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EFFECT OF LONG-TERM DRUG ABUSE ON COMPLETE BLOOD COUNT AND SERUM LIPID LEVEL

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Abstract

Background: *Drug use is a growing public health issue that can harm the haematological and metabolic systems. This study examined how long-term drug usage affects CBC values and serum lipid levels in drug abusers.*

Aim: *To evaluate the hematological profile of drug abusers by assessing hematological indices (PCV, MCV, MCH, and MCHC) and determining the total leukocyte count (TLC).*

Materials and Methods: *This study was descriptive cross sectional and 50 males with long term history of substance use disorder were recruited by convenience sampling from a drug rehabilitation centre in Mardan, Pakistan. Blood samples were tested for complete blood count. Serum lipid analysis used total cholesterol and triglycerides.*

Results: *Most responders (60.0%) were 21–30. Most subjects had normal PCV (80.0%) and MCV (76.0%). Of those who participated, 58% had low MCH and 82% low MCHC, with 90% of whom having normal total leukocyte counts. Mean MCHC was 30.83 ± 0.79 g/dL. Most of the participants had a normal level of total cholesterol, while a small number had high triglyceride levels, the TLC test indicated 10.0% increased. The mean haemoglobin concentration was 13.19 ± 0.90 g/dL, and the MCHC was 30.83 ± 0.79. The mean total cholesterol and triglyceride readings were 199.70 ± 22.31 and 247.62 ± 47.59 mg/dL, respectively. Significant differences in haemoglobin, PCV, and MCHC were seen among age groups ($p < 0.001$).*

Conclusions: *shows chronic drug use modifies several haematological markers, with MCH and MCHC changing more and the lipid profile changing less. Chronic drug abusers may benefit from haematological monitoring.*

Keywords: *Complete blood count, Drug abuse, HDL, LDL, Lipid profile*

INTRODUCTION

A growing global public health concern, drug use affects millions of people physically, psychologically, socially, and economically. Young adults are increasingly using alcohol, cannabis, methamphetamine, opioids, and other psychotropic drugs (1). Substance abuse harms several physiological systems and causes addiction and behavioural difficulties. By altering haematological and biochemical indicators, long-term drug use can harm the liver, kidneys, cardiovascular system, immune system, and metabolism (2, 3).

The United Nations Office on Drugs and Crime (UNODC) estimates that 275 million individuals, or around 5.5% of the global population, misused drugs in 2020; by 2030, this figure is predicted to rise by 11% (4). According to statistics, 36 million people globally have drug addiction disorders. Over 583,000 drug-related fatalities occur annually, with 31,000 from methamphetamine. Drug use accelerates infectious diseases like hepatitis and HIV (5, 6).

Chronic drug misuse creates physiological and biochemical issues that can harm health and lead to addiction.Long-term drug abuse releases dopamine, serotonin, and other neurotransmitters, which can cause depression and other health difficulties. Additionally, it worsens mood disorders (7, 8). Drug abuse's systemic effects are shown by thyroid hormone (T3, T4), thyroid-stimulating hormone (TSH), liver enzymes (ALT, AST, Alkaline Phosphatase), kidney function tests (Urea and Creatinine), and haematological markers

(RBC, Haematocrit, Haemoglobin, WBC, Platelets, M The endocrine, liver, kidney, and haematopoietic systems can be damaged by drug misuse (9). Haematological and biochemical tests are crucial laboratory instruments for assessing a person's health and organ function (10). Haematological tests include Hb, RBC, WBC, HCT, platelet count, MCV, MCH, and MCHC to identify blood disorders, anaemia, infections, inflammatory responses, and immunological dysfunctions. Biochemical tests give vital information on endocrine activity, lipid metabolism, renal function, and liver function (11, 12).

Biochemical tests include lipid profile analysis assess cardiovascular and metabolic health. Triglycerides, total cholesterol, HDL, and LDL make up the lipid profile. High triglycerides, the body's main fat store, raise the risk of cardiovascular disease and pancreatitis (13, 14). High-density lipoprotein (HDL), or "good cholesterol," removes cholesterol from blood vessels and prevents cardiovascular disease. However, low-density lipoprotein (LDL), or "bad cholesterol," causes arterial plaque and raises the risk of hypertension, stroke, and coronary artery disease. Drug addiction can cause liver dysfunction, poor nutrition, hormonal imbalance, and oxidative stress, altering lipid metabolism (15).

