

# Study of level of serum Iron level in the patients of Gall Bladder disease and normal individuals at tertiary health care center

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## Abstract

**Background:** Gallstone disease is a disorder with changing prevalence, reflecting the increasing life expectancy and changes in lifestyle and factors related to it as obesity, metabolic disorder and dietary habits. Iron deficiency has been shown to alter the activity of several hepatic enzymes, leading to increased cholesterol saturation of bile in gall bladder and hence promoting cholesterol crystallization. Present study was aimed at studying serum Iron level in the patients of Gall Bladder disease and normal individuals at tertiary health care center. **Material And Methods:** Present study was single-center, prospective, observational study, conducted in Patients age group of 21 – 70 years, either gender, cases (Cholelithiasis confirmed by ultrasonography) and controls (not suffering from gall stone confirmed by ultrasonography). Venous blood sample of 4 ml was taken in red vacutainer for evaluation of serum iron and serum ferritin level. **Results:** In present study, 80 cases and 80 controls were studied. Age and distribution was comparable among cases and controls and difference was not significant statistically ( $p > 0.05$ ). Low levels of serum iron (in male  $< 60 \mu\text{g/dL}$ , and in female  $< 35 \mu\text{g/dL}$ ) was noted in majority of cases (in male 51.85 %, and in female 64.15 %) as compared to controls cases (in male 10 %, and in female 22 %) and difference was significant statistically ( $p = 0.001$ ). Low levels of serum ferritin (in male  $< 15 \mu\text{g/dL}$ , and in female  $< 12 \mu\text{g/dL}$ ) was noted in majority of cases (in male 66.67 %, and in female 79.25 %) as compared to controls cases (in male 23.33 %, and in female 34 %) and difference was significant statistically ( $p = 0.001$ ). **Conclusion:** Low Serum Iron levels and low serum ferritin levels are associated with increased incidence of cholelithiasis. **Keywords:** Low Serum Iron, low serum ferritin, cholelithiasis, gallstone.

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## INTRODUCTION

Cholelithiasis i.e., gallstone disease is one of the most common disease of upper digestive tract, for which patients visit hospital with complaints of flatulence, dyspepsia and upper abdominal pain. Gallstone disease is

a disorder with changing prevalence, reflecting the increasing life expectancy and changes in lifestyle and factors related to it as obesity, metabolic disorder and dietary habits.<sup>1,2</sup> The role of iron in the pathogenesis of gallstone disease has not been well established so far. Iron deficiency has been shown to alter the activity of several hepatic enzymes, leading to increased cholesterol saturation of bile in gall bladder and hence promoting cholesterol crystallization.<sup>3</sup> Iron deficient diet alters hepatic enzyme metabolism, increases gallbladder bile cholesterol and promotes cholesterol crystal formation and activity alteration of many hepatic enzymes also occurs.<sup>4</sup> Conditions that favor the formation of cholesterol gallstones are super saturation of bile with cholesterol, kinetically favorable nucleation and presence of cholesterol crystals in the gall bladder long enough to agglomerate into a stone. Recent studies have defined the

role of trace elements (Fe, Ca, Zn and Cu) and defective pH in the formation of gallstones.<sup>5</sup> The present study was aimed at studying serum Iron level in the patients of Gall Bladder disease and normal individuals at tertiary health care center

### MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in Department of Surgery, Gian Sagar Medical College and Hospital, Ramnagar, India. Study duration was of 2 years (July 2018 to June 2019). Study was approved by institutional ethical committee. Study was conducted in collaboration with department of biochemistry.

**Inclusion criteria: Cases-** Patients age group of 21 – 70 years, either gender, with Cholelithiasis confirmed by ultrasonography, admitted in surgery ward. **Controls-** Patients age group of 21 – 70 years, either gender, not suffering from gall stone confirmed by ultrasonography, admitted in surgery ward for non-infectious cause.

**Exclusion criteria:** Patients taking iron for anemia, Patients diagnosed with cirrhosis of liver on ultrasound scan, Patients with gallstone diseases due to hemolytic

anemias, Patients diagnosed case of biliary tract surgery, Crohn’s disease, cystic fibrosis.

Study was explained in local language and written informed consent was taken for participation. A detailed history was taken and clinical examination done in all the patients. Routine investigations such as ultrasound of abdomen were done in all the patients. Venous blood sample of 4 ml was taken in red vacutainer for evaluation of serum iron and serum ferritin level. Serum ferritin level was assessed by chemiluminescence. Serum iron was estimated by the ferrozine kit method. Adult male with hemoglobin level <13 and adult female with <12 were diagnosed as anaemic. Normal serum ferritin levels in adult male average is 100 µg/L (15–200 µg/L) and in female average is 30 µg/L (12–150 µg/L). Normal serum iron levels in adult male is 60–160 µg/dL, and in female 35–145 µg/dL. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

### RESULTS

In present study, 80 cases and 80 controls were studied. Age and distribution was comparable among cases and controls and difference was not significant statistically (p>0.05).

