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BIOCHEMICAL ASPECTS RELATED TO ALCOHOL CONSUMPTION

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KEYWORDS

Alcohol consumption
Health risks
Biochemical parameters
Chronic disease

ABSTRACT

Alcohol addiction (alcoholism) is characterized by the regular consumption of large quantities of alcohol, by the inability of the individual to stay awake for a longer period of time. There are many causes e.g. genetic, psychological and social factors, that can lead to the installation of this condition, and as individuals continue to consume alcohol, changes occur that can compromise the structure and functions of the brain, determine the transition from controlled consumption, to abusive, chronic, difficult to control. Women and men metabolize alcohol differently, and alcohol consumption affects women more than men in the sense that they are more vulnerable to short and long - term effects and can develop diseases associated with alcohol consumption faster than men. Regardless of the severity of alcohol addiction, the effects it has on health, but also on the life of the individual, can be devastating. This study analyzes the variation of certain biochemical parameters: glucose, ALT (alanine aminotransferase), AST (aspartate aminotransferase), GGT (gamma glutamyltransferase), which are useful in the early detection of cellular damage caused by excessive ethanol consumption in different patient groups. The results obtained reflected differences between sexes, ages, and the risk factors monitored.

INTRODUCTION

The term alcoholism was used for the first time by Magnus Huss, a Swedish doctor, in 1849. In the 19th century and the first half of the 20th century, the term dipsomania was used for alcohol addiction (Prisecaru et al., 2021). Alcoholism can be mild, moderate or severe, depending on the number of symptoms experienced. Warning signs may include: inability to limit the amount of alcohol; unsuccessful attempts to do so; strong craving or urge to consume alcohol; failure to fulfill major obligations due to repeated drinking (Rahman et al., 2020; Mitincu-Caramfil et al., 2025). Alcoholism can include periods of drunk (alcohol poisoning) and withdrawal symptoms (nausea, sweat and tremor) (Sonntag et al., 2001). Alcohol tolerance develops as the body adapts to the presence of alcohol, causing people with alcoholism to consume progressively larger amounts to experience the same effects (Healthline, 2025; Sonntag et al., 2001).
Even if they know, the harmful consumption of ethanol is a major health problem, with biological, psychological and social implications (Oscar-Berman et al., 2003). The mortality attributed to alcohol was higher among men with 2 million deaths, compared to 600,000 deaths among women (2019) (Breuninger et al., 2020). Moreover, 209 million people suffer from alcohol addiction ((Healthline, 2025; Alcool 2024). Regular consumption of ethanol can cause different conditions such as: high blood pressure, stroke, gastritis, liver disease (toxic-nutrition hepatitis, cirrhosis), biliary lithiasis (cholecyst calculations), pancreatitis, different types of cancer, psychic disorders such as anxiety, cognitive deficits (Cui et al., 2013; Kuria et al., 2012; Graham et al.,2015). Another important aspect, sometimes neglected, is that alcohol causes damage to people around consumers by: routine accidents caused by alcohol consumption, other injuries/injury, with or without intention, and here they can be

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included, burns, sexual aggression, domestic violence, suicide. Regardless of the severity of alcohol addiction, the effects it has on health, but also on the life of the individual, can be devastating (WHO, 2017; Prisecaru et al., 2021).
This study aims to analyze some useful biochemical parameters in the early detection of cellular lesions that the harmful consumption of ethanol produces, the pursuit of risk factors, the distribution by sex and the environment of origin of the studied patients, with the evidence of the negative effects for health. This study highlights the importance of biochemical assessment for all parameters that can be useful in therapeutic decision-making.

MATERIALS AND METHODS

The study group included a number of 100 patients from the Moldova region, from whom samples were collected for biochemical determinations in order to confirm the presumptive diagnosis of ethanol exposure (Tietz et al., 1995; Fischbach et al., 2005; Ialongo C., et al. 2025). The harvested specimen was venous blood, as a harvesting container, vacutainer was used/without separator gel. Vacutainers were centrifuged for 15 minutes at 3500 - 4000 rpm (Biobase, BKC-TL4C, China) for separating the serum that was worked immediately. Intensely lipemic or intense hemolysis specimens have been rejected. Dosage of biochemical parameters: glucose (mg/dL), ALT (alanine aminotransferase) (U/L), AST (aspartate aminotransferase) (U/L), GGT (gammaglutamyl transferase) (U/L), ethanol (mg/dL) was performed on the Cobas Integra 400 Plus analizer, the reagents used were provided by Roche (Switzerland).

