Original Article

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# Effect of Alcohol Consumption on Indices of Serum Iron and Ferritin in a Tertiary Care Hospital of Rural, Maharashtra

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## Abstract

**Background:** Alcohol increases body iron stores. Alcohol and iron may increase oxidative stress and the risk of alcohol-related liver disease. The relationship between low or "safe" levels of alcohol use and indices of body iron stores, and the factors that affect the alcohol iron relationship have not been fully characterized. Other aspects of the biological response to alcohol use have been reported to depend on iron status.

**Aims and Objectives:** (1) To study the serum iron indices (serum iron, transferrin saturation, and ferritin) in alcoholics. (2) To study the relation of age, sex, type of alcohol, amount of alcohol, duration of alcohol, and the alcoholic liver disease on iron markers.

**Materials and Methods:** A comparative study of 100 cases. It is calculated with a confidence interval of 95% and absolute precision of 10%. 25 controls, age and sex matched healthy subjects not consuming alcohol are taken in the study as controls.

**Results:** All the cases, in the study, were males 100% (*n* = 100). The majority of the cases 52% (52 cases) had history of consuming country liquor. About 14% (14 cases) had history of consuming beer. Only 4% (4 cases) had history of consuming rum. Mean values for serum iron, transferrin saturation, and ferritin varied with the duration of alcohol consumed and was not statistically significant (*P* value 0.59, 0.70 and 0.09, respectively). Mean values for serum iron and ferritin increased significantly with the increased amount of alcohol consumed (*P* value 0.003, <0.001, respectively).

**Conclusion:** Alcohol consumption is associated with increasing levels of serum iron, transferrin saturation and ferritin. Serum iron and ferritin levels increases with the increase in the amount of alcohol consumed.

**Key words:** Alcohol consumption, Duration of alcohol, Serum iron, Serum ferritin level, Serum transferrin level

## INTRODUCTION

Alcoholism also called as alcohol dependence is a condition where there is clear evidence of alcohol use responsible for physical or psychological harm. Alcohol causes impaired judgment or dysfunctional behavior which may lead to disability or have adverse consequence for interpersonal relationship.[1] Alcohol is consumed by the majority of the population at some times in their life. At low doses can have some beneficial effects such as decreased incidence of myocardial infarction, stroke, gallstones possibly vascular, and Alzheimer's dementia, but consumption more than two standard drink-per day increase the risk for health problems in many organ systems.[2] Chronic liver disease in the clinical context is a disease process of the liver that involves progressive destruction and regeneration of the liver parenchyma leading to fibrosis and cirrhosis.[3] Hepatic iron deposition unrelated to hereditary hemochromatosis is common in Cirrhosis.[4] It is known since long time that iron stores are increased in alcoholics and heavy drinkers.[5-7] Increase in indices of iron stores, such as serum ferritin has also been described in subjects drinking a small amount of alcohol.[8] It has been suggested that iron accumulation is one of the mechanisms involved in chronic liver disease.[9,10]

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Hence, mortality is greater from alcoholic liver cirrhosis in subjects with higher hepatic iron content.[11] There is evidence that both iron and alcohol can initiate free radical formation and produce oxidative stress within liver and hence hasten the progression toward cirrhosis.[9,12,13] Conditions such as Porphyria cutanea tarda, hepatocellular carcinoma, hepatitis C may be promoted or exacerbated by high iron content alcohol or both.[14-17] The relationship between alcohol intake and iron stores are therefore of interest both at the high end of alcohol intake spectrum and general population.

## MATERIALS AND METHODS

This study was conducted in Medicine OPD and Indoor Patients admitted in Krishna Institute of Medical Sciences, Karad, over a period of 2-year. Study design: Comparative study and sample size: 100 cases, it is calculated with a confidence interval of 95% and absolute precision of 10%. 25 controls, age and sex matched healthy subjects not consuming alcohol are taken in the study as controls. Inclusion criteria: Persons consuming two or more drinks per day for more than 1 year duration and with or without liver cirrhosis. Exclusion criteria: (1) Cirrhosis of liver due to other cause, (2) Patient who has received iron therapy, (3) Patient who has evidence of gastrointestinal bleeding in last 3 months. After informed and written consent, subjects (cases and controls) meeting the above criteria are taken in the study. Detailed questionnaires regarding the alcohol intake in cases was taken and quantified into number of drinks per day. Through clinical examination was done with emphasis on vital function, height, weight, body mass index, and signs of liver cell failure.