**Table1: Age and gender distribution**

Age Group (years)	Cases (n=80) (%)	Controls (n=80) (%)
21 - 30	8 (10 %)	9 (11.25 %)
31 - 40	35 (43.75 %)	32 (40 %)
41 - 50	22 (27.5 %)	24 (30 %)
51 - 60	9 (11.25 %)	8 (10 %)
61 - 70	6 (7.5 %)	7 (8.75 %)
Gender		
Male	27 (33.75 %)	30 (37.5 %)
Female	53 (66.25 %)	50 (62.5 %)

Low levels of serum iron (in male < 60 µg/dL, and in female < 35 µg/dL) was noted in majority of cases (in male 51.85 %, and in female 64.15 %) as compared to controls cases (in male 10 %, and in female 22 %) and difference was significant statistically (p - 0.001).

**Table 2: Serum iron distribution**

Serum iron level (µg/dl)	Cases (n=80)		Controls (n=80)		P value
	Male (n=27)	Female (n=53)	Male (n=30)	Female (n=50)	
Low	14 (51.85 %)	34 (64.15 %)	3 (10 %)	11 (22 %)	0.001
Normal	12 (44.44 %)	19 (35.85 %)	19 (63.33 %)	38 (76 %)	
Above normal	1 (3.7 %)	0	8 (26.67 %)	2 (4 %)	
Mean ± SD	75.26 ± 31.22	57.28 ± 30.29	86.24 ± 28.56	64.23 ± 45.82	
P value	0.950		0.52		

Low levels of serum ferritin (in male < 15 µg/dL, and in female < 12 µg/dL) was noted in majority of cases (in male 66.67 %, and in female 79.25 %) as compared to controls cases (in male 23.33 %, and in female 34 %) and difference was significant statistically (p - 0.001).

**Table 3: Serum ferritin distribution in males**

Serum ferritin level (ng/ml)	Cases (n=80)		Controls (n=80)		P value
	Male (n=27)	Female (n=53)	Male (n=30)	Female (n=50)	
Low	18 (66.67 %)	42 (79.25 %)	7 (23.33 %)	17 (34 %)	0.001
Normal	9 (33.33 %)	11 (20.75 %)	18 (60 %)	33 (66 %)	
Above normal	0	0	5 (16.67 %)	0	
Mean $\pm$ SD	43.94 $\pm$ 20.45	31.46 $\pm$ 21.45	79.89 $\pm$ 37.45	54.93 $\pm$ 31.37	
P value	<0.001		<0.001		

## DISCUSSION

Gallstone forms by the precipitation of calcium, bilirubin, cholesterol mucous and proteins. It is one of the commonest ailments presenting to surgical units. A study reported an incidence of 9.03%. Nearly 75% of the patients with gall stones are symptomless. Gallstones may produce several symptoms or may remain asymptomatic. Over half the cases are asymptomatic, usually detected by abdominal ultrasound.<sup>6</sup> Gallstone disease is a chronic recurrent hepatobiliary disease, the basis for which is the impaired metabolism of cholesterol, bilirubin and bile acids, which is characterized by the formation of gallstones in the hepatic bile duct, common bile duct, or gallbladder. Four factors which explain gallstones are supersaturation of secreted bile, concentration of bile in gallbladder, crystal nucleation, and gallbladder dysmotility.<sup>7</sup> Iron acts as a coenzyme for nitric oxide synthetase (NOS), which synthesizes nitric oxide (NO) and that is important for the maintenance of basal gall bladder tone and normal relaxation.<sup>8</sup> It was found that iron deficiency resulted in altered motility of gall bladder and sphincter of Oddi leading to biliary stasis and thus increased cholesterol crystal formation in the gall bladder bile.<sup>8,9</sup> In the study by Gurinderjit Singh, most of the patients were from age group of 31 to 40 years (35.57%) followed by the age group of 41 to 50 years (29.8%). There was female predominance with a female-male ratio of 80.7:19.2.<sup>10</sup> In the study, by Arora BK<sup>11</sup> the gallstones are more prevalent in female population than males in ratio of 5.4:1. Serum iron in males was low in 41.93% as compared to 20.8% of control suggesting that low serum iron is not associated with Cholelithiasis in male. Serum ferritin levels were normal in 35.50% of cases and 66.66% of controls and above normal in 16.66% of controls suggesting that low serum ferritin is associated with gall stones in males. Also, low serum iron was seen in 23.07% of females comparable to 23% low serum iron in control females and low ferritin was seen in 35.50% of female cases as compare to 15.38% of controls. Defective hepatic cholesterol metabolism and stasis of bile because of decreased motility of the gall bladder can lead to more precipitation of cholesterol and hence formation of stone. The increased prevalence of gall stone formation in females could be attributed to the fact, that anemia is more common in females than in males. Bindesh Ashok *et al.*,<sup>12</sup> noted a positive but negligible