RESULTS AND DISCUSSION

This study included patients between the ages of 21 and 80, with the sex ratio of female to male being f/m = 0.19 (Figure1):

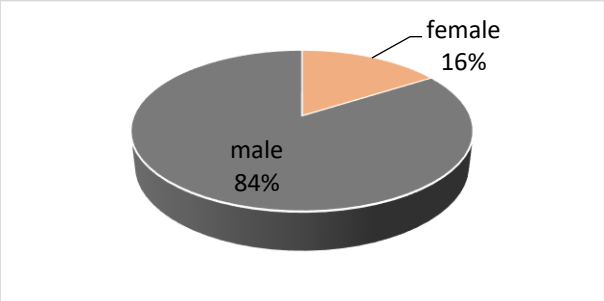

Figure 1. Distribution by sex of investigated patients

Patients in the studied group were distributed by sexes and age groups (Figure 2):

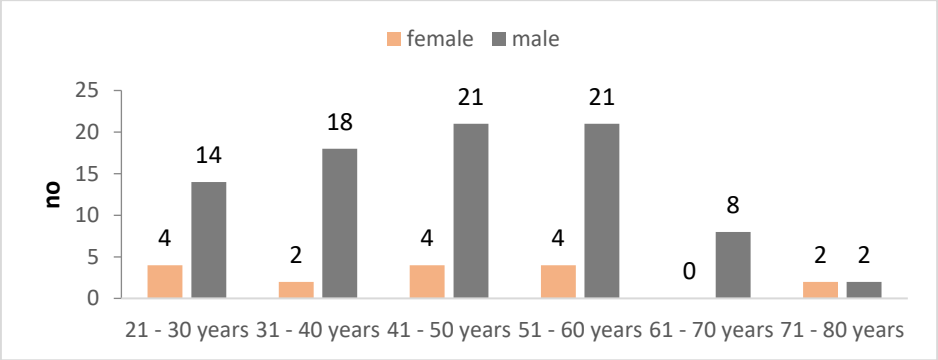

Figure 2. Distribution by age groups of investigated patients

From the analysis of Figure 2 there is an equal number of female and male patients in the age groups 41 - 50 years, 51 - 60 years, respectively 71 - 80 years. If the largest number of male patients registered in the age groups 41- 50 years, respectively 51-60 years, the smallest number of male patients registered in the age group 71 - 80 years. In the female patients the most number of patients was in the age group 31- 40 years, and no patient was registered in the age group 61-70 years. Regarding the environment of origin, the distribution of patients was the following (Figure 3):

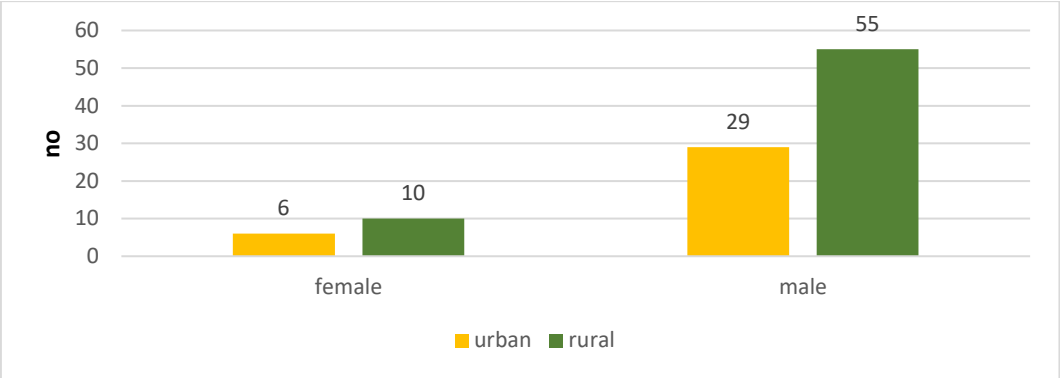

Figure 3. The distribution of patients investigated according to the environment of origin