## RESULTS

The present study was performed in Department of Medicine, Krishna Institute of Medical Sciences, Karad, Maharashtra, India. Patients are divided into two groups. (1) Cases (those consuming alcohol), (2) control (those not consuming alcohol).

All the cases were male. The mean age in cases was 44.93 ± 11.85 years and in controls, it was 33.6 ± 9.10 years (Table 1 and Graph 1).

Around 32 (32%) cases have history of consuming alcohol for 6-10 years. About 27 (27%) cases have history of consuming alcohol for 11-15 years. Exactly 27 (27%) cases have consumed for 1-5 years and 13 (13%) cases for about 16-20 years. Only 1 case (1%) has history of consuming alcohol for more than 20 years (Table 2 and Graph 2).

It is observed that the mean value for sr. iron, transferrin saturation and ferritin vary with the age of the cases. However, the difference in their mean value is not statistically significant (*P* value 0.66, 0.99, and 0.87) (Table 3).

The mean values for serum iron and serum ferritin were found to be greater in people consuming brandy (172.58 ± 12.34 μg/dL and 573.08 ± 177.26 μg/L, respectively) than other alcohol types, but are not statistically significant (*P* = 0.42 and 0.206, respectively). The mean value for transferrin saturation is found to be greater in cases those who are consuming brandy (53.75% ± 2.86%) and wine (50.28% ± 2.28%) than other alcohol types and the difference are statistically significant (Table 4 and Graph 3).

The mean values for serum iron, transferrin, and ferritin are found to vary with duration of alcohol consumed. However, the difference in their mean values with the duration of alcohol consumed is not statistically significant (*P* value 0.59, 0.70 and 0.09, respectively) (Table 5 and Graph 4).

The mean values for serum iron and serum ferritin are found to increase with the amount of alcohol consumed. The mean values were (159.30 ± 10.82 μg/dL) and

**Table 1: Age distribution**

| Age (in years) | Cases *n*=100 (%) | Control *n*=25 (%) |
|---|---|---|
| 20-29 | 7 (7) | 9 (36) |
| 30-39 | 31 (31) | 6 (24) |
| 40-49 | 23 (23) | 10 (40) |
| 50-59 | 25 (25) | 0 (0) |
| >60 | 14 (14) | 0 (0) |
| Mean±SD | 44.93±11.85 | 33.6±9.10 |

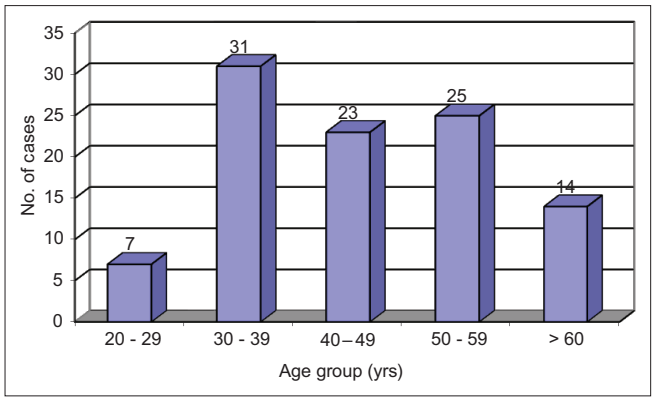
SD: Standard deviation

**Table 2: Duration of alcohol consumed in cases**

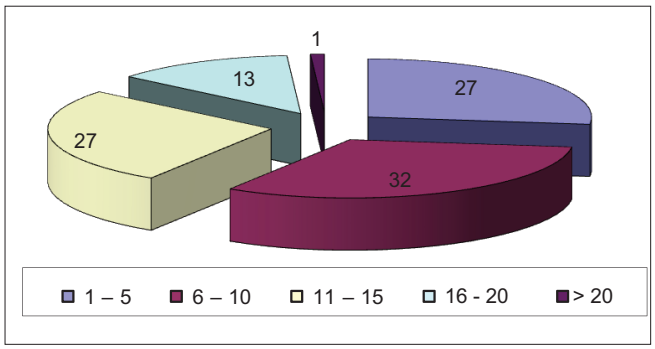
| Duration of alcohol consumed (years) | Number of subjects (%) (*n*=100) |
|---|---|
| 1-5 | 27 (27) |
| 6-10 | 32 (32) |
| 11-15 | 27 (27) |
| 16-20 | 13 (13) |
| >20 | 1 (1) |

