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Original article

HAEMATOLOGICAL VARIATIONS ASSOCIATED WITH ALCOHOL CONSUMPTION IN A NIGERIAN UNIVERSITY COMMUNITY

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Abstract: **Introduction:** Alcohol consumption is widespread, contributing to approximately 3 million deaths worldwide. This study aimed to assess haematological indices among alcohol consumers compared to non-consumers in the University of Calabar Community, Nigeria.

Materials and Methods: This case-control study enrolled 100 subjects (50 alcohol consumers and 50 non-consumers) from the University of Calabar community. Blood samples were collected aseptically for Full Blood Count and Thrombin Time analysis. Rigorous study design, meticulous data collection, and thorough analysis ensured the reliability of our findings.

Results: The mean corpuscular volume (MCV) (76.21 ± 7.35 fl), mean corpuscular haemoglobin (MCH) (25.31 ± 3.26 pg), Platelet (PLT) (154.38 ± 54.89 x 10^9) and Platelet Crit (PCT) (0.14 ± 0.04%) of alcohol consumers were significantly lower than that of the controls respectively (79.36 ± 5.76 fl, 26.47 ± 2.15 pg, 187.22 ± 58.34 x 10^9 and 0.17 ± 0.04%) ($p < 0.05$). At the same time, the red cells distribution width (RDWCV), Platelet distribution width (PDW), and thrombin time (TT) varied significantly among alcohol consumers (15.14 ± 1.05%, 14.91 ± 0.43fl and 15.22 ± 2.53s) respectively than in the controls (14.74 ± 0.95%, 14.76 ± 0.29 fl and 12.70 ± 1.52s). Other parameters were comparable ($p > 0.05$) between the two groups of subjects studied. A significant negative correlation ($r = 0.801$, $p = 0.001$) was observed between Thrombin time and Plateletcrit in the test subjects. In contrast, a significant positive correlation ($r = 0.698$, $p = 0.001$) was observed between Mean Corpuscular Haemoglobin Concentration and Haemoglobin in alcohol consumption. A significant negative correlation ($r = 0.973$, $p = 0.001$) was observed between lymphocytes and granulocytes in percentage in the test subjects. These significant findings provide valuable insights into the haematological variations associated with alcohol consumption.

Conclusion: These significant differences observed in this study underscore the impact of alcohol consumption on haematological indices. The study concluded that derangements in some haematology parameters occur in alcoholics, which can affect their quality of life.

Keywords: Haematology, Alcohol consumers, Platelet count.

INTRODUCTION

Alcohol is a chemical substance known for its ability to induce intoxication and alter mental and physical functions when consumed (1). The American Society of Addiction Medicine (ASAM) defines alcoholism as a primary chronic disease influenced by genetic, psychosocial, and environmental factors. This condition is often progressive and fatal, characterized by continuous or periodic impaired control over drinking despite adverse consequences and cognitive distortions, most notably denial (2). Similarly, Godwin defines alcoholism as a compulsion to drink, causing harm to oneself and others (3).

Alcohol is a psychoactive substance with dependence-producing properties and has been widely used across various cultures and ethnic groups for many years. The harmful use of alcohol in society today is significant, leading to a burden of diseases and illness-

es, as well as substantial social and economic consequences. High rates of problems are associated with family members, friends, and co-workers of individuals with alcohol use disorder (4, 5).

The consumption of alcohol predisposes individuals to various diseases, accidents, domestic violence, and other health-related conditions. These include liver cirrhosis, cardiovascular diseases, certain carcinomas, heart diseases, and irregular heartbeat. Alcohol also affects the pancreas, immune system, and can lead to mental and behavioral impairments (6, 7). Alcoholism often reduces a person's life expectancy by around ten years, with cardiovascular complications being the most common cause of death among alcoholics (8, 9).

