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Comparison of Haematological Parameters in Alcoholics and Non-Alcoholics: A Hospital-Based Cross-Sectional Study

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ABSTRACT

Background
Alcohol abuse is an emerging public health concern with significant systemic consequences, particularly affecting hematopoiesis and liver function. Chronic and heavy alcohol consumption affects red blood cells, platelets, the coagulation profile, and liver enzymes. Early detection of hematological alterations in alcoholics can help prevent morbidity and mortality associated with alcoholism. This study aimed to evaluate and compare haematological parameters between alcoholics and non-alcoholics admitted to a tertiary care hospital.

Methods
This one-year hospital-based cross-sectional study was conducted from January 2023 to December 2023 at KLE's Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. A total of 120 male patients aged ≥18 years were included, comprising 60 alcoholics (≥14 standard drinks/week) and 60 non-alcoholic controls. Patients with other hepatic disorders, chronic illnesses, hematological malignancies, or renal diseases were excluded. Hematological indices, liver function tests, renal function tests, and prothrombin time were assessed. Data were analyzed using SPSS version 27.0, and $p < 0.05$ was considered statistically significant.

Results
Among the alcoholics, 56.66% had consumed alcohol for more than 10 years, and all were classified as severe drinkers. Moderate to severe anaemia was significantly more prevalent in

alcoholics. Statistically significant reductions were observed in hemoglobin (11.03 ± 2.89 g%), RBC count (3.64 ± 1.09 million/cumm), platelet count (1.69 ± 9.3 lakh/cumm), and PCV (34.76 ± 9.26%) compared to non-alcoholics ($p < 0.001$). Mean corpuscular volume was significantly elevated in alcoholics (96.41 fl; $p = 0.038$), indicating macrocytosis. Liver function parameters and prothrombin time were significantly deranged in alcoholics ($p < 0.001$). No significant differences were noted in WBC count, MCH, MCHC, blood urea, or serum creatinine.

Conclusion

Chronic and severe alcohol consumption is significantly associated with anemia, thrombocytopenia, macrocytosis, altered liver function, and prolonged prothrombin time. Routine hematological parameters serve as simple, cost-effective markers for early detection of alcohol-related complications, facilitating timely intervention and counseling.

Keywords: Haematological Parameters, Alcoholics, Non-Alcoholics, Macrocytosis, Liver Function Tests, Prothrombin Time.

INTRODUCTION

In recent years, alcohol abuse has emerged as one of the most significant public health concerns among both youth and adults in society.[1,2] Alcohol consumption in India amounted to approximately 5 billion liters in 2020 and was projected to increase to about 6.21 billion liters by 2024.[3-5] Alcohol use is widespread across all states of India, with an estimated 160 million individuals consuming alcohol.[3] The rising trend of alcohol intake reflects changing social norms, increasing urbanization, and greater social acceptability of drinking behaviors.

With the growing culture of socialization and increased acceptance of alcohol consumption among both males and females-particularly among the younger generation-the number of alcoholic consumers has substantially increased. Consequently, the burden of alcohol-related health, social, and economic problems has also risen in parallel with increased alcohol consumption. Chronic alcohol use not only affects individual health but also contributes to broader societal challenges.

The health consequences of alcohol use largely depend on the quantity and duration of consumption.[4,5] Heavy alcohol intake significantly affects hematological parameters by altering various blood cell lineages. These alterations may occur either directly through bone marrow suppression[6,7] or indirectly due to nutritional deficiencies commonly observed in alcoholics, resulting from decreased nutrient absorption, impaired nutrient activation, and poor dietary habits.[8,9]

The liver is the primary organ affected by chronic alcohol consumption.[10] Alcoholic liver disease contributes substantially to increased morbidity and mortality and imposes significant social and economic costs.[11] In addition to hepatic injury, alcohol consumption has been associated with several other abnormalities, including restriction of cell production secondary to tissue inflammation,[7] interference with folic acid absorption and metabolism,[12] disruption of mitochondrial function, normal pyridoxal phosphate (PLP) metabolism, and heme synthesis,[13] and the development of membrane abnormalities that shorten the lifespan of blood cells.[14,15] Understanding these mechanisms is essential for early detection and prevention of alcohol-related haematological complications.