**Table 3: Age and iron indices in cases**

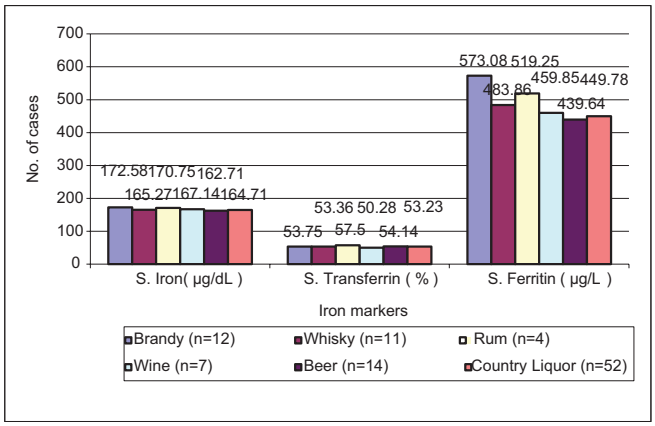
| Age (years) | Serum iron (μg/dL) | Transferrin (%) | Ferritin (μg/L) |
|---|---|---|---|
| 20-29 | 162.85±15.90 | 53.57±3.35 | 437.28±123.93 |
| 30-39 | 166.06±15.89 | 53.51±3.52 | 458.93±163.99 |
| 40-49 | 163.73±13.88 | 53.39±3.10 | 478.69±182.99 |
| 50-59 | 166.12±13.00 | 53.24±4.01 | 467.20±139.99 |
| >60 | 170.42±8.94 | 53.35±3.38 | 504.21±141.60 |
| *P* value | 0.66 | 0.99 | 0.87 |




**Graph 1: Age distribution in cases**




**Graph 2: Duration of alcohol consumed**




**Graph 3: Alcohol and iron indices**

(357.45 ± 100.41 µg/L) in cases consuming 1-5 drinks per day and (174.66 ± 11.95 µg/dL) and (589.58 ± 141.20 µg/L), respectively, in cases consuming alcohol more than 15 drinks per day. The difference in mean for rise in serum iron and ferritin with increase amount of alcohol intake was found to be statistically significant ($P = 0.003$, 0.001, respectively) (Table 6 and Graph 5).

It is observed that the mean value for serum glutamic-oxaloacetic transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) vary with the rise in serum ferritin. However, this was not statically significant (*P* value 0.84, 0.58, respectively) (Table 7).

**Table 4: Type of alcohol and iron indices in cases**

| Type of alcohol | Serum iron (µg/dL) | Serum transferrin (%) | Serum ferritin (µg/L) |
|---|---|---|---|
| Brandy (*n*=12) | 172.58±12.34 | 53.75±2.86 | 573.08±177.26 |
| Whisky (*n*=11) | 165.27±15.80 | 53.36±4.80 | 483.86±175.65 |
| Rum (*n*=4) | 170.75±5.31 | 57.50±2.08 | 519.25±156.54 |
| Wine (*n*=7) | 167.14±10.22 | 50.28±2.28 | 459.85±129.49 |
| Beer (*n*=14) | 162.71±9.77 | 54.14±3.05 | 439.64±145.73 |
| Country Liquor (*n*=52) | 164.71±15.21 | 53.23±3.30 | 449.78±148.04 |
| *P* value | 0.42 | 0.029 | 0.206 |

**Table 5: Duration of alcohol consumed and iron indices in cases**

| Duration alcohol consumed (in years) | Serum iron (µg/dL) | Serum transferrin (%) | Serum ferritin (µg/L) |
|---|---|---|---|
| 1-5 (*n*=27) | 169.29±8.71 | 53.59±3.36 | 526.37±154.33 |
| 6-10 (*n*=32) | 165.06±16.53 | 53.56±3.19 | 440.71±146.78 |
| 11-15 (*n*=27) | 164.18±9.44 | 52.62±4.03 | 431.92±129.47 |
| 16-20 (*n*=13) | 164.00±21.56 | 54.07±3.30 | 492.92±200.20 |
| >20 (*n*=1) | 175±0 | 55.0±0 | 652.0±0 |
| *P* value | 0.59 | 0.70 | 0.09 |