It has been reported that there is a high rate of suicide among chronic alcohol consumers, which increases with the duration of alcohol exposure. Approximately 3–15% of alcoholics die by suicide, and research has found that over 50% of all suicides are associated with alcohol or drug dependence (10, 11).

This is believed to be due to alcohol causing physiological distortion of brain chemistry and social isolation. Suicide is also very common among adolescent alcohol abusers, with 25% of adolescent suicides being related to alcohol abuse (12).

Drinking during pregnancy can result in foetal alcohol spectrum disorders. Women are generally more sensitive than men to the harmful effects of alcohol, primarily due to their smaller body weight, lower capacity to metabolize alcohol, and a higher proportion of body fat (13). Alcohol consumption is widespread, with about 3 million deaths worldwide attributed to it. In 2016, a global burden of disease study estimated that Nigeria is one of the countries with the highest prevalence of current alcohol use among adults 15 years and older in Sub-Saharan Africa (5).

Haematological parameters, including red blood cells, white blood cells, and haemoglobin concentrations, are widely used as clinical indicators of health and disease (14, 15). This study aims to provide information useful to healthcare practitioners on the dangers of alcohol consumption and its management.

MATERIALS AND METHODS

Study Area

This study was conducted between July and December 2023 at the University of Calabar Community, Calabar, located in Cross River State in the South-South Geographical Zone of Nigeria.

Study Design

A case-control study design was adopted for this study. Demographic information was obtained and documented from the study subjects through interviews.

Sampling

A purposive sampling method was adopted for this study.

Selection of Subjects

A total of 100 subjects between the ages of 15 and 65 were enrolled for this study. Fifty (50) were alcohol consumers, and fifty (50) were non-alcohol consumers, including both males and females. Informed consent was duly obtained from all participants. For the minors who participated in the study, consent to obtain blood samples was obtained from their parents.

Inclusion Criteria

Both alcohol consumers and control subjects who gave their informed consent were recruited for this study.

Exclusion Criteria

Both alcohol consumers and control subjects who did not give their informed consent were excluded from this study. Subjects with a history of liver disease, viral hepatitis, renal disease, and haematology malignancies were excluded from participating in the study.

Ethical Consideration

Ethical clearance was sought and obtained from the Cross River State Ministry of Health's Ethical Committee with the number REC No: CRSMOH/HRP/REC/2023/416. A well-structured questionnaire was administered, and their consent was obtained to participate in the study.

Sample Collection

Five (5) milliliters of blood were collected from the antecubital vein of the subjects after properly disinfecting the venepuncture site with 70% ethanol. Three (3) milliliters were dispensed into an Ethylene Diamine Tetra Acetic Acid (EDTA) bottle with a final concentration of 2mg/ml for Full Blood Count (FBC) determination. Two (2) milliliters were dispensed into a tri-sodium citrate anticoagulated bottle with a concentration of 3.13% for thrombin time determination.

Sample Handling, Storage, and Processing

The samples were transported to the laboratory in an ice pack cooler. The samples were stored in a refrigerator at 4-8°C for full blood count, and those for thrombin time were spun at 3000 rpm. The plate-

let-poor plasma was separated from the whole blood and stored refrigerated.

The full blood count sample was processed using a haematology auto-analyser (BC—2800 Mindray). The thrombin time samples were analyzed using a manual one-stage quick method with the Helena thrombin Kit purchased in Lagos, Nigeria.

Assay of Parameters

Determination of Full Blood Count

Full Blood Count Samples were determined using the Automated Haematology analyzer Mindray BC-2800, UK.

Determination of Thrombin Time

Thrombin time samples were analyzed manually using a water bath at 37°C on the STA-Compact. The fibrinogen concentration in plasma was determined quantitatively by the Clauss clotting method, which involves measuring the rate of fibrinogen-to-fibrin conversion in diluted samples under the influence of excess thrombin.

