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EFFECT OF CHRONIC ALCOHOL INTOXICATION ON HEMATOLOGICAL PARAMETERS IN RATS.

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Abstract

Since alcohol is widely available nowadays, people all over the world get easily intoxicated with it. This also produces protease-destroying effects in humans. In order to consider the effects of alcohol on humans, it is first necessary to determine the effects of alcohol on rats. Chronic alcohol intoxication in rats can significantly affect various blood parameters of their offspring. Studies show that alcohol consumption can lead to fetal alcohol spectrum disorders (FASD), which include a range of physical, cognitive and behavioral abnormalities in offspring. In the article, the changes that occurred in rats as a result of the effect of chronic consumption of alcoholic beverages were investigated.

Key words: *Hematology, alcohol, blood cells, platelet*.

Introduction

The study of the effect of alcohol, which is one of the extreme factors that is very widespread in the household and distinguished by its acute and chronic negative effects on the body, can lead to certain positive results in the direction of solving a large and important social problem. The study of the neurochemical mechanism of the toxic effects of toxic substances, including alcohol, on the body is one of the most important and social problems of modern healthcare.

Chronic use of alcoholic beverages seriously damages various internal systems and organs of the body and causes degeneration (Watabiri et al., 1999). The constant use of alcoholic beverages affects various parameters such as liver dysfunction, metabolic disorders, various neurological effects, and weight loss. Effects on blood parameters noted are:

1. **Hematological changes:**Chronic exposure to alcohol in rats can cause changes in hematological parameters of the offspring. These changes may include a decrease in the number of red blood cells (anemia), changes in the number of white blood cells (leukopenia or leukocytosis), and changes in the platelet count.
2. **Liver dysfunction:** In rats, chronic alcohol consumption can cause liver damage, including fatty liver disease, alcoholic hepatitis, and cirrhosis. This is one of the most well-known effects of chronic alcohol use in both rats and humans.Elevated levels of liver enzymes such as alanine transaminase (ALT) and aspartate transaminase (AST) may indicate liver damage or dysfunction.
3. **Immune dysfunction:** Chronic alcohol use suppresses the rats' immune systems, making them more susceptible to infections and weakening their ability to fight pathogens. Prenatal alcohol exposure is associated with impaired immune function in offspring. This can manifest as changes in immune cell populations and changes in cytokine levels in the blood, potentially leading to increased susceptibility to infections.
4. **Metabolic disorders:**Chronic alcohol exposure can disrupt metabolic processes in rats, causing abnormalities in blood glucose levels, insulin resistance, and dyslipidemia, as well as various problems such as metabolic syndrome. These metabolic disturbances can increase the risk of developing diseases such as diabetes and obesity later in life.
5. **Neurological effects:** Alcohol is neurotoxic, and chronic alcohol intoxication can cause neuronal damage as well as cognitive function and behavioral impairment in rats. Although not directly related to blood parameters, it is important to note that chronic exposure to alcohol can cause neurological disorders in offspring, including cognitive deficits, learning disabilities and behavioral problems.
6. **Cardiovascular effects**: In rats, chronic alcohol consumption can cause cardiovascular problems, including hypertension, cardiomyopathy, and an increased risk of cardiovascular disease.
7. **Reproductive effects:**Chronic alcohol consumption can cause reproductive problems in rats, including reduced fertility, impaired sexual function, and developmental abnormalities in the offspring if alcohol consumption occurs during pregnancy.
8. **Behavioral changes:**Chronic alcohol consumption can cause behavioral changes in rats, including increased aggression and altered social interactions.

Despite the above, the purpose of this study is to evaluate the effect of alcohol intoxication on some hematological parameters in rats.

Studies conducted on the basis of blood samples taken from rats allow to evaluate the hematological parameters caused by alcohol intoxication in the offspring and to determine the effect of alcohol. The main blood parameters that allow determining the effect of alcohol on rats are: hemoglobin (Hb), red blood cell count (RBC), red cell indices (MCV, MCH, MCHC), platelet count, white blood cell count (WBC), lymphocytes, neutrophils and so on. These parameters are measured periodically to assess the general condition of the rats and monitor their health in studies.