**Table 6: Amount of alcohol consumed and iron indices in cases**

| Number of drinks/day | Serum iron (µg/dL) | Serum transferrin (%) | Serum ferritin (µg/L) |
|---|---|---|---|
| 1-5 (*n*=20) | 159.30±10.82 | 53.80±4.04 | 357.45±100.41 |
| 6-10 (*n*=34) | 162.97±15.20 | 53.26±3.54 | 432.02±140.20 |
| 11-15 (*n*=34) | 169.70±12.16 | 53.67±3.27 | 533.05±148.48 |
| >15 (*n*=12) | 174.66±11.95 | 52.33±2.87 | 589.58±141.20 |
| *P* value | 0.003 | 0.650 | 0.001 |

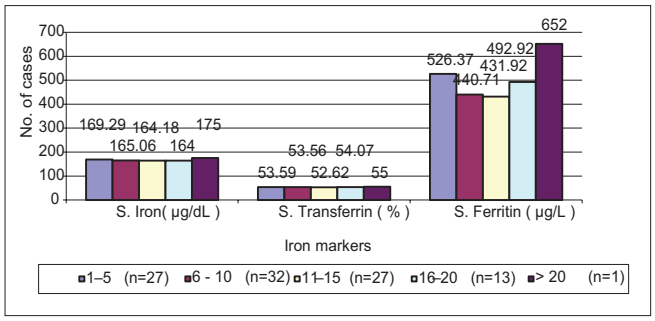
**Table 7: Ferritin and liver enzymes**

| Ferritin (µg/L) | SGOT (IU/L) | SGPT (IU/L) |
|---|---|---|
| <300 | 55.07±29.49 | 45.53±20.60 |
| 300-399 | 50.59±28.41 | 39.59±15.31 |
| 400-499 | 45.25±28.69 | 38.07±18.01 |
| 500-599 | 50.76±29.62 | 41.41±16.84 |
| >600 | 46.50±24.79 | 36.30±13.02 |
| *P* value | 0.84 | 0.58 |

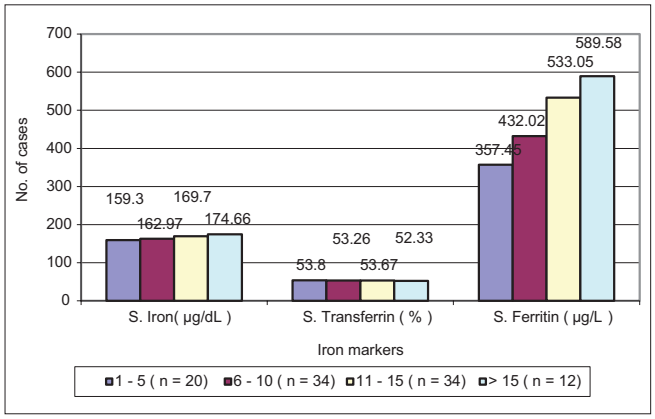
SGOT: Serum glutamic-oxaloacetic transaminase, SGPT: Serum glutamate pyruvate transaminase

## DISCUSSION

It has been observed from the study, alcohol causes increase in the serum iron markers – serum iron, transferrin saturation, and ferritin. Alcohol increases the absorption of iron from the intestine by increases body iron stores. Under certain circumstances such an effect might be beneficial whereas in others it may be harmful. Particularly in men who are less likely to be iron deficient and who consume more alcohol on average than women, the synergistic effect of alcohol and iron lead to, or exacerbate liver damage.




**Graph 4: Duration of alcohol consumed and iron indices**




**Graph 5: Number of drinks per day and iron indices**

A number of conditions apart from iron overload are known to increase serum ferritin including acute liver injury, inflammation or infection and malignant disease. The subjects were grouped into cases (those consuming alcohol) and controls (those not consuming alcohol).

## Age, Sex and Iron Indices

### *Age*

In the present study, the majority of the cases are in the age group of 30-39 years. The mean age at presentation was 44.93 ± 11.85 years. This observation was similar to the observation made by Whitfield *et al.*,[18] and Anttila *et al.*[19] The mean age of cases in the study by Whitfield *et al.*[18] was 44 years and of Anttila *et al.*[19] was 49 years. However in the study by Milman *et al.*,[20] the mean age at presentation was 55 years. In the present study, age of the patient was not significantly associated with iron indices. This observation was similar to Fleming *et al.*[21] study, where age was not related to ferritin. However, in the study conducted by Baker,[22] age was positively correlated with serum ferritin with $P < 0.01$.