Statistical Analysis

The Statistical Package for Social Science (SPSS) version 20.0 was used for the analysis. The data were summarized as percentages, charts, mean, standard deviation, and Student's t-test. The results were presented in tables and figures. Pearson's correlation was used to correlate the variables of alcohol consumers, with a significance level set at $P \leq 0.05$.

RESULTS

This research examined some haematological parameters of alcohol consumers and non-alcohol consumers who served as control groups in the University of Calabar Community. The parameters assayed were Full Blood Count and thrombin time. A total of 100 subjects, 64 males and 36 females, were enrolled for the study.

Table 1 shows the demographic data of alcohol consumers and non-alcohol consumers. The majority of the alcohol consumers were between ages 15-25 years, while the majority of the controls were between ages 26-35 years. There were more male alcohol consumers than females, with a frequency of 40 (80.0%) males and 10 (20.0%) females, respectively. In contrast, non-alcohol consumers were 24 (48.0%) males and 26 (52.0%) females. Single individuals participated more in both groups: 38 (76.0%) alcohol consumers and 44 (88.0%) non-alcohol consumers, compared to married individuals, who comprised 12 (24.0%) alcohol consumers and 5 (10.0%) non-alcohol consumers. Additionally, only 1 (2.0%) non-alcohol consumer was cohabiting.

Tertiary education had higher attendance in both groups: 34 (68.0%) alcohol consumers and 43 (86.0%) non-alcohol consumers, compared to secondary institutions: 16 (32.0%) alcohol consumers and 7 (14.0%) non-alcohol consumers.

Students participated more in both groups, with 28 (56.0%) alcohol consumers and 39 (78.0%) non-alcohol consumers, followed by business owners. The least participants were academic and non-academic staff alcohol consumers, 3 (6.0%) respectively.

Among alcohol consumers, those who consumed alcohol for 1 to 5 years were the majority, 27 (54.0%), followed by those who drank for 11 years and above, 16 (32.0%), and the least were those who drank for 6 to 10 years, 7 (14.0%). Consumers of spirits were 18 (36.0%), followed by other types of alcohol at 32.0%, and the least were red wine and palm wine consumers, 8 (16.0%) each. Those who changed their brands of alcohol were 39 (78.0%), more than those who did not, 11 (22.0%). Consumers of alcohol with 42% alcohol content were the most, 12 (24.0%), followed by those with 5% and 17.5% alcohol content, 10 (20.0%) each, and the least were those with 8% (8 (16.0%)), 65% (3 (6.0%)), and other percentages (3%, 25%, 35%, and 45% (1 (2.0%) each)).

Table 2 shows the comparison of full blood count and thrombin time between alcohol consumers and controls. The mean corpuscular volume (MCV) was significantly lower ($P = 0.01$) in alcohol consumers compared to controls, and the mean corpuscular haemoglobin (MCH) was significantly lower ($P = 0.03$) in alcohol consumers. The red cell distribution width (RDWCV) was significantly higher ($P = 0.04$) in alcohol consumers compared to controls. The platelet count (PLT) was significantly lower ($P = 0.01$) in alcohol consumers compared to the control group. The platelet distribution width (PDW) was significantly higher ($P = 0.05$) in alcohol consumers compared to the control group. Plateletcrit (PCT) was significantly lower ($P = 0.01$) in alcohol consumers compared to controls. Meanwhile, the thrombin time (TT) was significantly higher ($P = 0.01$) in alcohol consumers compared to the control group. All other haematological parameters were comparable between the two groups.

