data from the surgical department (cases) and orthopedic and plastic surgery departments (controls) were utilized for the study. Information such as personal and medical details, anthropometric measurements, and 24-hour dietary recall data were gathered from medical files.

Anthropometric measurements

Weight and height measurements were taken, and body mass index (BMI) was calculated for each case. This information likely contributed to the assessment of the participants' physical health and nutritional status.

Statistical analysis

Statistical analysis of the collected data was performed using IBM statistical package for the social sciences (SPSS) version 23.0. This analysis likely involved comparing dietary habits, anthropometric data, and other relevant variables between the cases and controls to identify any significant associations.

Inclusion criteria

Patients diagnosed with gallstone disease (cases), patients admitted to Al-Jala Hospital in Benghazi, Libya, cases diagnosed between January 2023 and December 2023, patients with complete medical records available for analysis, patients of all genders who meet the age criteria for the study, and patients who provide informed consent to participate in the study were included.

Exclusion criteria

Patients without a confirmed diagnosis of gallstone disease, patients with a history of other significant gastrointestinal diseases, patients with incomplete or missing medical records, patients who do not consent to participate in the study, patients with conditions that may affect dietary habits significantly (e.g., eating disorders, specific dietary restrictions), and patients with a history of bariatric surgery or other procedures that could impact dietary intake were excluded.

RESULTS

During 01 January 2023 and 31 December 2023, the total number of cases presented with GBS at Al-Jala Hospital was 108 cases and 218 controls. Starting with socio demographic data shows patients age as Table 1 shows 326 of cases and controls divided into two groups; less than 40 years and who are more than 40 years, also shows that sixty-five point nine percent of cases were females, thirty-four point one percent were males, while sixty-eight percent of controls were females and thirty-two present were males (Table 1). Because of matching between cases and controls there's no differences in demographical data. The anthropometric data were collected, Weight and height were measured, and BMI was calculated from the anthropometric data for each case; by using the equation (BMI=weight/height in meters) (Table 2). Most of patients were founded mainly overweight and grade 1 obesity, they were almost the same in cases and controls due to collecting from same society The physical activity of cases divided into low medium and highly active (i.e. low means inactive, medium which means walking or standing for two to four hour a day and high means active for more than four hours a day) (Table 3). Total daily calories can be estimated from weight and physical of cases though an equation (weight×1×24×physical activity) and the average

number of daily calories was (1664 k cal) for cases and (1599 k cal) for controls. The frequency of meals was variable were thirty-four point two percent of cases had less than three main meals a day, while forty-three point two percent had two main meals and about twenty-four percent were having more than three meals while in controls found forty percent, forty-five percent and fifteen percent respectively (Table 4). A Chi-square test was used to analyze the data, the results suggest a significant association between number of main meals difference between cases and controls, χ^2 (1, N=326) = 2.29, p=0.001. Also, there are also many people who had light meals in between the main meals (Table 5). Next table shows that sixty point thirty percent have utilizing unhealthy carbohydrates includes white bread, rice, pasta and sweets contrast to only forty-three of controls had utilized while thirty-nine point seventy of cases had utilizing healthy carbohydrates as oats, barley breads and brans in contrast fifty-seven of controls had utilized them (Table 6). The different types of fats have consumed in large amount in different types of foods as vegetable oils and butter which always containing mainly cholesterol and saturated fats consumed mainly in more than seventy-five point five percent of cases contrast to fifty-five percent of controls; while the olive oil that contains triglyceride which represent unsaturated fat consumed in twenty-four point five percent of cases had utilized them contrast forty-five percent of controls (Table 7). The calcium which found mainly in milk and dairy products shows sixty-five percent of cases have consumed whole milk contrast to controls who consumed forty-five percent while five percent and nineteen percent for medium and skimmed fat respectively of cases contrast controls who had ten percent and twenty-three percent for medium and skimmed fat; in addition, fifteen percent of cases had not consumed at all contrast controls had not consumed by twenty-two percent (Table 7).