Analyzing figure no.3, the distribution of patients, who were tested on exposure to ethanol, depending on the origin environment, it is noted that most patients were from rural areas both in female patients and male patients. The distribution of age groups of female patients has led to the following results (Figure 4):

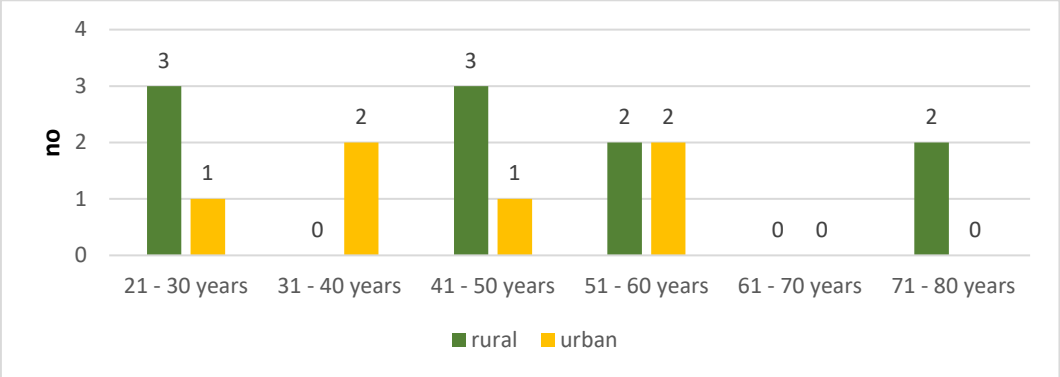

Figure 4. The distribution of female patients according to the environment of origin

Regarding the distribution of patients by age groups depending on the origin environment, it is noted that the largest number of female patients came from the rural area and was highlighted in the age groups 21-30 years, respectively 41 - 50 years. The largest number of female patients in the urban environment was noted in the age groups 31-40 years, respectively 51- 60 years (Figure 4). Distribution by age groups of male patients invested led to the following results (Figure 5):

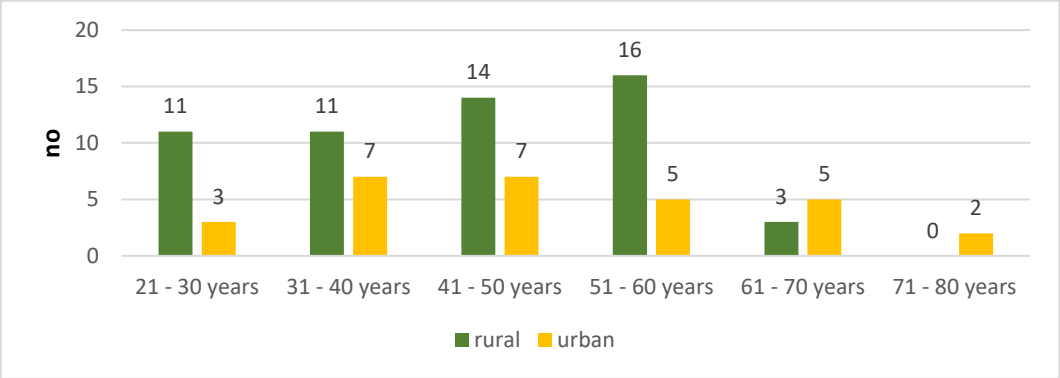

Figure 5. The distribution of male patients according to the environment of origin

From the analysis of Figure 5 it is found that in male patients, the largest number of patients in the rural area registered in the age group 51-60 years, followed by the group 41- 50 years, and for the patients in the urban area, the highest number of cases was registered in the age groups 31-14 years, respectively 41- 50 years. If in the female patients from the urban environment, no case was registered in the age group 71-80 years, in the male patients from the rural area there was no case in the same age group. Following the determinations of the biochemical parameters in the female patients, the following results were obtained (Figure 6):