Material and methods

All experiments were carried out in accordance with the principles of the International Declaration of the European Union on the protection of animals used for experimental and other scientific purposes. Since there are different breeds of rats, it is possible to see different results in each species against alcohol intake. Albino Wistar, Sprague-Dawley, Long-Evans rat breeds are mainly used in laboratory experiments. Also, the sex of the rats can cause them to react differently to the effects of alcohol. Therefore, 28 Sprague-Dawley rats of both sexes with a body weight of 150-300 g were used in these experiments. Animals are divided into 2 groups. Control animals were included in the first group, and animals exposed to alcohol intoxication were included in the second group. Rats were exposed to alcohol for two weeks. The experimental group was given grower mash and 100% alcohol. At this time, the control groups were fed with normal feed (breeder mash) and ad libitum water for two weeks. Throughout the experiment, the health condition, behavior, and blood parameters of the rats were monitored periodically. At the end of the experiment, blood samples were collected from the rats.

All experiments conducted were processed according to Fisher-Student and Wilcoxon non-parametric (Manna-Whitney) statistical method. Calculations were made with the help of "Statistica" program. Values are expressed as mean ± SD with significance level set at $p<0.05$.

Results and their discussion

The results showed that the number of red blood cells of the control and experimental groups was $5.02 \pm 0.45x10^{6}\mu l^{-1}$ for the experimental group and $5.32 \pm 0.222x10^{6}\mu l^{-1}$ for the control group, respectively. This value for the experimental group ($P>0.05$) was not lower than the value for the control group. The PCV for the experimental group was 38.5 ± 4.69% ($P>0.05$) and was significantly higher than the control group (38.5 ± 1.42%). The MCV value increased by 83.7 ± 3.4 fl in the experimental group compared to the control group (71.8 ± 5.11 fl). In addition, it was observed that the average number of hemoglobin of the experimental group (12.6 ± 1.38 gdl^{-1}) was lower than that of the control group (13.6 ± 1.63 gdl^{-1}). On the other hand, the MCH for the experimental group was 21.10 ± 2.05 pg, lower than the control group (21.35 ± 2.49 pg). The average concentration of hemoglobin in erythrocytes (MCHC) decreased in the experimental group (28.5 ± 3.26 g/dl) compared to the control group (33.03 ± 4.53 g/dl).

Parameters	Group (control)	Group (practice)
RBC ($10^{6}\mu l^{-1}$)	5.32 ± 0.222	5.02 ± 0.45
PCV (%)	38.5 ± 1.42	38.5 ± 4.69
MCV (fl)	71.8 ± 5.11	83.7 ± 3.4
Hb (g/L)	13.6 ± 1.63	12.6 ± 1.38
MCH (pg)	21.35 ± 2.49	19.10 ± 2.05
MCHC (g/dL)	33.03 ± 4.53	28.5 ± 3.26

Table 1: Characteristics of observed parameters (RBC, PCV, Hb and indices)

Values (mean ± SD); RBC: Red Blood Cell Count; PVC: Packed cell volume; Hb: Hemoglobin count; Red cell indices: MCV- average volume of erythrocytes; MCH- average amount of hemoglobin in erythrocyte; MCHC-mean concentration of hemoglobin in erythrocyte.

The value of leukocytes - white blood cells (WBC) for the control group was 7.82 ± 0.74 10^6/l, and for the experimental group, this value was 5.32 ± 0.96 10^6/l, which was not significantly lower than the control group (P>0.05). The number of platelets for the experimental group was 190.3 ± 32.4 10^6/l, and for the control group, this number was 482.7 ± 134.3 10^6/l. The average number of monocytes was recorded as 5.7 ± 2.1% for the experimental group. This value was recorded as 3.78 ± 1.72% for the control group. The average number of lymphocytes was 46.8 ± 7.89% for the experimental group and 42.8 ± 9.67% for the control group. Based on the comparison of these values, it is clear that the values recorded for the experimental group are not significantly higher than those recorded for the control group (P>0.05). Also, the average number of neutrophils for differentials was 53.03 ± 10.3% for the control group and 44.87 ± 5.02% for the experimental group, and this result is not lower than that for the control group. The basophil value of the experimental group was 1.43 ± 0.1%, and the basophil value of the control group was recorded as 1.43 ± 0.12%, and there was no significant difference between these values. The results are shown in table 2. Thus, according to the obtained results, it can be said that deep pancytopenia occurred in the experimental group depending on chronic alcohol intake.