### *Sex*

In the present study, all cases were males.

### *Alcohol and iron indices*

In this study, the mean values for serum iron, transferrin, and ferritin were increased significantly in alcoholic subjects. These observations were similar to the observations by Friedman *et al.*,[23] Milman *et al.*,[20] Bell *et al.*,[24] Milman *et al.*,[8] Fleming *et al.*,[21] Whitfield *et al.*,[18] Jurczak *et al.*,, and Ioannou *et al.*[25]

| Study | Serum iron | Serum transferrin | Ferritin |
|---|---|---|---|
| Friedman *et al.*[23] (1988) *n*=1250 (male - 591, female - 614) Age - 16-19 years | Increased | Increased | Increased |
| Milman *et al.*[20] (1993) *n*=82 (male - 53, female - 29) Age - 18-84 years | Increased | Increased | Increased |
| Bell *et al.*[24] (1994) *n*=111 | - | Increased (15.2%) | Increased (58%) |
| Ford *et al.*[26] (1995) | - | Increased transferrin saturation >60% in 16% patients | Ferritin >1000 unit; ng/ml in 16% patients |
| Milman *et al.*[8] (1996) *n*=2235 (male - 1044, female - 1191) Age - 30-60 years | Increased | - | Increased |
| Fleming *et al.*[21] (1998) *n*=634 Age - 67-93 years | Increased | Increased | Increased |
| Whitfield *et al.*[18] (2001) *n*=3375 (male - 1134, female - 2241) | Increased | Increased | Increased |
| Ioannou *et al.*[25] (2004) *n*=8839 | - | Increased | Increased |
| Present study (2008) *n*=100 (M=100) Mean age 44.9±11.85 years | Increased | Increased | Increased |

## Type of Alcohol and Iron Indices

Majority of the cases 52% ($n = 52$) had history of consuming country liquor. Only 4% cases had history of consuming rum. This observation was similar to the observation made by Gupta *et al.*[27] in their study, where most of the patient had history of consuming country liquor. The reason for country liquor being the most common type of alcohol is due to the extensive network at outlets serving country liquor and to its low price. In the present study, the mean serum iron and ferritin was more in subjects consuming brandy than in other types of alcohol and mean transferrin saturation was greater in subjects consuming brandy and wine but the difference was not significant. However, Whitfield *et al.*,[25] in their study observed a significant effect of beer intake but not wine or spirit intake on serum ferritin in both men and women. For both iron and transferrin saturation, both wines and spirits showed similar effects to beer. None of the beverages had any significant effect on transferrin.

## Duration of Alcohol Consumed and Iron Indices

Most of the cases 32% had history of consuming alcohol for 6-10 years. 27% cases had consumed alcohol for

11-15 years and only 1% consumed alcohol for >20 years. In the present study, the mean serum iron, transferrin saturation, and ferritin did not increase with the duration of alcohol consumed. These observations were similar to the observation by Whitfield *et al.*[18] who found no difference in the mean levels of iron and transferrin between patients who had alcohol intake. However, ferritin levels were increased in patients with alcohol dependence.

### Amount of Alcohol Consumed and Iron Indices

In this study, the majority of the cases 68% (68 cases) had history of consuming 6-15 drinks per day. This was in contrary to the observations made by Gupta *et al.*[27] in their study, where most of the patients had history of consuming 5-6 drinks per day. This heavy drinking pattern was probably due to illiteracy among the people and due to easy availability of the alcohol in the society. In the present study, it is observed that the mean iron and ferritin increased significantly with the amount of alcohol consumed. These observations were similar to the observation by Whitfield *et al.*[18] where the mean iron, transferrin saturation and ferritin increased with the increase in the amount of alcohol consumed. The increasing amount of alcohol intake causes increased necroinflammation of the hepatocytes which release the iron and ferritin from the hepatocytes. Also increased alcohol intake results in increase in the levels of carbohydrate-deficient transferrin (CDT), which are taken up by the CDT receptors present on the hepatocytes which are up regulated in the habitual drinkers.