AIMS AND OBJECTIVES

The present study was aims to evaluate the effects of alcohol consumption-based on both quantity and duration-on the cellular components of blood in the Indian population. The primary objective of the study was to assess the hematological manifestations among alcoholics and compare them with non-alcoholic individuals admitted to Dr. Prabhakar Kore Hospital and

Medical Research Centre (MRC), Belagavi. By identifying early hematological alterations in chronic alcoholics, the study aims to facilitate timely counseling and appropriate management for alcohol dependence, thereby reducing future complications, morbidity, and mortality associated with alcoholism.

MATERIALS AND METHODS

Study Design

The present study was a hospital-based cross-sectional study conducted at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. The study included patients categorized as moderate to severe alcoholics and non-alcoholics who were admitted during the study period. Data collection was carried out over a duration of one year, from 1st January 2023 to 31st December 2023. All eligible patients fulfilling the inclusion and exclusion criteria during this period were enrolled in the study to evaluate and compare the hematological parameters between the two groups.

Inclusion and Exclusion Criteria

The study included adult patients aged ≥18 years with a history of moderate to severe alcohol consumption, defined as more than 7 standard drinks per week for women and more than 14 standard drinks per week for men (where one standard drink equals 14 grams of pure alcohol, equivalent to 360 ml of beer, 120 ml of wine, or 45 ml of distilled spirits). Additionally, 60 adult non-alcoholic individuals were included as controls for comparison. Patients were excluded if they were younger than 18 years, had other hepatic disorders, were receiving hepatotoxic drugs, had a previous history of hematological malignancies, suffered from chronic illnesses such as tuberculosis, were taking hematinics, had chronic kidney disease, or had known bleeding disorders.

Sample Size Calculation

$n= 2S2(Z_{1-\alpha}+Z_{1-\beta}) / d2$

Where, $Z_{1-\alpha}$ = Z value for alpha level (1.96 at 5% 1-α error or 95 % confidence) $Z_{1-\beta}$ = Z value for beta level (1.282 at 10% 1-β error or 90% power)

S=pooled SD = (S1 + S2)/2 d - Margin of error = 1.09

Sample size n = 54 should be taken in each group (alcoholic and nonalcoholic group) but for the purpose of making calculations convenient 60 will be taken in each group.

Data Collection Procedure

This hospital-based cross-sectional study was conducted over a period of one year from January 2023 to December 2023 at KLE's Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. All patients aged ≥18 years who fulfilled the inclusion and exclusion criteria were enrolled in the study. A total of 120 participants were included and categorized into two groups based on alcohol consumption: moderate to severe alcoholics (more than 7 standard drinks per week for women and more than 14 standard drinks per week for men) and non-alcoholic controls. Informed consent was obtained from all participants prior to enrollment. Detailed clinical information and relevant history were recorded in a structured study proforma. Blood samples were collected from all subjects for laboratory investigations to evaluate and compare the haematological parameters between the two groups.

Statistical Analysis

The data collected were entered into a master chart using Microsoft Excel and subsequently analyzed using SPSS software version 27.0. Descriptive statistics were applied to summarize the data, including calculation of mean, standard deviation, and variance where appropriate. Categorical variables were analyzed using the Chi-square test. For comparison between groups, the independent sample t-test was used as applicable. Continuous variables were further analyzed using analysis of variance (ANOVA) when required. Sensitivity and specificity were also calculated where relevant. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Age Group (Years)	Alcoholics (n=60)	%	Non-Alcoholics (n=60)	%
18–30	6	10.0%	9	15.0%
31–40	17	28.3%	11	18.3%
41–50	13	21.7%	8	13.3%
51–60	17	28.3%	12	20.0%
>60	7	11.7%	20	33.3%
Mean ± SD	**46.82 ± 12.94**		**51.2 ± 18.26**	
p value				**0.12 (NS)**

Table 1: Age Distribution of Study Participants

Table 1 observes that alcoholics were predominantly in the 31–40 and 51–60 year groups, whereas non-alcoholics were more commonly above 60 years. There was no statistically significant age difference between the groups.