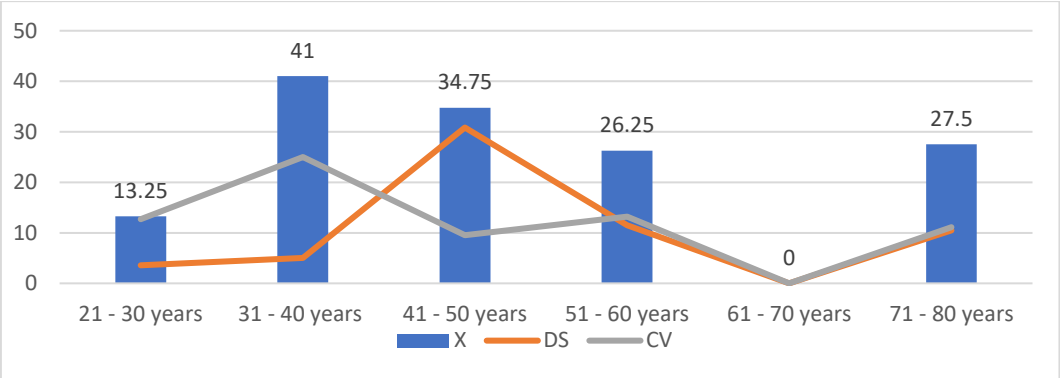

Figure 6. The average values of the ALT parameter (U/L) in female patients (X-mean, DS-standard deviation, CV- coefficient of variation)

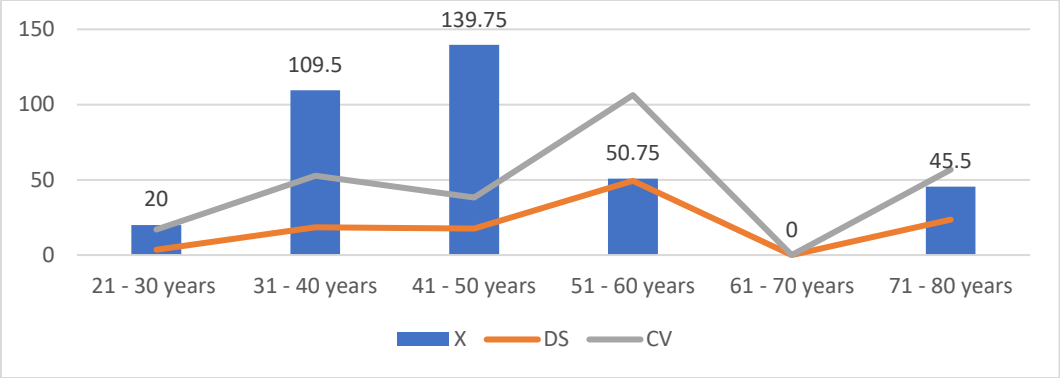

Figure 7. The average values of the AST parameter (U/L) in female patients (X-mean, DS-standard deviation, CV- coefficient of variation)

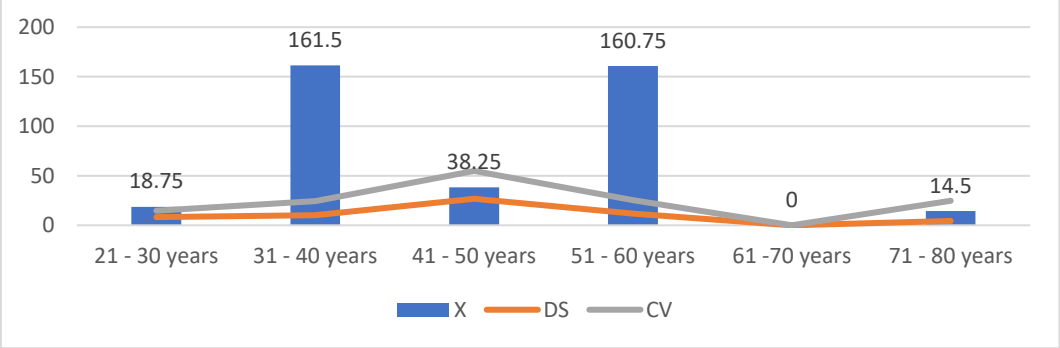

Figure 8. Average GGT parameter (U/L) in female patients (X-mean, DS-standard deviation, CV- coefficient of variation)