Cannabis, methamphetamine, alcoholic, and psychiatric drug users had higher liver enzymes, WBC, and platelet counts, modified lipid profiles, higher serum creatinine and urea levels, and lower haemoglobin, haematocrit, and RBC counts (16). These alterations imply that long-term substance misuse might affect organ function and raise the risk of metabolic disorders, anaemia, inflammatory illnesses, and cardiovascular problems (17, 18). High liver enzymes, inflammatory markers, lipid peroxidation, and blood parameters are also connected to methamphetamine addiction. Drug abusers had abnormal haematological and biochemical outcomes, according to research in India, Iran, and Pakistan (19).

While various studies have assessed the significance of substance use on haematological and biochemical parameters, very few studies have been conducted in Pakistan and these are related to the combined assessment of complete blood count (CBC) and serum lipid profile (SLP) in individuals with chronic substance use disorder (SUD) who attend rehabilitation centres. Thus, this study was conducted to fill this void and to give baseline information to the local population.

MATERIALS AND METHODS

A six-month descriptive cross-sectional study investigated the impact of prolonged drug consumption on CBC values and serum lipid profiles in individuals with substance use disorders. The inquiry was carried out at a drug rehabilitation facility in Mardan, Pakistan, with a clinical diagnostic laboratory. We enlisted 50 male subjects aged 10 to 40 who have a background of prolonged substance abuse by non-probability convenience sampling. The rehabilitation facility was selected as the primary site for recruitment due to its provision for clinically supervised participant selection and specimen gathering. The rehabilitation facility mostly accepted male patients during the study duration. All subjects provided documented consent prior to registration.

The demographic information (gender, age) was obtained by information sheet and a structured questionnaire after obtaining a written informed consent. Venous blood was drawn from each participant aseptically about 5 mL. Blood samples were taken in gel and EDTA tubes for biochemical and haematological analysis. Automated Mindray haematology analysers performed complete blood count analysis and quality control according to manufacturer specifications. TLC, Hb, platelets, RBCs, packed cell volume (PCV), MCV, MCH, MCHC, neutrophil, lymphocyte, monocyte, and eosinophil percentages were used. Centrifuged serum samples were used to evaluate total cholesterol and triglycerides using enzymatic biochemical techniques.

STATISTICAL ANALYSIS

SPSS version 25.0 analysed the data after entry and coding. The study employed mean ± standard deviation (SD) for continuous variables and frequency and percentages for categorical variables. One-way analysis of variance (ANOVA) and Tukey's Honestly Significant Difference (HSD) post hoc test for multiple comparisons were used to compare the age groups (10-20, 21-30, and 31-40). Pearson's correlation coefficient was used to assess the relationship between serum lipid profile characteristics and haematological

indicators, P value < 0.05 was deemed significant, and all statistical analyses used a 95% confidence range.

RESULTS

The demographic characteristics of the research participants are presented in Table I. The study encompassed a total of 50 drug addicts, all of whom were male, representing 100% of the participants. The predominant age cohort among participants was 21–30 years, comprising 60.0% (n = 30), succeeded by the 31–40 age cohort at 36.0% (n = 18). Two individuals (4.0%) were aged between 10 and 20 years. The findings indicated that substance misuse was prevalent among young individuals, particularly within the 21 to 30 age.

Table I. Demographic characteristics of drug abusers

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	50	100.0
	Female	0	0
Age groups	10–20 years	2	4.0
	21–30 years	30	60.0
	31–40 years	18	36.0

The distribution of hematological indices for the study participants is shown in Table II. Most of the participants (80.0%, n = 40) had packed cell volume (PCV) within the normal range while 8.0% (n = 4) had low PCV and 12.0% (n = 6) had high PCV. Based on mean corpuscular volume (MCV), 76.0% (n = 38) of the participants had normal level, while 24.0% (n = 12) had decreased level of MCV. Low levels of MCV were seen in 58.0% (n = 29) and the remainder 42.0% (n = 21) were within the normal range. Low levels of MCH were seen in 58.0% (n = 29) and 42.0% (n = 21) were within the normal level. Mean corpuscular hemoglobin concentration (MCHC) was then analyzed and it was observed that most of the individuals (82.0%, n = 41) had a low MCHC. The normal MCHC values were found in 14.0% (n = 7), and elevated MCHC values were in 4.0% (n = 2).

