Pharmacophore

ISSN-2229-5402

Journal home page: http://www.pharmacophorejournal.com

CHANGES IN THE CONCENTRATION OF ETHYL ALCOHOL IN THE BLOOD WHEN IT IS STORED IN DIFFERENT TEMPERATURE CONDITIONS

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ARTICLE INFO

Received:
16 Feb 2020
Received in revised form:
12 Jun 2020
Accepted:
14 Jun 2020
Available online:
28 Jun 2020

Keywords: ethyl alcohol, temperature modes of storage of biological samples

ABSTRACT

The article deals with changes in the concentration of ethanol in the blood in the structure of mortality in the Stavropol region. The interval of delivery of objects to the forensic chemical Department from the regional forensic medical departments of the region is from 5 to 14 days. In this connection, it is important to determine the content of ethanol in the storage of cadaverous blood in various conditions. While stored in a common refrigerator chamber during the experiment, after 4 weeks, the level of ethanol increases, the values of which reach a level that can serve as a basis for an erroneous conclusion about the fact of alcohol consumption by the deceased before death. In samples that initially do not contain alcohol, while stored in the laboratory, a new formation of ethyl alcohol occurs; in samples that contain alcohol, the indicator is increased. When freezing cadaveric blood in which initially alcohol was not detected for up to 4 weeks the formation of ethyl alcohol was not noted.

To Cite This Article: S.F. Andrusenko, E V. Denisova, O.I. Anfinogenova, E.A. Melchenko, A.A. Kadanova, I.E. Brycina, (2020), "Changes in the Concentration of Ethyl Alcohol in the Blood When it is Stored in Different Temperature Conditions", ***Pharmacophore, 11(3),*** *75-77.*

Introduction

During the forensic examination of the corpse, it is necessary to establish the presence and degree of alcohol intoxication. The correct determination of ethanol content in the blood is important for law enforcement officers investigating the causes of death and employees of insurance companies making decisions about payments to insured people [1].

The fact that alcohol is present in biological fluids at the time of death does not present difficulties for conducting research as soon as possible after taking the biological material. Difficulties arise for district doctors and forensic experts due to the territorial remoteness from forensic chemical laboratories since it is impossible to deliver sectional material on the day of the forensic autopsy. The same difficulties may arise in a disaster situation, i.e. in the event of an accident mass death of people when before conducting a forensic chemical study for the presence of alcohol it is necessary firstly to conduct a molecular genetic or medical-forensic examination, which naturally takes a certain period of time during which samples for chemical research are stored [2-7].

The purpose of the study was to experimentally establish the most accurate method of temperature preservation of cadaveric blood for a period of up to 4 weeks in order to preserve the original values of ethyl alcohol in it.

The object of the study is cadaveric blood of 211 people of different genders aged from 21 to 65 years with different causes of death, both with the presence and absence of ethanol in the blood at the time of death.

The scientific novelty consists in expanding the knowledge related to the methods of thermal preservation of cadaveric blood in order to determine ethanol after a delayed period of time after autopsy.

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Materials and Methods

Immediately after the forensic autopsy, the objects were sent to the forensic chemical laboratory for initial testing for the presence of alcohols and then the samples selected for the study were stored in three temperature modes: in the laboratory room without a refrigerator, in the conditions of a common refrigerator chamber, and in deep freezing.
All samples were initially divided into two control groups: the first one with the content of ethanol; the second one without ethanol content. The study was performed for 4 weeks without changing the original method of temperature preservation.
To detect ethanol in the blood, the gas chromatography method was performed using "Chromosome GC-1000" with a flame-ionizing detector. Blood sampling was performed with a syringe from the large veins of the extremities or sinuses of the Dura mater in an amount of 10-20 ml. The samples were placed in clean glass vials and were hermetically sealed.
All samples before analysis were stored under the following conditions: filling of the container by at least 80% of the volume, dense blockage of the container.
Blood samples were taken using medical documentation as well as studies for the presence of narcotic and medicinal substances taking into account factors that may affect the course of the study [8-10]. Only those samples were taken in which narcotic and medicinal substances were not detected. The samples, in which there was a new formation of other alcohols (butyl), as a result of rotting processes, were disposed of and further research was not conducted with them.

Results and Its Discussion

Most often, in the absence of special freezers, objects are stored in a common refrigerator until the alcohol test is completed. Therefore, we examined the objects for 4 weeks.
The biomaterial was divided into 2 groups. The first group included samples that did not contain ethanol at the time of death and the second group contained samples containing ethanol at the time of death.
Initially, the chemical study was performed immediately during the autopsy of the corpse and then it was continued every week. In total, 211 blood objects were initially examined including 63 samples containing ethyl alcohol, 47 objects from male and 16 female citizens.
After the first week of storage, all samples were re-examined by gas chromatography. Each week before the start of the study of control samples, a new calibration schedule was built from a mixture of alcohols using solutions of ethyl alcohol of different concentrations to obtain a recalculation coefficient for cadaver blood. The quantitative study of each sample was performed twice with the addition of an internal standard. The percentage of samples after 2 weeks of storage with a new formation of ethyl alcohol is shown in Table 1.

Table 1- Number of samples for the first and second week of storage with new growth of ethyl alcohol

Temperature preservation mode°C	week 1, neoplasm %	week 2, neoplasm %
+18/+22	52	30
+6/+8	26	42
–20/–22	There were no changes	2

The change in the concentration of ethyl alcohol for 2 weeks depending on storage conditions is shown in Table 2.

Table 2 - change in the concentration of ethyl alcohol after 2 weeks, depending on storage conditions

Room temperature	Freezer chamber	General refrigerator chamber
Samples that do not initially contain ethanol (average value)		
0,1 ‰	-	0,07 ‰
Samples containing ethyl alcohol (average value)		
0,3 ‰	-	0,09 ‰

The average values of changes in the concentration of ethyl alcohol after four weeks of storage under various conditions are shown in Table 3.

Table 3 - changes in the concentration of ethyl alcohol after 4 weeks, depending on storage conditions.

Room temperature	Freezer chamber	General refrigerator chamber
Samples that do not initially contain ethanol (average value)		
0,2 ± 0,015 ‰	-	0,09 ± 0,015 ‰
Samples containing ethyl alcohol (average value)		
0,38 ± 0,015 ‰	-	0,1 ± 0,015 ‰

Conclusions

We conducted a study of cadaveric blood from male and female individuals with various causes of death, both with the presence and absence of ethanol in the blood at the time of death. They found that gender, age, and cause of death did not affect the results of the study.

The selected items were stored for 4 weeks in a common refrigerator chamber (at a temperature interval +6/+8); in the freezer (at a temperature range of -20/-22) and in the laboratory room without a refrigerator (at a temperature range of +18/+22).

When storing biological samples at room temperature, there has been a reduction in the amount of ethanol in the first week. After the second and subsequent weeks of storage, all samples show an increase in ethanol by an average of 0.1 %.

When stored in a common refrigerator chamber the concentration increases to 0.07 % for samples that do not initially contain ethanol. When storing cadaveric blood in the conditions of a common refrigerator chamber for up to 1 month, there is a neoplasm of up to 0.38 ± 0.015% or an increase in the initial concentration of ethyl alcohol.

In objects that were stored in the freezer even after 4 weeks of storage, there was no change in the level of ethanol. Thus, for long-term storage of cadaveric blood temperature preservation in the form of freezing is best suited.

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