About different types of meats shows twenty-five point three percent of cases had consumed red meats contrast twenty percent of controls while thirty-five point five percent had chicken contrast thirty percent of controls had consumed it, and about sixteen percent had consumed fish contrast twenty percent of controls had consumed it; in addition to twenty-three point two of cases had been vegetarian while twenty-eight of controls also vegetarians (Table 8). Different types of vitamins, minerals and fibers which are found in fruits and fresh vegetables are daily consumption (Table 9). Also, Table 9 shows that cases not consumed by 2.4 times multivitamins than controls. Table 10 shows a twenty-three percent of cases having three or more times a day of different types of caffeine drinks as coffee, tea, Nescafe and others; while thirty-one percent consumed two times per day and thirty percent have consumed once daily and sixteen percent have none.

Table 1: Age and sex distribution difference between cases and controls.

Variables	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Age group (years)				
Less than 40	70	65	153	70
More than 40	38	35	65	30
Total	108	100	218	100
Sex				
Female	71	65.9	148	68
Male	37	34.1	70	32
Total	108	100	218	100

Table 2: Cases and controls difference in distribution according the BMI.

BMI	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Underweight	12	11.3	23	10.5
Normal	15	14	29	13.3
Overweight	34	31.3	68	31
Grade I obese	40	37	86	39.4
Grade II obese	4	3.7	6	2.7
Grade III obese	3	2.7	6	2.7
Total	108	100	218	100

Table 3: Physical activity difference between cases and controls.

Physically active	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Low	55	51.3	107	49
Medium	41	38.2	87	40
High	12	10.5	24	11
Total	108	100	218	100

Table 4: Percentage of cases according different types of meals.

Number of meals/day (main meals)	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Less than three main meals	37	34.2	87	40
Three main meals	47	43.2	98	45
More than three main meals	24	22.4	33	15
Total	108	100	218	100

Table 5: Difference of cases and controls in having light meals.

Have light meals	Cases	Controls
Yes	86	130
No	22	88
Total	108	218

The odds ratio=86×88/22×130=2.6 means that patient with gall bladder stones (cases) have 2.6 times had light meals than other patients (controls)

Table 6: Difference of utilization for types of carbohydrates.

Types of carbohydrates	Number of cases	Percentage of cases	Number of controls	Percentage of controls
White bread, rice, pasta and sweets	65	60.30	95	43
Oats, barley breads and bran	43	39.70	123	57

The odds ratio=65×123/43×95=1.95 it means that cases have utilizing unhealthy carbohydrates by 1.95 times than controls and cases had less utilizing of healthy carbohydrates contrast to controls

Table 7: The differences of fat consumption between cases and controls, also percentage of milk and dairy products.

Variables	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Types of fat				
Vegetable oils and butter	82	75.5	120	55
Olive oil	26	24.5	98	45
Milk and dairy products consumption				
Whole milk	65	61	98	45
Medium or low fat	6	5	22	10
Skimmed fat	21	19	50	23
Not consumed	16	15	48	22

Odds ratio=82×98/26×120=2.5. Means cases had utilized 2.5 times of saturated unhealthy sources of fat than controls. A Chi-square test was used to analyze the data. The results suggest a significant association between different types of dairy products between cases and controls, χ^2 (1, N=326) = 4.55, p=0.005

Table 8: Differences between cases and controls in consuming different types of meats.

Types of meat	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Red meats	27	25.3	44	20
Chicken	39	35.5	65	30
Fish	17	16	48	22
None	25	23.2	61	28

A Chi-square test was used to analyze the data, the results suggest a significant association between different types of meats between cases and controls, χ^2 (1, N=326) = 4.68, p=0.005

Table 9: Differences between cases and controls in consumption of fresh vegetables and fruits consumption.