Table II. Distribution of hematological indices among drug abusers

Parameter	Category	Frequency (n)	Percentage (%)
PCV (%)	Low (<36)	4	8.0
	Normal (36–46)	40	80.0
	High (>46)	6	12.0
MCV (fL)	Low (<80)	12	24.0
	Normal (80–100)	38	76.0
MCH (pg)	Low (<27)	29	58.0
	Normal (27–33)	21	42.0
MCHC (g/dL)	Low (<32)	41	82.0
	Normal (33–36)	7	14.0
	High (>37)	2	4.0

The distribution of total leukocyte count (TLC) was presented in Table III. Most of those who abused drugs (90.0%, n = 45) had TLC in normal range (4,000 – 11,000 /mm^3). Ten participants (10.0%) however had elevated levels of TLC (>11,000/mm^3). The results showed that the leukocyte counts were normal in most participants, even with prolonged drug abuse. However, it could indicate potential chronic inflammatory responses, infections, or immune system changes in a group of individuals with high TLC levels.

Table III. Distribution of total leukocyte count (TLC) among drug abusers

TLC Category	Frequency (n)	Percentage (%)
Normal (4000–11000/mm^3)	45	90.0
High (>11000/mm^3)	5	10.0
Total	50	100.0

The descriptive statistics of the hematological and lipid profile parameters of the study subjects are summarized as shown in Table IV. The mean total leukocyte count (TLC) was 11,533.28 ± 1267.24/mm^3, while the mean hemoglobin concentration was 13.19 ± 0.90 g/dL. The average platelet count was 225,590.28 ± 47,670.31/mm^3, and the mean red blood cell (RBC) count was 4.84 ± 0.35 ×10^6/μL. The blood cell indices were

mean packed cell volume (PCV): 43.06 ± 3.13%, mean corpuscular volume (MCV): 87.73 ± 2.84 fL, mean corpuscular hemoglobin (MCH): 28.23 ± 1.41 pg, and mean corpuscular hemoglobin concentration (MCHC): 30.83 ± 0.79 g/dL. The relatively low mean MCHC value suggests that the subjects of the study were at risk of lower hemoglobin concentration in red blood cells. The mean percentage neutrophil in the differential leukocyte count was 36.70 ± 5.12%, lymphocyte 49.40 ± 6.28%, monocyte 11.64 ± 2.33% and eosinophil 2.84 ± 1.42%. Most of the leukocytes were lymphocytes in the participants. As far as lipid profile parameters, the mean total cholesterol was 199.70 ± 22.31 mg/dL while the mean triglyceride concentration was 247.62 ± 47.59 mg/dL.

Table IV. Hematological profile of drug abusers

Parameter	Mean ± SD
TLC (/mm³)	11533.28 ± 1267.24
Hemoglobin (g/dL)	13.19 ± 0.90
Platelets (/mm³)	225590.28 ± 47670.31
RBC Count (×10⁶/µL)	4.84 ± 0.35
PCV (%)	43.06 ± 3.13
MCV (fL)	87.73 ± 2.84
MCH (pg)	28.23 ± 1.41
MCHC (g/dL)	30.83 ± 0.79
Neutrophils (%)	36.70 ± 5.12
Lymphocytes (%)	49.40 ± 6.28
Monocytes (%)	11.64 ± 2.33
Eosinophils (%)	2.84 ± 1.42
Total Cholesterol (mg/dL)	199.70 ± 22.31
Triglycerides (mg/dL)	247.62 ± 47.59

The lipid profile parameters of the study participants are given in Table V. A total cholesterol analysis showed that 100.0% (n = 50) of the participants had total cholesterol levels within the normal range (151–200 mg/dL). No one had high or low total cholesterol levels. Concerning triglycerides, most of the participants (96.0%, n = 48) had normal levels of triglyceride (150-199 mg/dL), while 4.0% (n = 2) had high levels of triglyceride (>200 mg/dL).