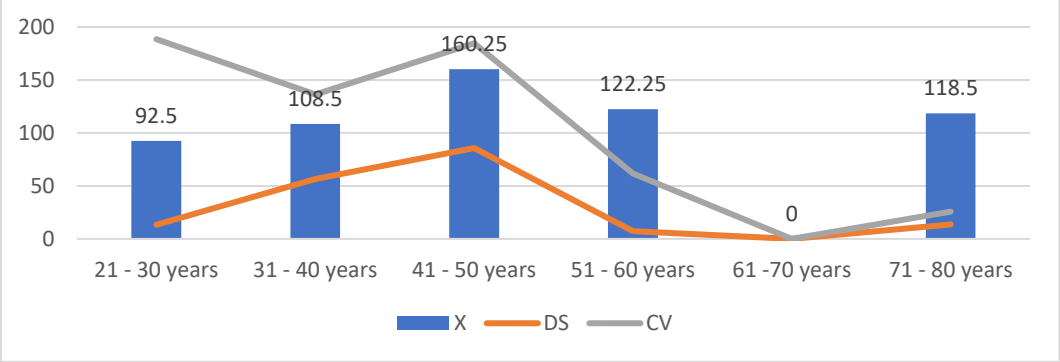

Figure 9. Average glucose parameter (mg/dL) in female patients (X-mean, DS-standard deviation, CV- coefficient of variation)

Following the determinations of the analyzes ALT, AST, GGT, Glucose (Figures 6-9). In the female patients it is found that, the average registered values have been included in the admitted reference interval (<41 U/L), for the

average values outside the reference interval (<38 U/L). Age groups 41 - 50 years (139.75 U/L), 31 - 40 years (109.5 U/L) and the age group 51 - 60 years (50.75 U/L). According to data in the specialized literature, if another is mainly found in the liver, this is found in several tissues: myocardium, liver, skeletal muscles, kidneys, pancreas, brain tissue, thus a less specific indicator of liver function. At the level of the liver cell, the isoenzymes are found both in the cytosol and in the mitochondria. For the GGT analysis, they registered the average value in the age groups 31- 40 years (161.5 U/L) and 51-60 years (160.75 U/L). GGT is the most sensitive indicator for the detection of alcoholism, being the enzyme whose growth exceeds the other currently dosed liver enzymes. In alcoholics the serum level of GGT can reach values 50 times above the normal value (8 - 61 U/L), the degree of growth depending on both the amount of alcohol consumed, and especially on the long persistence of consumption. GGT also plays a role in monitoring abstinence from alcohol. In female patients, 4 female patients had values of GGT larger than 61 U/L which corresponds to a 25% percentage. For the analysis of glucose, average values outside the reference range (74 - 106 mg/dL) were registered in the age group 41 - 50 years (160.25 mg/dL), followed by the age group 51 - 60 years (122.25 mg/dL), respectively the age group 71 - 80 years (118.5 mg/dL). A recent study highlighted that 42% of alcohol - related deaths could be attributed to chronic diseases.

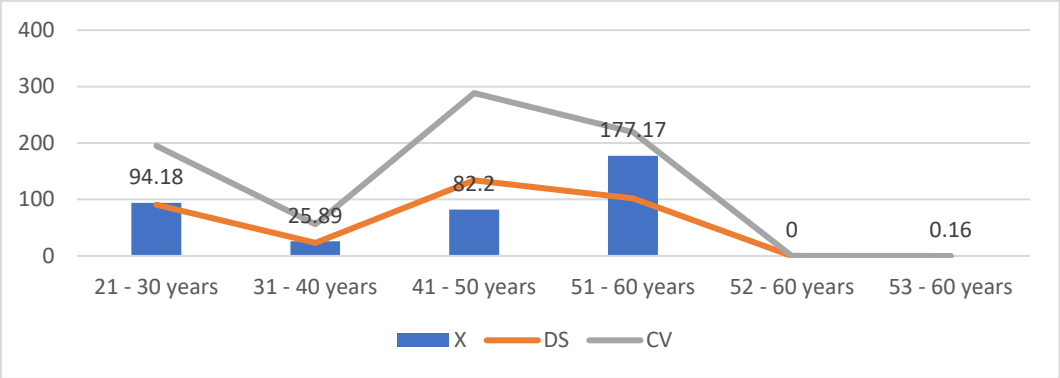

Figure 10. Average ethanol parameter (mg/dL) in female patients
(X-mean, DS-standard deviation, CV- coefficient of variation)