Variables	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Fresh vegetable and fruits daily consumption				
Once a day	59	55	87	40
Twice a day	22	20	100	46
Three or more	10	9	11	5
None	17	16	20	9
Multivitamins daily utilization				
Not consumed	76	70.3	107	49
Consumed	32	29.7	111	51

A Chi-square test was used to analyze the data. The results suggest a significant association between number of times of fresh vegetables and fruits daily consumption between cases and controls, χ^2 (1, N=326) =33, p=0.005. Odds ratio=76×111/32×107=2.4. Means that cases not consumed by 2.4 times multivitamins than controls

Table 10: Differences between cases and controls in caffeine consuming.

Daily using of caffeine	Number of cases	Percentage of cases	Number of controls	Percentage of controls
Not consumed	65	60	98	45
Consumed	43	40	120	55

Odds ratio=65×120/43×98=1.85. So, cases have less consumption of caffeine than controls by 1.85 times

DISCUSSION

Gallstone disease is a global health issue and remains one of the leading causes of surgical intervention. Dietary habits play a crucial role in its development. In this study, data confirmed a correlation between dietary habits and gallstone formation when comparing cases and controls.[10-12]

Most studies identify overweight and obesity as key risk factors for gallstone formation, with high BMI being a significant risk factor.[13] A study from Poland highlighted that gallstones are a major risk for women, particularly those under 40 years old.[14] Our findings align with this, showing a significant association between BMI and gallstone risk (p=0.005), with the majority of cases being overweight or obese (31% and 37%, respectively). High sugar intake is also linked to gallstone formation. Our study found that patients with gallstones consumed more white bread, pasta, rice, and sweets compared to controls, who consumed healthier carbohydrates like oats and barley (OR=1.95).[15-17] Additionally, a higher intake of saturated fat increased the risk of gallstones, while unsaturated fats reduced the risk. Cases consumed more saturated fats like vegetable oil and butter, compared to controls who favored unsaturated fats like olive oil (OR=2.5). Furthermore, gallstone patients consumed more red meat and whole milk, which are associated with increased gallstone risk (p=0.05). In contrast, dietary fiber from fresh fruits and vegetables had a protective effect against gallstones, with a significant difference in consumption between cases and controls (p=0.005).[18] Vitamin supplements also showed a protective role, as cases were 2.4 times less likely to consume them compared to controls. Caffeine intake, particularly from coffee, was inversely associated with gallstone risk, with controls consuming more caffeine than cases (OR=1.85).[20-22]

These results align with previous studies, which suggest that a diet high in refined sugars, animal fats, and low in dietary fiber increases the risk of gallstones, while vitamins and caffeine may offer protection.

Limitations

The sample size might be limited, affecting the generalizability of the findings to the broader population. Being conducted at a single center (Al-Jala Hospital) may limit the study's external validity. The study's findings might be influenced by the specific population in Benghazi, Libya, limiting generalizability to other regions or ethnicities.

The study duration (January 2023 to December 2023) might not capture seasonal variations or long-term dietary habits accurately.

CONCLUSION

Dietary habits significantly influence the development of gallbladder stones. The study highlights that a high intake of carbohydrates, proteins, and saturated fats, along with a low intake of dietary fiber, vitamins, minerals, and caffeine, contributes to the increased prevalence of gallstone formation. Gender and high BMI are also key factors in gallstone development. Promoting healthier dietary habits, maintaining a normal weight, and ensuring adequate consumption of essential nutrients can help reduce the risk of developing gallbladder stones.

Recommendations

Improving nutritional habits by increasing nutrition educational programs for the people.

Reducing weight by using moderate caloric restriction programs, and avoid very low caloric diet programs (due to very low caloric diet may exacerbate bile saturation).

Change in dietary habits by decreasing intake of high carbohydrates, cholesterol and saturated fat diet like and increasing intake of high fiber diet like (fresh vegetables, and fruits, barely and bran bread) could reduce the formation of gall stones.

More researches relating to the dietary risk factors and cholelithiasis should be performed in future.

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