Figure 1 shows the distribution of alcohol and non-alcohol consumers based on ethnicity. Figure 2 shows a significant negative correlation ($r = 0.801$, $p = 0.001$) between thrombin time and plateletcrit. Figure 3 shows a significant positive correlation ($r = 0.698$, $p = 0.001$) between mean corpuscular haemoglobin concentration and haemoglobin. Figure 4 shows a sig-

Table 1. *Demographic data of alcoholics and apparently healthy non-alcoholics in the University of Calabar Community*

Demographics	Alcoholics	Non-alcoholics
Age range		
15-25	24 (48.0%)	22 (44.0%)
26-35	17 (34.0%)	25 (50.0%)
36-45	6 (12.0%)	2 (4.0%)
46-65	3 (6.0%)	1 (2.0%)
Gender		
Male	40 (80.0%)	24 (48.0%)
Female	10 (20.0%)	26 (52.0%)
Marital status		
Singles	38 (76.0%)	44 (88.0%)
Married	12 (24.0%)	5 (10.0%)
Cohabiting	0 (0.0%)	1 (2.0%)
Level of education		
Secondary	16 (32.0%)	7 (14.0%)
Tertiary	34 (68.0%)	43 (86.0%)
Occupation		
Students	28 (56.0%)	39 (78.0%)
Business owners	16 (32.0%)	10 (20.0%)
Academic staff	3 (6.0%)	0 (0.0%)
Non-academic	3 (6.0%)	1 (2.0%)
Duration of consumption (years)		
1-5	27 (54.0%)	0 (0.0%)
6-10	7 (14.0%)	0 (0.0%)
11 & above	16 (32.0%)	0 (0.0%)
Brand of alcohols		
Beer	16 (32.0%)	0 (0.0%)
Red wine	8 (16.0%)	0 (0.0%)
Spirit	18 (36.0%)	0 (0.0%)
Palm-wine	8 (16.0%)	0 (0.0%)
Ever changed brand of alcohol		
Yes	39 (78.0%)	0 (0.0%)
No	11 (22.0%)	0 (0.0%)
Percentage of alcohol in a brand		
3 (%)	1 (2.0%)	0 (0.0%)
5%	10 (20.0%)	0 (0.0%)
6%	2 (4.0%)	0 (0.0%)
8%	8 (16.0%)	0 (0.0%)
17.5%	10 (20.0%)	0 (0.0%)
25%	1 (2.0%)	0 (0.0%)
35%	1 (2.0%)	0 (0.0%)
42%	12 (24.0%)	0 (0.0%)
45%	1 (2.0%)	0 (0.0%)
65%	3 (6.0%)	0 (0.0%)

Table 2. *Mean values of haematological parameters of alcoholics and non-alcoholics*

Parameters	Alcoholics n = 50	Non-alcoholics n = 50	p-value < 0.05
Total WBC	5.71 ± 1.83	5.53 ± 1.41	0.57
Lymphocyte	2.70 ± 0.91	2.54 ± 0.74	0.35
Mid L/L	0.54 ± 0.19	0.55 ± 0.16	0.70
Gran L/L	2.47 ± 1.07	2.43 ± 0.91	0.85
Lymph %	47.23 ± 8.26	46.33 ± 8.13	0.58
Mid %	9.91 ± 1.99	10.36 ± 2.86	0.36
Gran %	42.84 ± 8.40	43.29 ± 8.99	0.79
Haemoglobin g/l	133.72 ± 27.83	135.60 ± 17.49	0.68
Red blood cells l/l	5.24 ± 0.88	5.11 ± 0.70	0.41
Haematocrit l/l	0.40 ± 0.07	0.40 ± 0.50	0.86
MCV fl	76.21 ± 7.35	79.36 ± 5.76	0.01*
MCH Pg	25.31 ± 3.26	26.47 ± 2.15	0.03*
MCHC g/dl	33.10 ± 1.72	33.39 ± 0.99	0.31
RDWCV %	15.14 ± 1.05	14.74 ± 0.95	0.04
RDWSD %	41.47 ± 3.64	42.54 ± 3.29	0.12
Platelet	154.38 ± 54.89	187.22 ± 58.34	0.00*
MPV	9.53 ± 0.04	9.30 ± 0.56	0.10
PDW	14.91 ± 0.43	14.76 ± 0.29	0.05*
PCT	0.14 ± 0.04	0.17 ± 0.04	0.00*
TT	15.22 ± 2.53	12.70 ± 1.52	0.00*