### Liver Enzymes and Ferritin

In the present study, the mean value for SGOT and SGPT of the cases were increased significantly compared to controls (SGOT more than SGPT). However, the liver enzymes SGOT and SGPT did not vary significantly with the ferritin levels. No enzyme -ferritin correlation was found. However, in the study by Whitfield *et al.*,[18] the liver enzymes SGOT and SGPT were highly and significantly (positively) correlated with the ferritin values in both men and women. This enzyme-ferritin correlation may be due to an indirect association, because iron overload is associated with liver damage, higher values of the liver function tests are to be expected in subjects with higher ferritin levels. The present study did not show this type of correlation. This could be because the majority of the patients were having cirrhosis and maximum liver damage had already occurred in these cases when they were included in the study.

Observations of the study are summarized as follows:

1. The mean age of the patients in cases was 44.9 ± 11.85 years and in control was 33.6 ± 9.10.
2. All the cases in the study were males 100% ($n$ = 100).
3. Majority of the cases 52% (52 cases) had history of consuming country liquor. 14% (14 cases) had history of consuming beer. Only 4% (4 cases) had history of consuming rum.
4. 32% (32 cases) had history of consuming alcohol for 6-10 years. 27% (27 cases) had history of consuming alcohol for 11-15 years. Only 1% (1 case) had history of consuming alcohol for more than 20 years.
5. 68% (68 cases) had history of consuming 6-15 drinks per day. 20% (20 cases) has history of consuming 1-5 drinks per day. Only 12% (12 cases) had history of consuming more than 15 drinks per day.
6. Mean values for serum Iron, transferrin saturation and ferritin varied with the age of the patient and it was not statistically significant ($P$ value 0.66, 0.99, and 0.87, respectively).
7. Mean values for serum iron, transferrin saturation and ferritin were increased significantly in subjects consuming alcohol as compared to those not consuming alcohol ($P < 0.001$).
8. Mean values for serum Iron and ferritin was higher in cases consuming brandy (172.5 ± 12.34 μg/dL, 573.08 ± 177.26%, respectively) than with other types of alcohol but was not statistically significant ($P = 0.42$ and 0.206, respectively). Mean value for transferin saturation was higher in cases consuming brandy (53.75 ± 2.86 μg/L) and wine (50.28 ± 2.28 μg/L) than other alcohol types and was statistically significant (0.04).
9. Mean values for serum Iron, transferrin saturation and ferritin varied with the duration of alcohol consumed and was not statistically significant ($P$ value 0.59, 0.70, and 0.09 respectively).
10. Mean values for serum iron and ferritin increased significantly with the increased amount of alcohol consumed ($P$ value 0.003, <0.001 respectively).
11. Mean values for SGOT and SGPT were increased significantly in cases (48.89 ± 27.78 IU/L and 39.59 ± 16.61 IU/L) as compared to controls (29.60 ± 18.59 IU/L and 27.04 ± 6.29 IU/L, respectively) ($P = 0.001$).
12. Mean values for SGOT and SGPT varied with the rise in serum ferritin but was not statistically significant ($P$ value 0.84, 0.58, respectively).

## CONCLUSIONS

1. Alcohol consumption is associated with increasing levels of serum iron, transferrin saturation and ferritin.
2. Serum iron and ferritin levels increases with the increase in the amount of alcohol consumed.
3. The duration of the alcohol and type of alcohol consumed has no influence on the serum iron indices.
4. Iron indices have no effect on the liver enzymes (SGOT and SGPT).