From the analysis of figure no.10 it is found that in female patients between the ages of 21 and 60 years, the average ethanol values have included outside the reference interval (values less than 10 mg/dL), the highest values registering in the age group 51- 60 years (177.17 mg/dL), followed by the age group), followed by the age group: (94.18 mg/dL), 41 -50 years (82.2 mg/dL), respectively 31 - 40 years (25.69 mg/dL).
According to the data in the specialized literature ethanol is easily absorbed from the gastrointestinal tract (WHO, 2017; Prisecaru et al., 2021). The presence of food in the stomach decreases the absorption of alcohol. Ethanol is rapid hepatic metabolized in acetaldehyde. Once the maximum blood concentrations have been reached, its disappearance is linear; a 70 kg man metabolizes 7-10 g alcohol/ hour (Ialongo et al., 2025). The determination of alcohol can be performed for medical or forensic purposes for the diagnosis of alcohol poisoning and the establishment of appropriate therapy. Ethanol levels should be tested in all cases of unclear etiology, because alcohol poisoning can mimic diabetic coma, brain trauma or drug overdose. This test is also used for screening alcoholism and for monitoring ethanol therapy in methanol intoxication (Fischbach et al., 2021). Of the 16 female patients taken in the studio a number of 8 women had the value of ethanol outside the reference range which corresponds to a percentage of 50%. Following the determinations of the biochemical parameters, in the male patients, the results obtained were markedly unsatisfactory (Figure 11).

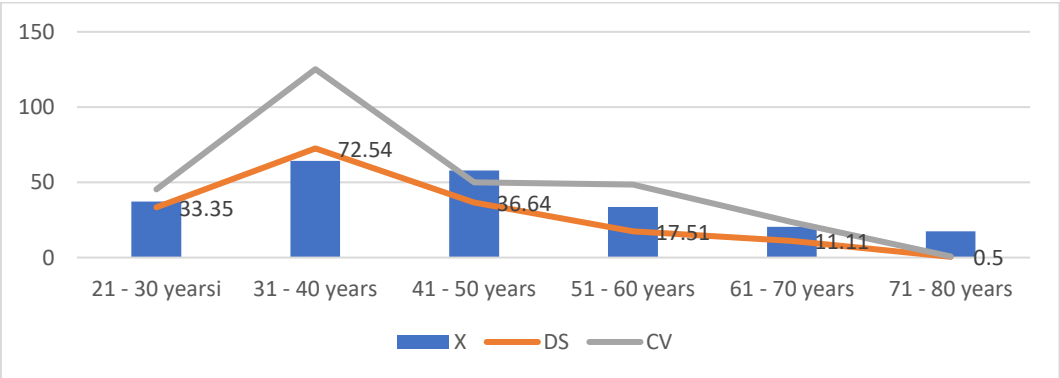

Figure 11. The average values of the ALT parameter (U/L) in male patients
(X-mean, DS-standard deviation, CV- coefficient of variation)