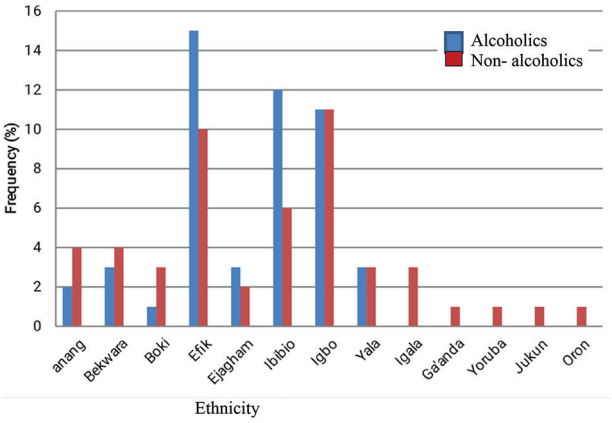

Figure 1. *Distribution of alcohol consumers and non-alcohol consumers based on Ethnicity*

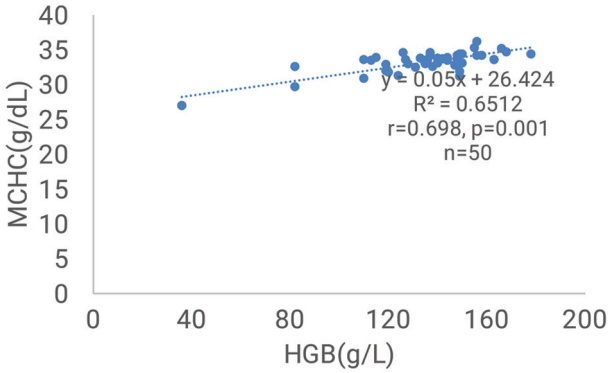

Figure 3. *Correlation of mean corpuscular haemoglobin concentrations (MCHC) and Haemoglobin (HGB) of Alcohol Consumers*

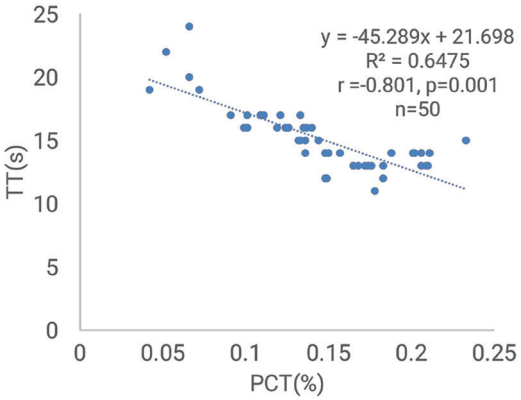

Figure 2. *Correlation of Thrombin Time and Plateletcrit of Alcohol Consumers*

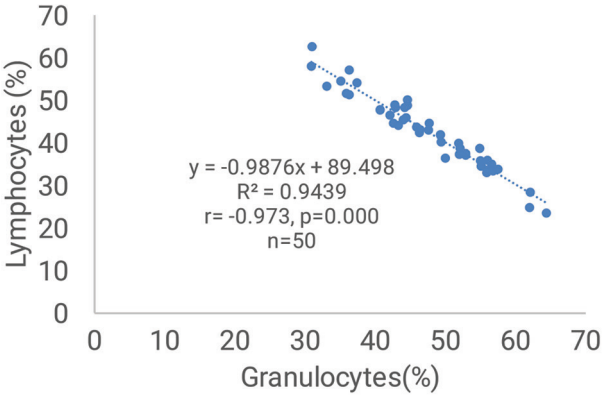

Figure 4. *Correlation of Lymphocytes (%) and Granulocytes (%) of alcohol consumers*

nificant negative correlation (r = 0.973, p = 0.001) between lymphocytes and granulocytes percentages.