Parameter	Number	%
1–5 years	6	10.0%
6–10 years	20	33.3%
11–15 years	15	25.0%
16–20 years	11	18.3%
>20 years	8	13.3%
≥14 drinks/week	60	100%
Mean duration ± SD	**14.48 ± 7.57 years**	

Table 2: Duration and Quantity of Alcohol Consumption (Alcoholics Only)

Table 2 illustrates that all alcoholic participants were severe drinkers (≥14 drinks/week). Majority (56.66%) consumed alcohol for more than 10 years, indicating chronic exposure.

Category	Alcoholics	Non-Alcoholics
Severe	8 (13.3%)	0
Moderate	23 (38.3%)	8 (13.3%)
Mild	12 (20.0%)	14 (23.3%)
Normal	17 (28.3%)	38 (63.3%)
p value		**<0.001 (Significant)**

Table 3: Haemoglobin Distribution (WHO Grading)

Table 3 demonstrates a significantly higher prevalence of moderate to severe anemia in alcoholics compared to non-alcoholics.

Parameter	Alcoholics	Non-Alcoholics	p value
RBC <4.5 million/mm³	44 (73.3%)	28 (46.7%)	<0.001
PCV <40%	41 (68.3%)	19 (31.7%)	<0.001
Table 4: RBC Count and PCV Comparison			

Table 4 shows significantly reduced RBC count and PCV in alcoholics, indicating anemia and marrow suppression effects.

Parameter	Alcoholics	Non-Alcoholics	p value
WBC abnormal	21 (35%)	11 (18.4%)	0.85 (NS)
Platelets <1.5 lakh/mm³	31 (51.7%)	7 (11.7%)	<0.001
Table 5: WBC and Platelet Count Distribution			

Table 5 reveals significant thrombocytopenia in alcoholics, whereas WBC differences were not statistically significant.

Parameter	Alcoholics	Non-Alcoholics	p value
Hb (g%)	11.03 ± 2.89	13.17 ± 1.83	<0.001
RBC (million/cumm)	3.64 ± 1.09	4.51 ± 0.74	<0.001
PCV (%)	34.76 ± 9.26	41.41 ± 5.21	<0.001
MCV (fl)	96.41 ± 9.31	89.96 ± 5.20	0.038
MCH	NS	NS	0.07
MCHC	NS	NS	0.76
Table 6: Hematological Indices (Mean ± SD)			

Table 6 illustrates significantly lower Hb, RBC, PCV and higher MCV (macrocytosis) in alcoholics. MCH and MCHC showed no significant difference.

Parameter	Alcoholics	Non-Alcoholics	p value
Total Bilirubin	Elevated	Lower	Significant
SGOT	80.64 ± 64.13	32.37 ± 28.18	<0.001
SGPT	47.30 ± 43.09	27.30 ± 19.54	0.003
Albumin	3.36 ± 1.09	3.91 ± 0.56	<0.01
Prothrombin Time (sec)	14.39 ± 4.44	11.36 ± 2.03	<0.001
Table 7: Liver Function Tests and Prothrombin Time			

Table 7 depicts significant liver dysfunction and prolonged prothrombin time among alcoholics, indicating hepatic impairment and coagulation abnormalities

DISCUSSION

The present hospital-based cross-sectional study was undertaken to evaluate and compare hematological parameters between alcoholics and non-alcoholics and to assess the impact of the quantity and duration of alcohol consumption on blood cell indices. A total of 120 participants were included, comprising 60 alcoholics and 60 non-alcoholic controls. The demographic and hematological findings of this study are discussed in comparison with previous literature.

The age distribution of alcoholics in our study showed that the majority belonged to the 3140 and 51–60 year age groups, with a mean age comparable to the findings of Namrata

Aggarwal et al.[16] who reported a mean age of 48.67 years among alcohol-dependent individuals. However, T. Oduola et al.[17] observed a lower mean age of 36.04 ± 11.28 years, which may be attributed to regional and sociocultural variations in alcohol consumption patterns. Similar to the studies conducted by Surinder Kumar Salwan et al.[18] and T. Oduola et al.[17] all participants in our study were males, reflecting the higher prevalence of alcohol use among men in the Indian population. In contrast, Chalmers et al.[19] included both genders, highlighting geographical differences in drinking patterns.