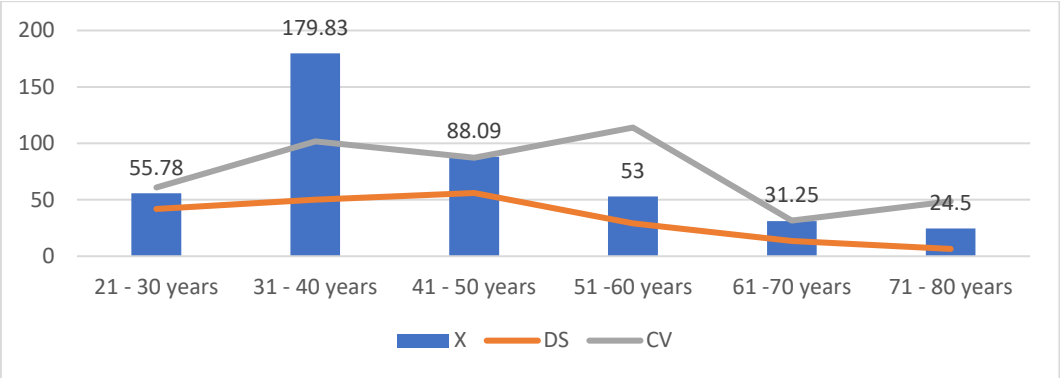

Figure 12. The average values of the AST parameter (U/L) in male patients (X-mean, DS-standard deviation, CV- coefficient of variation)

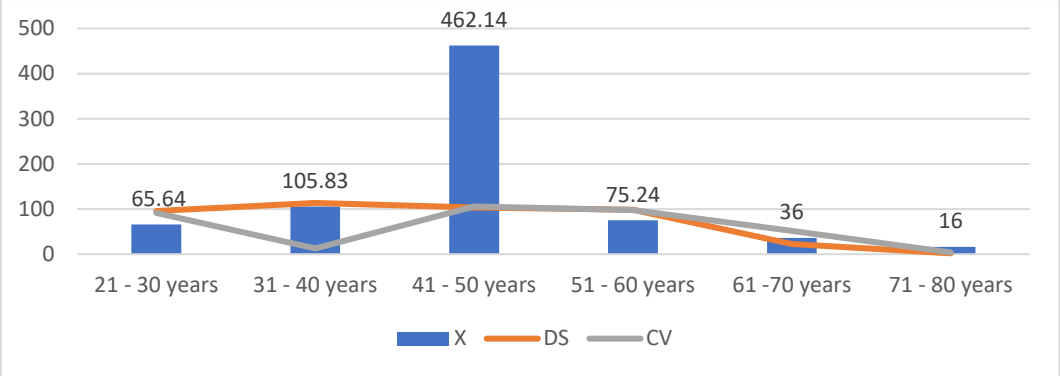

Figure 13. Average GGT parameter (U/L) in male patients (X-mean, DS-standard deviation, CV- coefficient of variation)

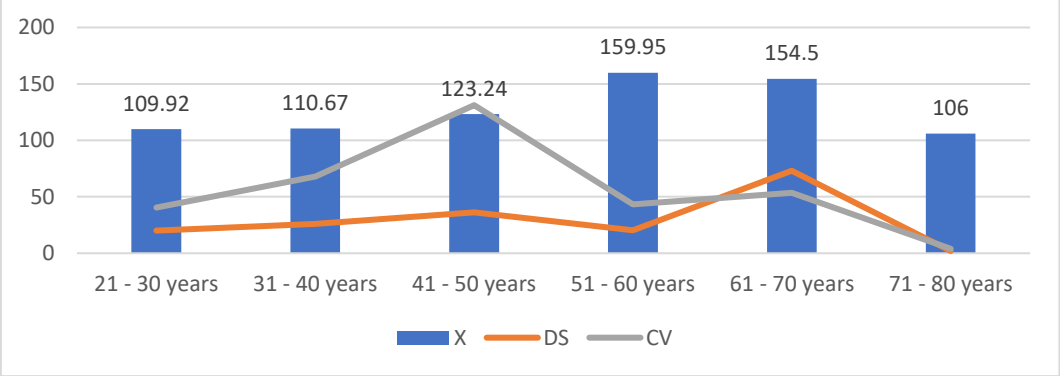

Figure 14. Average glucose parameter (mg/dL) in male patients (X-mean, DS-standard deviation, CV- coefficient of variation)

Determination of ALT biochemical parameters, AST, GGT, glucose in male patients (Figures 11-13) led to the following results: another registered the average value outside the reference interval (<41 U/L) to the age group 31 - 40 years (72.54 U/L), this registered average values abroad. (<38 U/L) in the age groups 31- 40 years (179.83 U/L), 41- 50 years (88.09 U/L), 21- 30 years (55.78 U/L), 51- 60 years (53 U/L), GGT registered values outside the reference range (8-61 U/L) in male patients with 60 males. years, the highest of value being in the age group 41 - 50 years (462.14 U/L), followed by: 31 - 40 age group (105.83 U/L), age group 51 - 60 years (75.24 U/L) and age group 21 - 30 years (77.78 U/L). In male patients GGT showed the value outside the reference range for 33 patients corresponds to a percentage of 39.29%. For the glucose parameter, patients between the ages of 31- 70 have presented the average value outside the reference range, the highest values being registered by the age group 51- 60 years (159.95 mg/dL), followed by the groups: 61- 70 years (154.5 mg/dL), 41- 50 years (123.24 mg/dL), 31 - 40 years (110.67 mg/dL).