DISCUSSION

The findings of this research have shown that alcohol consumption affects the Full Blood Count and Thrombin time of alcohol consumers. Recent studies have reported that no amount of alcohol use is beneficial to the body and also the associated health risks. Its use among university students is a severe cause of concern. In this study, more males were found to consume alcohol than females; this could be a result of peer pressure, cultural upbringing, or environmental influences. This aligns with a study by Ajayi et al. (4). Students who were between 15 and 25 years old had a higher prevalence of alcohol use. This may be because this age group signifies a period of adulthood; it is a time when many young adults experiment and try new things, including alcohol consumption. Also, this age group is subjected to so many societal pressures and the zeal to attain success, which may lead them to embrace the use of alcohol. Many of the students in this study were, in one way or another, dependent on their parents for their livelihood and mostly had small sources of income.

There is a higher prevalence of alcohol use among consumers of cultural origin who are Efiks, followed by Igbos and Ibibios. This could be due to their frequent engagement in cultural and religious activities. Similar findings were observed in a study by Olashore et al. (16) in Nigeria.

The distribution of marital status among alcohol consumers in this study was majorly singles; this may be attributed to the young age of the alcohol consumers since the majority were between the ages of 15-25 years. Additionally, the study reveals a higher representation of tertiary education among alcohol consumers, and a similar case was observed between the controls. This study showed that the majority of the consumers had taken alcohol for 1-5 years, and mostly, about 18(36.0%) of the consumers prefer spirit and 16 (32.0%) beer. About 39 (78.0%) of alcohol consumers in this study had changed from one brand of alcohol to another and preferred brands with alcoholic content of about 42.0% being about 12 (24.0%). Data obtained from this study has shown that the duration of alcohol consumption has a statistically significant difference when compared to alcohol consumers.

The complete blood count and Thrombin Time of alcohol and non-alcohol consumers were compared. A comparison of the haematological parameters of alcohol consumers with non-alcohol consumers reveals a statistically significantly lower mean corpuscular volume (MCV). However, this observation disagrees with the findings of a study conducted by Ballard (17), who reported a significant increase in the MCV of alcohol consumers but agreed with the work of Okafor et al. (18). A substantial decrease in the mean cell haemoglobin (MCH) was observed in this study. This does not align with a similar study by Jain et al. (19) in India. Also, in this study, there was a statistically significant decrease in some platelet parameters of alcohol consumers. This observed decrease may be a result of the effect of the long duration of consumption of alcohol since most of the consumers have been exposed for about 1-5 years. Similar findings were observed in previous studies carried out by Quraish et al. (20) and Etura et al. (21), who reported that the effect of prolonged alcohol exposure can stimulate some level of inflammatory response in the test subjects. Also, there was a significant decrease in the red cell distribution width (RDWCV). A significant decrease was observed in the Plateletcrit (PCT) of alcohol consumers and a substantial increase in the thrombin time (TT) of alcohol consumers, which could be due to the effect of alcohol on the clotting factors.

Similarly, there was a statistically significant strong negative correlation between thrombin time and Platelet Crit. The reason for this is not clearly understood, but it implies that long-term alcohol consumption may alter Thrombin time and Plateletcrit.

CONCLUSION

The findings of this study reveal a significant decrease in Mean Corpuscular Volume and Mean Corpuscular Haemoglobin, as well as in some platelet parameters (platelet count, platelet distribution width, and plateletcrit) of alcohol consumers. Additionally, the Red Cell Distribution Width Coefficient of Variation and Thrombin time of alcohol consumers were significantly increased. These significant differences underscore the impact of alcohol consumption on haematological indices. The study concludes that derangements in some haematological parameters occur in alcoholics, which can affect their quality of life.