Parameters	**Group (control)**	**Group (practice)**
WBC (10^6/l)	7.82 ± 0.74	5.32 ± 0.96
Platelets (10^6/l)	482.7 ± 134.3	190.3 ± 32.4
Monocyte (%)	3.78 ± 1.72	5.7 ± 2.1
Lymphocyte (%)	42.8 ± 9.67	46.8 ± 7.89
Neutrophil (%)	53.03 ± 10.3	44.87 ± 5.02
Basophil (%)	1.43 ± 0.1	1.43 ± 0.12

Table 2: Characteristics of observed parameters (WBC, platelet, differential)

The results of the study showed that chronic alcohol intoxication has a negative effect on hematological parameters. Changes in hematological parameters and red blood cell indices provide important information about the general condition of blood after exposure to exogenous influences. Changes in red blood cell count after alcohol consumption may be associated with low hemoglobin levels (Jaana, 2004), and microcytic anemia may occur if treatment continues for longer periods (Herman, 1998).

Chronic alcohol use is a growing and serious health problem. Although many treatment methods have been implemented for this problem, it is also true that these methods are not always successful. Researchers claim that alcoholism has a negative effect on many organs, tissues, and blood cells in the body. 28 Sprague-Dawley rats were used for this experiment. The purpose of the experiment was to investigate the effect of alcohol on the blood cells of rats. The rats used in the experiment were randomly divided into two groups, control and experimental groups. While the number of red blood cells was not significantly lower in experimental group rats,mean amount of hemoglobin in erythrocyte (MCH), mean concentration of hemoglobin in erythrocyte (MCHC), hemoglobin count (Hb) is quite low. While some values are low, PCV and mean erythrocyte volume (MCV) are higher than normal.

In addition, the research showed an increase in the number of monocytes and lymphocytes, and a decrease in the number of WBC and neutrophils, but no change was observed in the number of basophils in the experimental groups that consumed alcohol. From here, based on the differences in the values shown as a result of the effect of alcohol, metabolic disorders, hormonal effects, behavioral disorders, etc. in rats. can be determined to have arisen. It can also be noted that a significant decrease in platelets results in a weakened immune response. In addition, the platelet count observed in the alcohol-treated experimental group may also be related to suppression of platelet production leading to thrombocytopenia. It is also possible that this condition occurs due to the cytotoxic effect of alcohol.

Additionally, aging and alcohol affect the survival of RBC circulating in the body and alter the amount of sialic acid on the outer surface of the red blood cell membrane.

The result

The results of these studies show that high levels of alcohol intake in rats cause changes in the number of blood cells, the diameter of erythrocytes and the composition of erythrocyte elements.

In general, chronic alcohol intoxication can have profound and long-lasting effects on the health and development of offspring, including changes in various blood parameters. These effects emphasize the importance of abstaining from alcohol.

Based on the results of the study, it is clear that chronic use of alcohol causes a wide range of negative effects such as thrombocytopenia, lymphocytopenia, erythrocytopenia, coagulation, anemia. The hematological changes noted are:

1. Anemia: Alcohol can affect hemoglobin levels in rats, reducing the number of red blood cells in the blood, leading to anemia, or reduced oxygen-carrying capacity of the blood.
2. Thrombocytopenia: Chronic alcohol intoxication can reduce platelet counts in rats or cause abnormal aggregation of platelets that form the normal outer layer of blood.
3. Lymphocytopenia: Long-term exposure to alcohol can cause lymphocytopenia, a decrease in the number of lymphocytes, which can weaken the immune system and reduce defenses against infections.
4. Blood clotting or coagulation changes: The long-term effects of alcohol consumption can disrupt the blood's normal coagulation functions, making it harder for the blood to clot.
5. Erythrocytopenia: Alcohol induced reduction in erythrocyte count in rats.

These results describe the changes of long-term alcohol intoxication on the hematological system in rats. These changes are caused by the effects of chemicals in alcohol on the rat's blood.

Thus, based on the obtained results, it was found that alcohol has a negative effect on hematological blood parameters. This suggests that the effect of alcohol on blood parameters of offspring is diverse and complex. Therefore, it is important to be careful with alcohol use and reduce it as much as possible to maintain health.

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