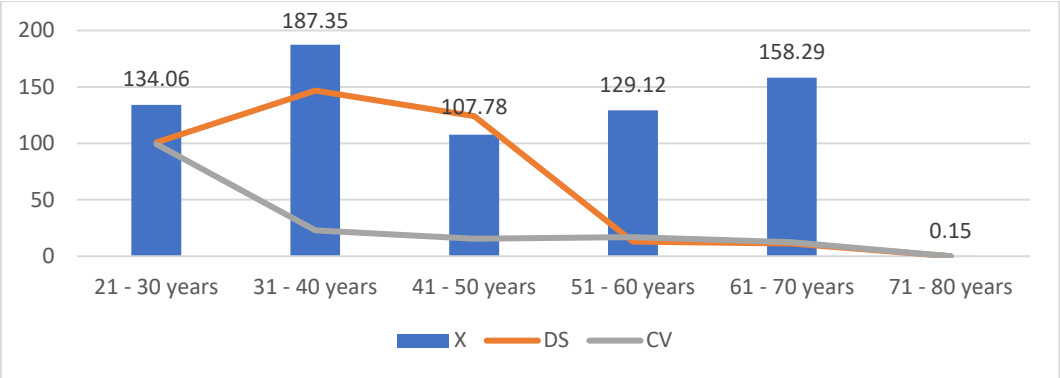

Figure 15. Average ethanol parameter (mg/dL) in male patients (X-mean, DS-standard deviation, CV- coefficient of variation)

From the analysis of Figure 15 it is found that in male patients the values recorded for ethanol were much higher than those registered in female patients. Male patients between the ages of 21 and 70 had average values for ethanol outside the reference range, the highest values were in the age group 31 - 40 years (187.35 mg/dL), followed by the groups; 61 - 70 years (158.29 mg/dL), 21 - 30 years (134.06 mg/dL), 51 - 60 years (129.12 mg/dL), 41 - 50 years (107.78 mg/dL). It is worth noting that in the age group 71- 80 years as in the case of female patients the average ethanol values have been in the reference range (0.16 mg/l for women and 0.15 mg/dL for men).

Of the 84 patients under study, 55 male patients had values for ethanol outside the reference range which corresponds to a percentage of 65.48 %.

CONCLUSION

The harmful consumption of ethanol is a major health problem, with biological, psychological and social implications.

The study included a number of 100 patients between the ages of 21 and 80. Regarding the environment of origin, it is noted that most patients were from the rural area regardless of sex. In male patients, the largest number of patients in the rural area was registered in the 51- 60 year old group, followed by group 41- 50 years. From the urban area, the largest number of cases was registered in the age groups 31-40 years, respectively 41-50 years. Therefore, the majority of alcohol consumers, both male and women, come from rural areas.

The biochemical parameters analyzed have undergone changes in both female patients and male patients, but it was not possible to identify whether these changes are due to alcohol consumption or due to other pathologies.

GGT is the most sensitive indicator for the detection of alcoholism, being the enzyme whose growth exceeds the other liver enzymes dosed. GGT is used for both screening for alcoholism and for monitoring the treatments of people with chronic alcoholism.

Following the serum GGT determinations in groups with high sugar intake, metabolic syndrome, or diabetic, a larger number of male patients had the value outside the reference range, compared to female patients.

As a result of serum ethanol determinations half of female patients and about two thirds of male patients had ethanol values outside the reference range.

Ethanol levels should be tested in all cases of unclear etiology coma, because alcohol poisoning can mimic diabetic coma, brain trauma or drug overdose.

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