Table V. Lipid profile categories among drug abusers

Parameter	Category	Frequency (n)	Percentage (%)
Total Cholesterol	Normal (151–200 mg/dL)	50	100.0
Triglycerides	Normal (150–199 mg/dL)	48	96.0
	High (>200 mg/dL)	2	4.0

The difference in hemoglobin level between the various age groups of drug abusers was statistically significant ($F = 29.963$, $p<0.001$). Likewise, significant differences were found between age groups for PCV ($F = 7.721$, $p = 0.001$). There was also a significant difference between age categories at the MCHC ($F = 3.457$, $p = 0.040$). This indicates that age might have an effect on some haematological parameters in chronic drug users.

DISCUSSION

This study examined the effects of long-term drug use on CBC parameters and serum lipid profile in 50 male drug addicts. The results show considerable changes in haematological parameters, especially red cell characteristics, and modest lipid profile modifications. Haematological Results Most individuals showed normal PCV, MCV, and TLC (80%, 76%, and 90%, respectively). MCH and MCHC abnormalities were prevalent, occurring in 58% and 82% of subjects, respectively. The results show that chronic drug users may have hypochromic red blood cells and haemoglobin synthesis abnormalities.

The hematological changes reported here are comparable to those reported in earlier studies. The results showed that opioid-dependent individuals had significantly lower levels of hemoglobin and MCHC than healthy controls, suggesting that chronic drug use leads to suppression of erythropoietic activity, possibly due to nutritional deficiencies, bone marrow suppression, and the toxic effects of opioids on hematopoiesis (20). Haghpanah *et al.,* 2010 found that the indices of hemoglobin and MCHC were

significantly lower in opioid-dependent individuals than in healthy controls, which may be due to suppression of erythropoietic activity caused by chronic opioid use (21). Another study conducted by Islawati (2025) showed that indices of RBCs were lower and susceptibility to anemia was higher in chronic drug users, which might be attributed to nutritional deficiency, suppression of bone marrow and toxic effect of drugs on hematopoiesis (22).

In the present study, it was also noted that 10% of the subjects had high TLC which indicated that there might be an inflammatory/infectious process going on. This is similar to findings by Assis *et al.,* 2021 revealed most drug users had normal leukocytes, which may be attributed to infection frequency and immune system activation depending on drug kind, duration, and route (23). Red blood cells stay constant. Red blood cells stay constant. Haematological parameter means values support these findings. The mean MCHC (30.83 ± 0.79 g/dL) was below the normal range, indicating hypochromic alterations in red blood cells. Some subjects had a borderline Hb level (13.19 ± 0.90 g/dL), indicating early or moderate anaemia. Multiple processes have been connected to drug addicts' haematological disorders (24).

Long-term usage can affect iron absorption, vitamin B12 and folate metabolism, and bone marrow function. In this study, drug-induced oxidative stress can damage erythrocyte membranes, shortening their lifespan and decreasing haemoglobin synthesis and red cell indices (25). In this study, all subjects had normal levels of total cholesterol and 4% of subjects had elevated triglyceride levels. However, the mean triglyceride level (247.62 ± 47.59 mg/dL) suggests a hypertriglyceridemia tendency in a subpopulation. The results are also consistent with the work of Zhang *et al.,* 2017 which showed long term use of opioids induced alterations in triglyceride levels and altered lipid metabolism when compared with non-opioid users (13).

CONCLUSION

In this study, long-term drug use altered MCH and MCHC, while most participants had normal PCV, MCV, and TLC. Age also significantly affected haematological indices, suggesting that prolonged drug use may harm haematology differently in various age groups. Although some individuals had elevated triglycerides, serum lipids were generally normal. Long-term drug use impacts haematological indicators more than serum lipids, highlighting the need for periodic laboratory testing to diagnose and prevent health risks in drug abusers.

Study limitations:

This study has a few limitations. A causal relationship cannot be determined in a cross-sectional study. The findings may not be generalizable due to the relatively small number of samples and due to the samples being drawn from a single rehabilitation center. Moreover, there were no female participants to generalize the results to females. These results should be replicated in larger, multicentre studies involving both males and females.

Conflict of interest:

Authors declared no conflict of interest.

Authors' contribution:

AY Data collection, laboratory investigations, data interpretation and manuscript drafting; MA Conceptualization, study design, supervision and critical review of the manuscript; MS Data collection, laboratory analysis and literature review; MH Statistical analysis, data interpretation and critical revision of the manuscript; AM Data collection, literature review and manuscript editing; AH Data analysis, interpretation of results, manuscript review, final approval of the manuscript and supervised.

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