correlation between serum iron and serum ferritin was observed (Pearson's correlation coefficient of 0.247). Negative correlation between serum iron vs serum cholesterol and serum ferritin vs serum cholesterol was observed. They concluded that a low value of serum iron and serum ferritin is a risk factor for cholelithiasis. In study by Prasad, P. *et al.*,<sup>13</sup> they concluded that a low body store of serum iron is a risk factor for cholelithiasis in females and serum iron, serum ferritin may be used as marker of iron store so that low serum iron status could be diagnosed at early stage. The low serum iron level in one or the other way was leading to bile super saturation with respect to cholesterol, which leads to gallstone formation. Serum ferritin cannot be taken as a sole diagnostic tool in the diagnosis of iron deficiency anemia as its value can vary due to other causes such as iron therapy, hepatocellular disease and inflammations (since cholecystitis is an inflammatory condition, this could be the reason for the high level of serum ferritin). Due to less literature available on the correlation between serum iron with cholelithiasis, further multicentric studies with a larger sample size need are recommended to validate our hypothesis.

## CONCLUSION

Low Serum Iron levels and low serum ferritin levels are associated with increased incidence of cholelithiasis. Low serum iron and serum ferritin levels are related to bile super-saturation with respect to cholesterol leading to gallstone formation.

## REFERENCES

1. Schafmayer C, Hartleb J, Tepel J, Albers S, Freitag S, Volzke H, et al. Predictors of gallstone composition in 1025 symptomatic gallstones from Northern Germany. *BMC Gastroenterol* 2006;6:36.
2. Lammert F, Sauerbruch T: Mechanism of disease: the genetic epidemiology of gallbladder stones. *Nat Clin Pract Gastroenterol Hepatol* 2005;2:423-433.
3. Johnston SM, Murray KP, Martin SA, Fox-Talbot K, Lipsett PA, Lillemoe KD, Iron Deficiency enhances cholesterol gall stone formation. *Surgery*. 1997;122(2):354-61.
4. Johnston SM, Murray KP, Martin SA, Fox-Talbot K, Lipsett PA, Lillemoe KD, et al. Iron deficiency enhances cholesterol gallstone formation. *Surgery*. 1997;122(2):354-61. Doi: 10.1016/S0039-0606(97)90027-1.

5. Prasad, P. and Gupta, Subodh and Kaushik, Nitin. (2012). To Study Serum Iron Levels in Patients of Gall Bladder Stone Disease and to Compare with Healthy Individuals. *Indian Journal of Surgery*. 77. 10.1007/s12262-012-0739-6
6. S.K. Gupta, V.K. Shukla, Silent gallstones: a therapeutic dilemma, *Trop. Gastroenterol*. 25 (2) (2004 Apr-Jun) 65e68
7. Babu RG, Bille S. Correlation of gallstone disease with iron deficiency anemia. *Arch Int Surg* 2017;7:121-5.
8. Goldblatt MI, Swartz-Basile DA, Choi SH, Rafiee P, Nakeeb A, Sarna SK, et al. Iron deficiency transiently suppresses neuronal nitric oxide synthase. *J Surg Res* 2001;98:123-8.
9. Kumar M, Goyal BB, Mahajan M, Singh S. Role of iron deficiency in formation of gall stones. *Indian J Surg* 2006;68:80-3.
10. Gurinderjit Singh Nagi, Rajiv Arora. "Incidence of Various Types of Gallstones in Patients of Cholelithiasis in North India." *Journal of Evolution of Medical and Dental Sciences* 2015; Vol. 4, Issue 97, December 03; Page: 16213-16214,
11. Arora BK, Yadav AK. Serum iron and serum ferritin levels in cholelithiasis: a randomized study. *Int Surg J* 2018;5:1411-6.
12. Bindesh Ashok kumar Dube and KS Kher et al., The Correlation between Serum Iron and Serum Ferritin in Gallstone Disease, *Journal of Clinical and Diagnostic Research*. 2020 Aug, Vol-14(8): PC01-PC03
13. Prasad, P. and Gupta, Subodh and Kaushik, Nitin. (2012). To Study Serum Iron Levels in Patients of Gall Bladder Stone Disease and to Compare with Healthy Individuals. *Indian Journal of Surgery*. 77. 10.1007/s12262-012-0739-6.

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