Abbreviations

ASM - American Society of Addiction Medicine
FBC - Full Blood Count
HCT - Haematocrit
HGB - Haemoglobin
MCH - Mean Corpuscular Haemoglobin
MCHC - Mean Corpuscular Haemoglobin Concentration
MCV - Mean Corpuscular Volume
MPV - Mean Platelet Volume

PCT - Platelet Crit

PDGF - Platelet-Derived Growth Factor

PDW - Platelet Distribution Width

PLT - Platelet

RBC - Red Blood Cells

RDWCV - Red Cells Distribution Width Coefficient of Variation

RDWSD - Red Cells Distribution Width Standard Deviation

TT - Thrombin Time

WBC - White Blood Cells

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Authors Contributions: JE contributed to the conceptualization, manuscript drafting, and laboratory analysis; KA contributed to the literature review and laboratory analysis; UA contributed to statistical analysis and literature review; ZJ contributed to the review of the manuscript and approved the final draft. All authors critically reviewed and approved the final copy for submission.

Note: Artificial intelligence was not utilized as a tool in conducting this study.

Sažetak

HEMATOLOŠKE VARIJACIJE POVEZANE SA KONZUMIRANJEM ALKOHOLA U UNIVERZITETSKOJ ZAJEDNICI U NIGERIJI

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Uvod: Konzumiranje alkohola je široko rasprostranjena i dovodi do otprilike 3 miliona smrtnih slučajeva širom sveta. Ova studija je imala za cilj da proceni hematološke pokazatelje kod onih koji konzumiraju alkohol u poređenju sa onima koji ne konzumiraju alkohol u zajednici Univerziteta u Kalabaru, Nigerija.

Materijali i metode: Ova case-control studija uključila je 100 ispitanika (50 potrošača alkohola i 50 nekonzumenata) iz zajednice Univerziteta u Kalabaru. Krvni uzorci su aseptično prikupljeni radi analize kompletne krvne slike i trombinskog vremena. Rigorozan dizajn studije, pedantno prikupljanje podataka i temeljna analiza osigurali su pouzdanost naših rezultata.

Rezultati: Prosečni volumen eritrocita (MCV) (76.21 ± 7.35 fl), prosečna količina hemoglobina u eritrocitima (MCH) (25.31 ± 3.26 pg), trombociti (PLT) (154.38 ± 54.89 x 109) i trombokrit (PCT) (0.14 ± 0.04%) kod konzumenata alkohola bili su značajno niži u odnosu na kontrolnu grupu, redom (79.36 ± 5.76 fl, 26.47 ± 2.15 pg, 187.22 ± 58.34 x 109 i 0.17 ± 0.04%) ($p < 0.05$). Istovremeno, koeficijent varijacije širine distribucije eritrocita (RDWCV), širina distribucije volumena trombocita (PDW) i trombinsko vreme (TT) značajno su varirali kod konzumenata alkohola (15.14 ± 1.05%, 14.91 ± 0.43fl i 15.22 ± 2.53s) u poređenju sa kontrolama (14.74 ± 0.95%, 14.76 ± 0.29fl i 12.70 ± 1.52s). Ostali parametri su bili slični ($p > 0.05$) između dve grupe ispitanika. Primećena je značajna negativna korelacija ($r = 0.801$, $p = 0.001$) između trombinskog vremena i trombokrita kod ispitanika. Nasuprot tome, primećena je značajna pozitivna korelacija ($r = 0.698$, $p = 0.001$) između srednje koncentracije hemoglobina u eritrocitu i hemoglobina kod konzumenata alkohola. Takođe je primećena značajna negativna korelacija ($r = 0.973$, $p = 0.001$) između limfocita i granulocita izražene procentima kod ispitanika. Ovi značajni nalazi pružaju dragocene uvide u hematološke varijacije povezane sa konzumacijom alkohola.

Zaključak: Ove značajne razlike uočene u ovom istraživanju naglašavaju uticaj konzumacije alkohola na hematološke pokazatelje. Studija zaključuje da dolazi do poremećaja u nekim hematološkim parametrima kod alkoholičara, što može uticati na njihov kvalitet života.

Ključne reči: hematologija, konzumenti alkohola, broj trombocita.

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