In our study, 56.66% of alcoholics had been consuming alcohol for more than 10 years, and all were classified as severe drinkers according to NIAAA criteria (≥14 standard drinks/week). Similar chronic and heavy drinking patterns were reported by Aggarwal et al.[16] Chalmers et al.[19] and Oduola et al.[17] Chronic alcohol consumption is known to exert both direct toxic effects on the bone marrow and indirect effects through nutritional deficiencies, resulting in altered hematopoiesis.[20-23]

Anemia was significantly more prevalent among alcoholics in the present study ($p < 0.001$), with moderate to severe anemia observed in a substantial proportion. These findings are consistent with studies by Berad et al.[24] and Surinder Kumar Salwan et al.[18] who also reported a higher incidence of anemia among alcoholics. The reduction in hemoglobin concentration and RBC count observed in our study aligns with findings by Aggarwal et al.[16] and Berad et al.[24] These changes may be attributed to bone marrow suppression, interference with erythropoiesis, folate deficiency, and shortened red cell survival secondary to membrane abnormalities.[20]

Packed cell volume (PCV) was significantly reduced among alcoholics in our study ($p < 0.001$), which is in agreement with findings by Salwan et al.[18] However, Akanni et al.[25] reported elevated PCV levels in alcoholics, possibly due to dehydration and hemoconcentration, suggesting variability depending on clinical status and study population.

Macrocytosis, reflected by a significant elevation in mean corpuscular volume (MCV) ($p = 0.038$), was observed among alcoholics. This finding corroborates studies conducted by Elanchezhian et al.[22] Berad et al.[24] and Salwan et al.[18] which demonstrated increased MCV among chronic alcohol consumers.[20-23] Alcohol-induced macrocytosis may result from direct toxic effects on erythroid precursors, folate deficiency, and impaired DNA synthesis.

Platelet counts were significantly reduced among alcoholics ($p < 0.001$), indicating thrombocytopenia. Similar findings were reported by Das et al.[23] and Erhabor et al.[26] The probable mechanisms include direct marrow suppression, splenic sequestration due to portal hypertension, and reduced thrombopoietin production.[20]

In contrast, the total leukocyte count did not show a statistically significant difference between the two groups, consistent with findings by Salwan et al.[18] and Oduola et al.[17] However, Elanchezhian et al.[22] reported leukopenia among alcoholics, suggesting that leukocyte alterations may vary depending on nutritional status and the degree of marrow suppression.

Liver function tests were significantly deranged among alcoholics, with elevated transaminases and reduced serum albumin levels, findings comparable to those reported by Gamit et al.[27] and Salwan et al.[18] Chronic alcohol intake causes hepatocellular injury, fatty infiltration, inflammation, and fibrosis, leading to altered synthetic and metabolic liver functions.[28] Prothrombin time was also significantly prolonged in alcoholics, similar to observations by Erhabor et al.[26] reflecting impaired hepatic synthesis of clotting factors.

Renal function parameters did not show significant differences between groups, unlike the findings of Elanchezhian et al.[22] possibly due to differences in sample characteristics and the duration of alcohol exposure.

The present study reinforces existing evidence that chronic and heavy alcohol consumption significantly affects hematological indices and liver function parameters. Early

recognition of these alterations through routine laboratory investigations can facilitate timely intervention, counseling, and management, thereby reducing alcohol-related morbidity and mortality.

CONCLUSION

In this study of 120 patients (60 alcoholics and 60 non-alcoholics), significant alterations were observed among alcoholics in haemoglobin, RBC count, PCV, platelet count, MCV, liver function tests, and prothrombin time, indicating the substantial impact of chronic alcohol consumption on haematological and hepatic parameters. No significant differences were noted in WBC count, MCH, MCHC, blood urea, and serum creatinine. These simple and cost-effective laboratory parameters can aid in the early detection of alcohol-related hematological and liver changes, enabling timely counselling and intervention to prevent complications such as alcoholic liver disease, pancreatitis, neuropathy, cerebellar degeneration, and cardiac disorders. Early identification and appropriate management are essential, especially in view of the increasing alcohol consumption among younger individuals, to reduce the associated morbidity, mortality, and social and financial burden of alcoholism.

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