## REFERENCES


1. Mathers C, Ayuso-Mateos JL. Global burden of alcohol use disorders in the Year 2000: Summary of methods and data sources. Epidemiology and Burden of Disease. Geneva: WHO; 2000.
2. Schuckit MA. Alcohol and alcoholism. In: Kasper DL, Braunwald E, Fauci AS, editors. Harrison's Principles of Internal Medicine. 16th ed. New York, NY: McGraw Hills; 2005. p. 2562-6.
3. Ashraf S, Naeem S. Frequency of hypersplenism in chronic liver disease patients presenting with pancytopenia. Spec Ed Ann 2010;16:1-6.
4. Abu Rajab M, Guerin L, Lee P, Brown KE. Iron overload secondary to cirrhosis: A mimic of hereditary haemochromatosis? Histopathology 2014;65:561-9.
5. Chick J, Pikkarainen J, Plant M. Serum ferritin as a marker of alcohol consumption in working men. Alcohol Alcohol 1987;22:75-7.
6. Irving MG, Halliday JW, Powell LW. Association between alcoholism and increased hepatic iron stores. Alcohol Clin Exp Res 1988;12:7-13.
7. Kristenson H, Fex G, Trell E. Serum ferritin, gammaglutamyl-transferase and alcohol consumption in healthy middle-aged men. Drug Alcohol Depend 1981;8:43-50.
8. Milman N, Kirchhoff M. Relationship between serum ferritin, alcohol intake, and social status in 2235 Danish men and women. Ann Hematol 1996;72:145-51.
9. Ishii H, Kurose I, Kato S. Pathogenesis of alcoholic liver disease with particular emphasis on oxidative stress. J Gastroenterol Hepatol 1997;12:S272-82.
10. Nordmann R. Alcohol and antioxidant systems. Alcohol Alcohol 1994;29:513-22.
11. Ganne-Carrié N, Christidis C, Chastang C, Ziol M, Chapel F, Imbert-Bismut F, *et al.* Liver iron is predictive of death in alcoholic cirrhosis: A multivariate study of 229 consecutive patients with alcoholic and/or hepatitis C virus cirrhosis: A prospective follow up study. Gut 2000;46:277-82.
12. Feder JN, Gnirke A, Thomas W, Tsuchihashi Z, Ruddy DA, Basava A, *et al.* A novel MHC class I-like gene is mutated in patients with hereditary haemochromatosis. Nat Genet 1996;13:399-408.
13. Niemelä O. Aldehyde-protein adducts in the liver as a result of ethanol-induced oxidative stress. Front Biosci 1999;4:D506-13.
14. Bonkovsky HL, Banner BF, Lambrecht RW, Rubin RB. Iron in liver diseases other than hemochromatosis. Semin Liver Dis 1996;16:65-82.
15. Elder GH. Porphyria cutanea tarda. Semin Liver Dis 1998;18:67-75.
16. Pagliaro L, Peri V, Linea C, Cammà C, Giunta M, Magrin S. Natural history of chronic hepatitis C. Ital J Gastroenterol Hepatol 1999;31:28-44.
17. Sampietro M, Fiorelli G, Fargion S. Iron overload in porphyria cutanea tarda. Haematologica 1999;84:248-53.
18. Whitfield JB, Zhu G, Heath AC, Powell LW, Martin NG. Effects of alcohol consumption on indices of iron stores and of iron stores on alcohol intake markers. Alcohol Clin Exp Res 2001;25:1037-45.
19. Anttila P, Järvi K, Latvala J, Niemelä O. Method-dependent characteristics of carbohydrate-deficient transferrin measurements in the follow-up of alcoholics. Alcohol Alcohol 2004;39:59-63.
20. Milman N, Graudal N, Hegnhøj J, Visfeldt J, Christoffersen P, Pedersen NS. Relation between bone marrow hemosiderin iron, serum iron status markers, and chemical and histochemical liver iron content in 82 patients with alcoholic and nonalcoholic hepatic disease. Ann Hematol 1993;66:203-7.
21. Fleming DJ, Jacques PF, Dallal GE, Tucker KL, Wilson PW, Wood RJ. Dietary determinants of iron stores in a free-living elderly population: The framingham heart study. Am J Clin Nutr 1998;67:722-33.
22. Baker LD. Alcohol consumption among South African blacks and its relationship to iron overload. S Afr Med J 1986;70:160-2.
23. Friedman IM, Kraemer HC, Mendoza FS, Hammer LD. Elevated serum iron concentration in adolescent alcohol users. Arch Pediatr Adolesc Med 1988;142:156-9.
24. Bell H, Skinningsrud A, Raknerud N, Try K. Serum ferritin and transferrin saturation in patients with chronic alcoholic and non-alcoholic liver diseases. J Intern Med 1994;236:315-22.
25. Ioannou GN, Dominitz JA, Weiss NS, Heagerty PJ, Kowdley KV. The effect of alcohol consumption on the prevalence of iron overload, iron deficiency, and iron deficiency anemia. Gastroenterology 2004;126:1293-301.
26. Ford C, Wells FE, Rogers JN. Assessment of iron status in association with excess alcohol consumption. Ann Clin Biochem 1995;32:527-31.
27. Gupta PC, Saxena S, Pednekar MS, Maulik PK. Alcohol consumption among middle-aged and elderly men: A community study from western India. Alcohol Alcohol 2003;38:327-31.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